Carbon Trading, the Clean Development Mechanism and the perceived benefits for South Africa

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DECLARATION

I, Anne du Toit (student number 83-31450) am a student registered for an MSc by coursework. I hereby declare that this research report is my own unaided work. It is being submitted in partial fulfillment of the requirements for the Degree of Master of Science in the School of Geography, Archaeology and Environmental Studies, Faculty of Science, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University

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Abstract

The Kyoto Protocol allows for the development of an international emissions-trading system. This led to the formulation of various mechanisms, namely Joint Implementation (JI), the Clean Development Mechanism (CDM) and Emissions-trading (ET).

Given the potential emission-reduction targets in 2012 for developing countries, and in particular for South Africa, the objective of this study is identifying the current implementation of the CDM project cycle steps, as well as assessing the appropriateness of them. Constraints, bottlenecks and opportunities, are identified and suggestions for improvement are made, in order to improve the body of scientific knowledge.

From the literature survey, and from discussions with experts in the field, it appears as if the benefits and issues identified, corroborate international findings. Benefits for countries hosting CDM projects include improved balance of payment, technology transfer and replacement of inefficient technology. Commonly occurring concerns, are that baseline setting, additionality and the entire CDM project cycle is complex. Resource and time constraints could jeopardize projects. Transaction costs have been prohibitive, further compounded by lack of initial upfront funding. Bureaucracy from the CDM executive board has frustrated attempts to implement projects. Lack of methodologies, as well as huge risk and cost in developing new methodologies have been obstacles for project developers, while clear guidelines on monitoring, governance and additionality have been conspicuously absent. Suggestions for improvement have been regular baseline revision and standard assessment procedures, application of the gold standard and an additionality tool.

Issues that seem to be uniquely particular to South Africa are the slow adoption of large companies to accept the benefits of CDM, difficulty in convincing company executives to embark on CDM projects, as well as unwillingness to delegate

authority to technical staff. Another notable pattern is a mismatch of opinion between scientists, academics and business. South Africa uniquely, produces 90% of its energy from fossil fuels, which could limit the adoption of CDM.

Lack of institutional knowledge and experience is concerning, as well as ethics and little collaboration amongst stakeholders. Innovative suggestions for improvement have included a weighting for sustainable development indicators, benchmarks to simplify baselines, sink projects to be excluded owing to their risk, sellers clearing houses, industrial gases to be excluded, and programmatic CDM. Another important suggestion is that taxation of CDM credits should be abandoned, and the restrictive Public Finance Management Act to be improved. The proposed study has attempted to highlight some of these significant issues, with the view to improving the current knowledge and advance the possibility of alleviating some of these burdening issues.

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Regarding climate change, mankind stands accused of “conducting a gigantic scientific experiment with the planet, and the consequences could be disastrous” (Meyer, Hildyard, 1997, 3).

To strive, to seek, to find, and not to yield

Ulysses, by Alfred Lord Tennyson

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Abbreviations, Acronyms, Glossary

AA	Assigned Amounts
AAU	Assigned amount units
AIJ	Activities implemented jointly
CDM	Clean Development Mechanism
CER	Certified Emission-reduction
COP	Conference of Parties
DME	Department of Mineral Affairs and Energy
DOE	Designated Operational Entity
DNA	Designated National Authority
EB	Executive Board (CDM)
EDRC	Energy Development and Research Centre
ERI	Energy Research Institute
EIA	Environmental Impact Assessment
ERU	Emissions Reduction Unit
ET	Emissions Trading
GDP	Gross Domestic Product
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
JI	Joint Implementation
MOP	Meeting of Parties
NAP	National Allocation Plans
NPV	Net present Value
OE	Operational Entity
PDD	Project Design Document
UNFCCC	United Nations Framework Convention on Climate Change

CHAPTER ONE - INTRODUCTION

The responsibilities of developing countries in mitigation of climate change are becoming increasingly significant, yet fraught with political controversy (Reid and Goldenberg, 1998). Their projected greenhouse gas emissions are expected to exceed those of developed countries, by 2020. Naturally, developed countries have requested that developing countries take considerably stronger action in order to prevent or at least alleviate these emissions.

Fortunately many developing countries are limiting emissions through reduction of fossil fuel subsidies. China has made impressive savings over a ten year period by dropping coal subsidies from 37% in 1984 to 29% in 1995. India, Mexico, Saudi Arabia, Brazil and South Africa (all of whom rank in the top 25 industrial carbon dioxide emitters), have cut their fossil fuel subsidies considerably (Reid and Goldemberg, 1998). Other developing countries have advocated the use of energy efficiency and renewable energy. In particular, Mexico, India and Brazil and South Africa have established specific energy efficiency and renewable energy programs (Reid and Goldemberg, 1998).

Considering the enormous global effort required to mitigate climate change, and the significant effect of developing countries, it would be prudent to investigate the potential of emission-reduction projects in South Africa and the relevance of South Africa as an investment destination (Reid and Goldemberg, 1998).

1.1 South Africa as an investment destination

Although the literature available refers to the attractiveness of a region/supplier to be dependent not only on low cost emission-reductions, but also on the business climate (for JI implementations), this could equally apply to CDM projects in South Africa and other developing countries. A compelling business environment has many dimensions, but would include quality of institutions, effective policies, legal and regulatory frameworks, political and economic stability, efficient and just tax system, as well as a free market society (Frankhauser and Lavric, 2003). Ethics and integrity of public and private participants and the minimizing of crime and corruption is also very important. Acceptable infrastructure and a thriving financial sector would be contributing factors (Franhauser and Lavric, 2003).

South Africa is a developing country positioned at the most southern tip of Africa. It has a population of approximately 43 million people, with a land area of 1.2 million square kilometers (UNIDO, 2004). South Africa is very vulnerable, should emission-reduction targets be imposed, since it is based on a fossil fuel economy, exports coal, and has not developed sufficient alternative technologies. In 1998, 90% of carbon dioxide emissions from fuel combustion originated from coal (Winkler *et al.,* 2002). South Africa produced approximately 194 TWh of electricity in 2000 (Sathaye *et al.*, 2004). This was mostly from coal-fired power stations which are largely owned and operated by Eskom (a state owned enterprise). At the end of 2000 there were 50 power stations operating, of which 20 were coal-fired. The non-coal power stations include Koeberg (Nuclear power station) and three pumped storage facilities (Sathaye *et al.*, 2004). Eskom does have some mothballed stations (reserve stations owing to excess capacity), but they are mostly 30 years old. New potential projects revolve around importing gas from Kudu Gas Fields, an efficient steam coal plant, a wind farm in Darling, imported hydro electric power as well as recommissioning two units in mothballed power stations (Sathaye *et al.*, 2004).

From an economic perspective, South Africa is the largest producer of gold and platinum group metals in the world, the fifth biggest producer of diamonds, and the forth largest producer of coal. Fossil fuels provide for 90% of the energy demand as mentioned above (UNIDO, 2004). South Africa would be well-placed to host Clean Development Mechanism projects owing to the strength of its economy and infrastructure and in particular, its extensive network of roads and rail, at least seven deep water ports and large amount of natural mineral resources. Further to that, it is the most technologically and economically advanced country in Africa (UNIDO, 2004). South Africa's emission intensity is quite high in relation to other developing countries and emitted 0.96kg carbon dioxide per dollar of GDP, while other non-OECD countries emitted an average of 0.66 (UNIDO, 2004). Despite a small population, South Africa is one of the top 20 emitters of greenhouse gases, and this is attributed to its dependence on coal, production of synthetic liquid fuels from coal, large mining and industries heavily reliant on energy, as well as wastage of energy. From calculations done, it appears as if "South Africa consumes half of Africa's electricity, with only 5% of its population" (UNIDO, 2004, 23). In 1990, South Africa emitted 1.02 % of total greenhouse gas emissions, (in 1994 it emitted 380 million tons of carbon dioxide - the per capita emissions of 8.5 tons which was double the global average of 4 tons (Kim, 2003), while in 1999 it had increased to 1.6% of global emissions. Inventories of emissions in 1994 showed that 78% of greenhouse gases originated from the energy sector, 9.3% from agriculture, 8% from industrial processes, and 4.3% from waste. Of all the greenhouse gases, carbon dioxide contributed 83.2%, methane 11.4% and nitrous oxide 5.4% (UNIDO, 2004).

Many industry associations have been researching climate-change issues, in particular Sasol, Eskom, The Chamber of Mines and the Chemical and Allied Industry Association (CAIA). The chemical industry contributes 5.3 % of GDP and represents 23% of the manufacturing sector (Kim, 2003). Eskom is one of the largest national energy suppliers and dominates bulk electricity sales. It has been able to provide inexpensive electricity from the country's plentiful coal supplies.

Carbon dioxide emissions are by far the greatest contributor to greenhouse gas emissions and the view is that they will continue to contribute the most for the foreseeable future; therefore they have been the main focus in all mitigation actions. Carbon dioxide emissions are produced almost entirely from fossil fuel use and are therefore relatively easy to measure and monitor. In addition, the electricity sector produces one third of total carbon dioxide emissions in the EU, the industrial sector produces one sixth and households, one fifth. It is expected that since the electricity sector is well informed of the potential to reduce carbon dioxide emissions, and tightly regulated, they will produce many of the emissions-reductions projects (Svendsen, 2003). Globally, carbon dioxide emissions have increased by 10% from 1990 to 1999. Growth in emissions from developing countries has been noticeable, despite the fact that per capita emissions are low (Dagoumas *et al.*, 2006). Emissions growth is seen to be owing to changes in GDP, population and the carbon intensity of the output. Based on predictive models for the period 1990-2010 the GDP growth is estimated to be 2.3% per annum for developed countries, and 4.4 % per annum for developing countries. These models also predict that global anthropogenic emissions of carbon dioxide will be 64.2% for the period 1990-2010 (Dagoumas *et al.*, 2006). Emissions from developing countries are predicted to increase by between 1.2 % per annum (Dagoumas *et al.,* , 2006) and 2.2% (Galeotti and Lanza, 1999), while developing countries are predicted to increase their emissions by approximately 3.3% (Galeotti and Lanza, 1999).

Other studies have shown that developed countries are characterized by high carbon dioxide emissions per capita and low carbon dioxide emissions per GDP, while developing countries exhibit low carbon dioxide emissions per capita and high carbon dioxide emissions per GDP. Asian countries, especially have high carbon dioxide emissions per GDP (Shin, 1998). Developing countries demonstrate a high population growth, low level of income, rapid economic development and very low GHG emissions and energy consumption per capita (Shin, 1998).

The Kyoto Protocol, signed at the third UNFCCC conference of the parties (COP3), established commitments and greenhouse gas emission-reduction targets for industrialized countries for the period 2008-2012 (Ellis and Treanton, 1998). Moreover, this agreement requires industrialized countries to consider ways to minimize adverse effects on developing countries (whose economies are dependent on export and consumption of fossil fuels), through mechanisms such as funding, insurance and transfer of technology (Babiker *et al.*, 2000). For the Kyoto Protocol to be adopted, it required at least 55 parties to ratify it, covering at least 55% of the developed countries' carbon dioxide emissions since 1990. In particular it needed approval from Russia or the USA. Fortunately, Russia did approve the protocol, but the USA felt that it contained provisions that could be harmful to the US economy. They also felt that developing countries should be subject to GHG emission-targets similar to those of developed countries (Shin, 1998).

Eventually all countries (including developing ones), would need to reduce their emissions, in order to stabilize atmospheric greenhouse gas reductions (Winkler et al., 2002). Economic growth, population, and emissions (annual and historic) are factors which would affect allocation schemes based on emissions intensity (CO2/ GDP), carbon dioxide emissions per capita and ability to pay (GDP per capita). Top-down, rule-based allocation schemes or pledge-based allocation schemes are possible options. When considering an equity-based view for allocation schemes, developing countries would argue that they have an entitlement to emissions since they have not polluted the atmosphere as much as developed countries have. Six major developing countries were evaluated (South Africa, China, Brazil, India, Argentina and Nigeria), with widely differing results. Top down allocation schemes encompass allocation of global growth caps, distributing reductions, or lastly, a rights-based approach (equal emissions per capita). Pledge-based allocation schemes require each country to propose a target, and negotiate internationally (Winkler et al., 2002).

From the research done, (Winkler *et al.*, 2002), it appears as if South Africa is the only one of the six countries with emissions per capita above world average (Argentina is close to average). From an ability to pay perspective, South Africa and Argentina are above average, with Brazil, China and India below. South Africa and China's emission-intensity is above world average. Primarily, the structure of each country's energy economies would affect the allocation schemes mentioned before. South Africa and Argentina have a greater than average ability to pay, so would be allocated fewer allowances, while China, India and Nigeria would benefit as they are poorer. Under a per capita scheme, South Africa would also clearly not benefit as it has a smaller population than India, Nigeria or China and has a higher emissions per capita. Lastly, under an emissions-intensity scheme, South Africa would also not benefit. Since it becomes patently obvious that the same allocation scheme would have vastly different effects on each country, two approaches have been proposed: Either, grouping countries into different categories with appropriate targets, or calculating reduction in emission intensity rather then a cap on total emissions. These approaches still need to evolve, especially owing to the fact that it would be inequitable to allocate the same reductions across all countries even, if adjusted for ability to pay, emissions intensity or emissions per capita (Winkler *et al.*, 2002).

There is a growing viewpoint, that GHG emission targets could be set for companies or sectors through incentives and regulations, within South Africa and other developing countries. It is also possible that GHG mitigation could be required by law and so carbon trading could become an important practice for companies. As a consequence, companies could pre-emptively include costs of GHG mitigation in new projects, consider renewable energy and energy efficiency and develop new energy-efficient technologies. They could also set emission targets for themselves and monitor their performance against these targets, as well as construct carbon trading systems within their companies (Energy Research Institute, 2002).

1.2 Recent Climate Decisions and Conferences

Quite recently, (28 November to 9 December 2005), Canada hosted the first meeting of the parties (MOP 1) to the Kyoto Protocol in Montreal, while simultaneously, the eleventh session of the conference of parties (COP 11) to the Climate Change Convention, was held. This was an historic event since it heralded the entry into force, of the Kyoto Protocol. More than forty decisions that will strengthen global efforts to fight climate change were adopted. Speaking at the closing address in Montreal, the conference president, Canadian Environment Minister Stephane Dion said “Key decisions have been made in several areas. The Kyoto Protocol has been switched on, a dialogue about the future action has begun, parties have moved forward work on adaptation and advanced the implementation of the regular work program of the convention and the protocol” (UNFCCC, 2005)

Some of the key decisions taken by COP11 and COP/MOP1 relating to CDM and emissions-trading are illustrated in Table 1 below.

Table 1: Key decisions adopted by the Conference of the Parties 11 and COP/MOP1 (After unfcc.int/meetings/Cop_11, 2005)

	COP 11	COP/MOP1
1.	Dialogue on long-term cooperative action to address climate change by enhancing implementation of the convention	Consideration of commitments for subsequent periods for Annex 1 parties to the convention under article 3.9 of the Kyoto Protocol
2.	Five year program on impacts, vulnerability and adaptation to climate change	Further guidance relating to the clean development mechanism (CDM)
3.	Submission of the second and where appropriate third national communications from non-Annex 1 parties to the convention	Guidance relating to CDM
4.	Tables of common reporting format for LULUCF	Modalities and procedures for a CDM as defined in article 12 of the Kyoto Protocol
5.	Additional guidance to an operating entity of the financial mechanism	Modalities and procedures for afforestation and reforestation and reforestation activities under the CDM in the first commitment period of the Kyoto Protocol
6.	Development and transfer of technologies	Simplified modalities and procedures for small scale afforestation project activities under the CDM
7.	Review processes during the period 2006-2007 for Annex 1 parties to the convention	Procedures and mechanisms relating to compliance under the Kyoto Protocol
8.	Research needs relating to the convention	Modalities for the accounting of the assigned amounts under Article 7.4 of the Kyoto Protocol
9.	Institutional linkage of the secretariat to the United Nations	Guidance relating to the registry systems under Article 7 of the KP
10.	Program for the budget for the biennium 2006-2007	Capacity building relating to the implementation of the Kyoto Protocol in developing countries
11.	Budget Performance in the Biennium 2004-2005 as at 30 June 2005	Capacity building relating to the implementation of the Kyoto Protocol in parties with economies

	COP 11	COP/MOP1
		in transition
12.		Land use, land use change and forestry (LULUCF)
13.		Good practice guidance for LULUCF activities under Article 3, paragraph 3 and 4 of the Kyoto Protocol
14.		Program Budget for the Biennium 2006-2007
15.		Budget performance in the biennium 2004-2005 as at 30 June 2005

In addition, a statement made by Marthinus van Schalkwyk, Minister of Environmental Affairs and Tourism, following the UNFCC COP11 and COP/MOP1 corroborated the view that Africa was a significant and meaningful participant to the Kyoto Protocol. He felt that it was time for "developing countries to take further action on their respective commitments under the convention, while recognizing the principle of 'common but differentiated responsibilities', and that the developed countries to provide positive incentives to developing countries to do more" (Aucamp, 2005). He believed that the six objectives namely, of promoting African solidarity and a coordinated African position, adopting the 19 Marrakesh Accords, improving the Clean Development Mechanism, emphasizing adaptation to the adverse impacts of climate change, and open dialogue on long-term cooperation and enhanced implementation of the protocol could be achieved.

South Africa has, in light of the above concerns, developed a national climate strategy, (launched on 7 October 2004 by the Deputy Minister of Environment Affairs and Tourism, Rejoice Mabudafhasi), which is based on a number of principles: (Kelly, 2004). First and foremost, it recognizes that climate change will have adverse impacts, and adaptation is necessary. Development is an ever-present requirement, as is growing the economy with the proviso that it remains competitive therefore, South Africa's emissions will continue to increase. Sustainable social, economic and environmental development needs have to be promoted, while using locally available resources. In addition, poverty eradication and job creation will be addressed. This integrated climate response strategy should ensure that climate issues are part of government policies and practices (Kelly, 2004).

Other concerns for South Africa are that certain areas of the country will become hotter and drier, while other areas will become wetter. It is also possible that crop production may be affected, with the maize triangle at great risk of non-existence within the next two generations (Kelly, 2004). The strategy has in particular, prioritized the development of renewable energy in order to obtain 10000 Gigawatt hours per annum by 2012, from renewable sources. The mitigation strategy is based on the premise of implementing a white paper on renewable energy and energy efficiency. Greenhouse Gas emissions in the agricultural sector need to be reduced, forest schemes should be extended and waste management needs to be optimized. Further to that, industrial development should be sustainable, while coal mining and the transport sector should follow relevant mitigation programs. Education, awareness and training programs should facilitate the appropriate response. Relevant ministries should ensure proper management programs are set in place, especially agricultural, rangeland and forestry practices, as well as countering health related impacts. The reaction to this initiative has generally been favorable. However, it has been said by some critics, that this strategy does not go far enough, but they do concede that it is a step in the right direction. A concrete action plan would be welcomed (Kelly, 2004).

1.3 Problem Statement

South Africa is also in a unique position in that it is the fourth largest producer of coal, produces 90% of its energy from fossil fuels, most of this inexpensively from coal (and has not developed sufficient alternative technologies), which could limit the adoption of the Clean Development Mechanism (CDM). It is the most technologically advanced country in Africa, and is one of the top 20 emitters of greenhouse gases. This is most definitely attributed to its dependence on coal. Considering that developing countries may be allocated emission-reduction targets in 2012, what are the barriers and constraints that South Africa may encounter when implementing CDM projects? There are also, however, a range of possible negatives including the fact that CDM projects may potentially become more expensive than JI projects (if the stipulation that 2% of the value of the Certified Emission-reduction credits should be set aside for adaptation and administration costs, is applied) (Michaelowa and Jotzo, 2005). Taxes on CDM projects could limit CDM supply resulting in some developing countries not embarking on CDM projects if the credit prices are very low (Michaelowa and Jotzo, 2005). Another concern would be if "Sustainable Development" is interpreted too strictly and increases the price of CDM projects (see more detail below). Other issues affecting the sale of CDM projects could involve transaction costs, and institutional rigidities (Michaelowa and Jotzo, 2005; Kim, 2003; Tangen and Heggeland, 2003; OECD, 2004). Transaction costs increase as implementation costs increase, and since fixed costs are extensive, smaller projects could be at a disadvantage (Michelowa and Jotzo, 2005; Krey 2005).

1.4 Justification and importance

In addition to the concern that developing countries may be allocated emission-reduction targets (and the requirement therefore to investigate possible proactive recommendations to comply with these targets), many benefits from the CDM have been highlighted in international circles. As illustrated in the literature above, these include: financial inflows, and returns, improved balance of payment, technology transfer and replacement of inefficient technology (UNEP, 2004). Cost savings through energy conservation, hedging against risk, development of environmentally friendly markets and job creation have also been mentioned. In light of the above, there are very definite social, economic and environmental advantages which would justify embarking on CDM projects.

1.5 Hypothesis

A central question for this research is that, given the potential emission-reduction targets in 2012 for developing countries, and in particular SA, how appropriate is the CDM project cycle to energy management, climate mitigation and overall sustainable development?

1.6 Aims and Objective

The aim and objective of the study was to identify the current implementation of the CDM project cycle steps in South Africa for a selected number of companies and sectors. Furthermore, the appropriateness and effectiveness of these steps, as well as the possible opportunities, constraints and bottlenecks were researched. The intention is to improve the body of knowledge in order to mitigate these issues /constraints that key stakeholders may be having, and share best practices / benefits in order to develop the market further, where appropriate.

Key Questions in the Study

The following questions were used to explore and probe:

1. The current perception of the Clean Development Mechanism within selected companies and other interested parties.
2. At what stage of implementation of the CDM project cycle, are the current projects?
3. How effective has the design of the project cycle been?
4. What are the current opportunities for developing CDM projects?

5. What are the current frustrations, concerns and constraints in registering and developing CDM projects?
6. Finally, suggestions for improvement to the process were sought (see also Appendix 2 for examples of the questions used in the study).

1.7 Study Area

One-on-one as well as telephonic interviews with appropriate stakeholders were conducted in the Gauteng and Western Cape areas. There is some CDM activity in the Kwazulu Natal area, as well as other parts of the country, but these parties could not be contacted. In cases where stakeholders were geographically distant (such as the Western Cape), and particularly where they were not available for telephonic interviews, the questionnaires were emailed.

1.8 - Methodology

A short proposal was developed using a preliminary literature study, in order to glean the necessary background information. This included formulating a standard set of questions which would be presented to interviewees during a pilot study, as well as an interviewee list. This proposal was then presented to the Wits Ethics committee in order to ascertain whether it would comply with the requirements and principles as determined by the university. While waiting for approval, a short pilot study was conducted to assess the clarity and usefulness of the questions for the final study. Upon approval from the Wits Ethics committee (for further details see Appendix 11), a few modifications were made to the final questionnaire, and it was emailed as well as presented in person to various interviewees. In some cases telephonic interviews were also conducted. The selection of interviewees was based on a list of project owners and developers that are registered with the Dept of Mineral Affairs and Energy, as well as NGO's, energy consultants, selected companies and other interested and affected parties that had some experience in the CDM project cycle. While interviewing the respective stakeholders, they referred me to other interested and affected parties, which allowed me to extend my list of prospective interviewees. All the interviewees that were contacted were extremely willing to complete the questionnaire, except for one, who had time constraints.

As of June 2006 there were 32 projects that had been reviewed by the DNA (Department of Mineral Affairs and Energy), of which three CDM projects that has been registered in South Africa, seven more are at the validation stage, and another 22 at the PIN stage (Project Information Note) (Tyani, L., pers com). The interviews conducted were confined to those key stakeholders that have had experience with these projects. Approximately 24 interviews were held, as these were the only available contact persons that have participated in CDM projects.

1.9 Conclusion

In this chapter the responsibilities of developing countries become clearly evident. Many developing countries have made progress towards limiting emissions through reduction of fossil fuel subsidies and advocating the use of renewable energy and energy efficiency. South Africa's emission intensity is high, and is one of the top 20 emitters of greenhouse gases, mostly owing to its dependence on coal, and is the biggest consumer of electricity in Africa. Eventually all countries, including developing ones, would need to reduce their emissions. Furthermore, South Africa would be well placed to host Clean Development Mechanism projects owing to the strength of its economy, extensive infrastructure and wealth of natural resources.

South Africa has developed a national climate strategy, which recognizes that climate will have adverse effects and adaptation is necessary. It also alludes to the fact that poverty eradication and job creation is a priority, while promoting sustainable social, economic and environmental development needs. This integrated climate response strategy will ensure that climate issues become fundamental components of government policies and practices.

Considering the above initiatives and the concerns that emission targets could be set for companies or sectors through incentives and regulations, Carbon Trading could become a very important practice for companies, and in fact the country at large.

CHAPTER TWO - LITERATURE REVIEW

2.1 Introduction

There is wide-ranging literature on the origins, function and implementation of the Clean Development Mechanism. As a precursor to this, the Kyoto Protocol, signed at the third conference of the parties (COP3), established commitments and greenhouse gas emission-reduction targets for industrialized countries for the period 2008- 2012 (Ellis and Treanton, 1998). Moreover, this agreement requires industrialized countries to consider ways to minimize adverse effects on developing countries (whose economies are dependent on export and consumption of fossil fuels), through mechanisms such as funding, insurance and transfer of technology (Babiker *et al.*, 2000).

Market-based approaches, such as emissions-trading have been proposed and adopted as alternatives to “command and control” legislation (Sonneborn, 2004). This market-based mechanism would serve to limit the liability associated with a corporate or nation’s release of carbon into the atmosphere, since it would provide them with an opportunity to mitigate their carbon emissions (Sedjo and Marland, 2003). Since the Marrakech accords were instrumental in describing the “Modalities and Procedures” around project-based mechanisms, they deserve mention, and have allowed for the implementation of the Kyoto Protocol.

Sustainable development is a distinguishing feature of CDM projects, and ultimately determines its acceptance and success. Some of the sustainable development criteria are illuminated, with the associated barriers and possible solutions recommended. Project- eligibility criteria are clearly important, and in South Africa there are a multitude of different types of projects that could justify CDM investments. Sink projects such as afforestation and deforestation have been accepted at COP 9 in Milan. They are considered as temporary credits, and there is some controversy and issues surrounding their use. Many institutions have contributed to the development of the CDM especially the Conference of the Parties, the CDM Executive Board, the Designated Operational Entities, the Designated National Authorities, NGOs, financial institutions, insurers, project Owners and other stakeholders. Other players in the CDM market include the Prototype Carbon Fund and the Dutch CERUPT. Voluntary trading schemes include the UK, New South Wales, and the Chicago Climate Exchange are a step in the right direction especially in countries who have not totally embraced the Kyoto Protocol (UNEP, 2004) (see Appendix 4 for further information).

The CDM project cycle is complex, and requires project-design and formulation (through a project design document- PDD), host country approval (through the Designated National Authority – which is the DME in this case), validation by a certified Operational Entity, and registration with the CDM executive board, project financing (through investors), monitoring (through the project participants), verification and certification (by another independent operational entity), and the issuance of certificates from the CDM Executive Board (UNEP, 2004; EDRC, 2002; Cdmguide.net, 2005). Baselines and additionality are important concepts and are discussed at length. Project Financing and funding is provided primarily through loans or grants.

The market potential of CDM credits and pricing is set by market forces, and is affected by the various associated risks. Transaction costs affect the Internal Rate of Return (IRR) (see Appendix 5 and 6 for further information), and are often quite high owing to the need for multiple approval steps. Simpler requirements have been established for small scale projects, and bundling of these projects reduces costs (see Appendix 7 for further information). Every risk has an associated cost of mitigation, and these are compared and contrasted especially with regard to CDM projects. Should non-compliance occur, enforcement mechanisms have been designed to deter potential transgressors (see Appendix 9 for further information). Carbon taxes have been proposed as alternatives to emissions-trading, but the recommendation is that tax rates are set higher than the emission-reduction credit price (UNEP, 2004).

2.2 The Kyoto Protocol and Market-based Mechanisms

The Kyoto Protocol allowed for the development of an international emissions-trading and project-based mechanism (EcoSecurities, 2002). This provided a flexible, cost-effective way to trade the rights to emit greenhouse gases between industrialized countries, or between industrialized and non-industrialized countries. Industrialised countries included developed countries and countries with Economies in Transition – i.e., Central and Eastern Europe. These countries are termed Annex 1 (those having non-binding commitments to reduce their GHG emissions) or Annex B countries (having legally-binding emission-reduction obligations). For practical purposes, Annex 1 and Annex B countries are considered to be the same (Ecosecurities, no date available). Non-industrialized countries are termed Non-Annex 1 countries.

Within the trading system, one ton of carbon dioxide equivalent is deemed to be the tradable unit. Credits could be claimed from emission-reduction specific projects (such as using clean energy technologies – i.e. solar, wind, biomass, hydro etc) (see Appendix 3 for other technological options for the mitigation of carbon dioxide) and can be traded under this project-based mechanism on world stock exchanges. According to IETA, (2005, 12) 'the Kyoto protocol prescribes that industrialized and economies in transition should not exceed the GHG emission targets during the first commitment period i.e. between 2008 and 2012'.

The structure of the Carbon Market is based on the premise that one entity will pay another entity for a carbon credit, in order to meet its emission-reduction targets (IETA, 2005). The payment can be via mechanisms such as direct investment in the project (i.e., cash), provision of new technologies for clean projects, or even shares. This has led to the formulation of various mechanisms of trading, namely Joint Implementation (J1), Clean Development Mechanism (CDM) and Emissions-trading (ET). There are two basic types of carbon transactions – allowance based transactions and project-based transactions. Allowance-based transactions occur where allowances such as Assigned Amount Units (AAUs) from Russia or Ukraine (economies in transition) are allocated under the Kyoto protocol, or EU allowances are allocated under the EU Emission trading scheme (EU ETS). These are less risky since they are government-issued. These allowances can be transferred between countries (if a particular country has a surplus) or used to offset their own emission-reduction targets. The EU ETS entered into operation in 2005 (IETA, 2005), and is a European specific market for GHG emission allowances.

There are other markets trading in greenhouse gas allowances in other countries as well – such as the UK emissions-trading system, the New South Wales trading system (Australia) and the Chicago Climate Exchange (USA) (IETA, 2005) (see Appendix 4 for further details). The USA and Australia have not ratified the Kyoto Protocol, but have domestic policies internally to reduce greenhouse gases. Ultimately these "non-Kyoto regimes" might be linked with the Kyoto regimes, but there is currently no clarity on that issue (IETA, 2005). A 'Linking Directive' provides the governance for the relationship between the Kyoto Protocol and the EU ETS. In essence, the Kyoto protocol covers trading throughout the world, while the EU ETS is European based. Under this linking directive, ERUs and CERs can be imported into the ETS making it more broad-based (IETA, 2005; de Witt Wijnen, 2004).

There are many benefits for linking the allowance and the credit market, but largely it is one of price. If they were not linked, the allowances (e.g., AAUs from Russia and Ukraine) would flood the market and reduce the market potential for credits (JI and CDM) (Jepma, 2003; IETA, 2004). Surplus AAUs held by Russia and the Ukraine cannot be exchanged for EU allowances (IETA, 2004). The EU

ETS is an excellent example of a government supported emissions-trading system (Proegler, 2004). Only carbon dioxide emissions are covered during the first trading period (2005-2007) and the allocation of carbon dioxide allowances are governed by each country's submission of National Allocation Plans (NAPs). Here each member state sets targets and allocates allowances to each installation e.g., fuel generator, oil refinery, paper and pulp manufacturing etc (Meilinger, Meyer and Steinbrecher, 2004).

The EU ETS is the single largest market for greenhouse gas emission allowances. EU countries are also allowed to fulfill their commitments jointly and can enter into regional agreements with each other in order to reach these commitments. This mechanism is called "Regional Bubbles". Members of EU countries have formulated a "Burden-sharing Agreement" (see Table 2) whereby some member states, i.e., UK and Germany have committed to an emission-reduction of over 20%, in contrast to others- for example Portugal and Greece are allowed substantial emissions increases. In the event of failure to achieve this joint commitment, each EU country is individually responsible for the 8% target, in compliance with the Kyoto Protocol (Laroui *et al.,* 2004). The Burden-sharing agreement was based on principles of "equity and according to common but differentiated responsibilities and respective capabilities "(Shin, 1998, 525).

Table 2: Burden-sharing Agreement (After Laroui *et al.,* 2004, 4)

Member State	Specific emission-reduction in EU Bubble (1% of 1990 GHG emissions)
Austria	-13%
Belgium	-7%
Denmark	-21%
Finland	0%
France	0%
Germany	-21%
Greece	+25%
Ireland	+13%
Italy	-6%
Luxembourg	-28%
Netherlands	-6%
Portugal	+27%
Spain	+15%
Sweden	+4%
UK	-21%

Auctioning has been suggested as a way to implement the Burden-sharing Agreement, where any member state would have the same opportunity to buy the permits they need. Revenues received could be used to promote energy-efficient investments, research and development or investment in other GHG abatement projects. The potential barriers to this would be that business may reject the additional costs imposed on them to purchase these credits, and rather prefer the Grandfathering method: This is the free allocation of permits to current emitters. The suggestion is not to base the allocation on historic emission levels, or per capita (since some sectors could be overcompensated), but rather on a percentage reduction on current emissions (Vesterdal and Svendson, 2004).

Project-based transactions are where a buyer purchases credits from a project running in a host country, where the host country either does not have to meet any formal emission-reduction obligations, or has surplus credits available owing to that project. Project-based emission-reductions are more risky especially if they have not been registered or delivered (Cogen *et al.*, 2004).

JI refers to a project-based trading mechanism between two industrialized countries. It allows the trading of ERUs or Emission-reduction Units. There is a fast track (Track 1) and a slow track (Track 2) mechanism for JI Projects -if the eligibility criteria for the fast track are not met (Van der Gaast, 2003). JI Host countries will be mainly central and eastern European countries (Woerdman, 2000). Technology transfer is optional for JI projects, but mandatory for CDM Projects (Woerdman, 2000).

CDM refers to emission-reduction projects between Annex 1 (Developed) and non-Annex 1 (Developing) countries. It is believed that abatements costs are lower in transition countries and developing countries, so the carbon market should institute global efficiency gains but very importantly, these projects must contribute to sustainable development, perpetuate clean technologies and provide new sources of (government and private) investment in the non-Annex 1 host country (IETA, 2005). All projects must be independently certified. The credit obtained is known as a CER or Certified Emission-reduction. These can be banked from the year 2000, and used during the first commitment period (2008 – 2012) (De Witt Weijen, 2004).

ET or Emission Trading allows Annex B countries to transfer portions of their Assigned Amounts (AAs) of GHG. This allows for countries that have not exceeded their limits, to transfer the excess capacity to countries which have exceeded their limit. (Ecosecurities, 2002), Any party is allowed to transfer or acquire ERUs , CERs and AAUs, if it is party to the Kyoto Protocol, has established its assigned amount, can estimate its emissions , uses a national registry and regularly submits its inventory (de Witt Weijnen, 2004). As part of the linking directive, both ERUs and CERs can be used to meet obligations under the Kyoto Protocol (IETA, 2005), and once credits have been issued, there is no difference between them and EU allowances or AAUs. The most important benefit of the linking directive is that it will reduce overall cost of compliance for all EU members (Jepma, 2003). Banking (other than in CDM projects) is currently not allowed, although from research done, it has been shown to reduce costs, since cost savings can be traded over time as well as improving flexibility (Schleich *et al.*, 2006).

JI projects have to conform to a “basic set of rules which include environmental effectiveness, cost effectiveness, equity and ethics, flexibility, practicality, respect for the sovereignty of states” (Illum and Meyer, 2004, 4). As with all emission-reduction mechanisms, JI projects should have as an overall objective, the reduction of greenhouse gas emissions and the minimal use of “hot air” which is surplus Kyoto units from Russia and Ukraine (Illum and Meyer, 2004).

For projects to qualify as CDM projects, they need to demonstrate valid mitigation of carbon dioxide emissions, and need to conform to certain eligibility criteria (Ecosecurities, no date available). Firstly, the host country needs to approve the project, based on the fact that it aligns with and contributes to their sustainable development policy. Secondly, emissions-additionality has to be proven (UNEP, 2004). This is the difference between business as usual emissions (the baseline) and emissions owing to the project. Obviously the project should display reduced greenhouse gas emissions. Both CDM and J1 Projects need to calculate their additionality. Baseline setting is highly complex and great uncertainty still remains in determining accurate levels. This is mostly because political, financial, regulatory, and economic factors can influence it. Knowledge of the socio – economic and macro- economic trends in the energy market needs to be known. Ultimately, all projects should lead to measurable, valid and sustainable reductions in emissions, resulting in an overall environmental benefit. Also, environmentally-sound projects should incentivise foreign direct investment and the transfer of technology (Rentz, 1998). In order for the project to be successful, environmental performance in achieving carbon dioxide reductions should exceed legal requirements, future developments, and historical precedents.

When considering the market potential and issues surrounding CDM projects, it appears as if CERs generated by these CDM projects will compete with other Kyoto mechanisms in the international market. The same applies to JI projects. Only if surplus Kyoto units from Russia and Ukraine (Hot Air) are limited, will the CDM projects be competitive (IETA - Margaree consultants, 2004).

2.3 The Marrakech Accords

The practical implementation of the Kyoto Protocol was still to be decided upon, and the Marrakech Accords (signed in November 2001) were instrumental in achieving this. Decisions from the seventh session of the conference of the parties (or COP 7) elaborated on the broad principles of the Bonn agreement (previous COP meeting) (Pew Center, 2006). Predominantly the main areas of discussion were the operating regulations for the ETS, CDM and JI, accounting procedures for transferring emissions units under all three mechanisms, creation of emission units for sink credits amongst others (Pew Center, 2006). It allowed for the prompt start of CDM projects so that projects commencing in 2000 could be eligible for CDM or JI projects. Crediting for CDM projects would be valid from 2000, while for JI projects, only from 2008 (Chen, 2003).The adaptation fund was formulated, whereby 2% of the CERs issued would be directed to that fund. Nuclear projects were completely excluded for CDM and JI projects owing to their controversial nature.

Other important decisions taken at Marrakech included a country specific ceiling on credits from forest management (69.87 MtCO2 per year), a cap on CDM projects (limit to 1% of base year emissions, and only afforestation and reforestation projects would be considered). Rules for LULUCF (Land Use Land Use Change and Forestry) were defined as well (Forner and Jotzo, 2002). It was also decided that there would be no quantitative limit on the use of CERs and ERUs , while ERUs, CERs, AAUs may be transferred with and between registries (Chen, 2003). Compliance was also discussed including the consequences and legal ramifications of non-compliance. Unilateral CDM was approved, allowing a developing country to initiate and run CDM projects without Annex 1 country involvement, and then sell the resulting certified emission-reductions (IETA, 2005). Also, emission-reduction credits were created for carbon sinks, although they were limited to an overall cap of 33Mt C per year (Forner and Jotzo, 2002) and full tradability was now allowed between the mechanisms, as mentioned above.

2.4 Comparison of CDM and JI projects to International Emissions-trading

Compared to International Emissions Trading (IET), some of the studies have argued that both CDM and JI projects will be more effective, efficient and politically acceptable (owing to avoidance of redistribution of property or user rights) (Woerdman, 2000). They also allude to the fact that trade in “hot air” from Russia and Ukraine could result in false reductions under IET. They believe that transaction costs may increase for IET owing to onerous trading rules and hybrid trading system design. Also, CDM and JI would enjoy competitive advantage over IET as a result of them being cheaper to implement (Woerdman, 2000).

2.5 Benefits, Barriers and possible solutions for CDM and JI projects

Barriers and Benefits of CDM Projects

Some of the noteworthy benefits of CDM projects are that currently CERs are cheaper to purchase than other emission-reduction units, and can be banked from the year 2000 (in other words, projects with valid credits from the year 2000 can be used from 2005 onwards). They are valid for both the first trading period of the EU ETS (2005-2007), as well as for the first commitment period of the Kyoto Protocol (2008-2012), therefore even have an advantage over JI projects (Gupta, 2001) and can be sold throughout the world, not just in the EU. If sufficient volumes are purchased, the transaction costs can be reduced (Mortimer, 2004). Based on practical experience from the Sulphur dioxide allowance trading scheme in the USA and some existing literature, “Emitters facing large abatement costs, will in general prefer to buy allowances from the market if prices are lower than the cost of implementing in-house measures, while emitters with low abatement costs will have incentives to cut emissions beyond their targets and sell the surplus with a profit” (Christiansen and Wettestad, 2003, 4). Consequently, if CDM projects consistently provide low cost abatement opportunities, they will enjoy a captive market.

Further benefits from CDM projects are based on the premise that developed countries could reduce their greenhouse gas-abatement costs by investing in relatively cheaper projects in developing countries. Developing countries in turn benefit from increased financial inflow and returns, improved balance of payment, job creation, advancing national development goals, technology transfer and replacement of old inefficient technology with new sustainable, environmentally-friendly technologies (UNEP, 2004). Enormous cost savings would be realized through energy conservation, efficiency, as well as renewable energy projects. From an environmental perspective, the potential benefits are huge such as reduced air, water and soil pollution, owing to less fossil fuel use, protection of biodiversity and generally resulting in conservation of these critical resources (UNEP, 2004).

CDM projects may potentially become more expensive than JI projects, if the stipulation that 2% of the value of the CERs should be set aside for adaptation and administration costs is applied. Taxes (including CER taxation by host countries (could be up to 10%), and an adaptation fund levy (2%)) on CDM projects could limit CDM supply resulting in some developing countries not embarking on CDM projects if the credit prices are very low (Michaelowa and Jotzo, 2005). Another concern would be if “Sustainable Development” is interpreted too strictly and increases the price of CDM projects (see more detail below). Other issues affecting the sale of CDM projects could involve transaction costs, and institutional rigidities (Michaelowa and Jotzo, 2005; Kim, 2003; Tangen and Heggeland, 2003; OECD, 2004). Transaction costs increase as implementation costs increase, and since fixed costs are extensive, smaller projects could be at a disadvantage (Michelowa and Jotzo, 2005; Krey 2005).

Other opinions suggest that the non-participation of the USA and the availability of “hot air” from Russia and Ukraine further contributes to the problem of low-priced CERs (Kim, 2003). They also feel that the complex and lengthy approval process for CDM projects serves to increase the transaction costs (OECD, 2004). In addition, the detailed operational process of CDM projects could result in slow speed of implementation and reduction in CDM credits (Chen, 2003). Limited capacity for running CDM projects and ineffective institutional frameworks, are other important factors (Chen, 2003; Singh, 2006). Lack of resources, time, knowledge and funding could limit the development of renewable energy projects (Martinot, 2001). Other concerns relating to the certifying authority have been that these third party monitors may know less about the complexities of these projects than the investing parties and recipients of the CERs (Singh, 2006). They may also be unable to design a contract to establish trustworthy and truthful information regarding investment intentions. This may encourage unjustified investments (Fischer, 2005). Finally, political stability is critical to the success of CDM projects (Jotzo and Michealowa, 2002; Singh, 2006).

Besides the barriers mentioned before, other constraints for CDM projects revolve around the fact that with new technologies, new markets, products and projects there is some apprehension and aversion by financial institutions to provide financial assistance and support (EDRC, 2002; Singh, 2006). This may be able to be overcome through provision of detailed design documents, and demonstration that thorough research has been done through competent personnel. Other barriers encountered as described in Table 3 have been lack of technology, staff competence, large risks to investors and lack of experienced management. In South Africa, support for renewable electricity projects has been lagging, perhaps owing to absent or lack of clarity in policy frameworks. Project developers have provided convincing motivations that carbon finance and technology and capacity transfer would alleviate these issues. Other experts argue that strict application of sustainable development criteria, and sustainable development impact assessments merely complicate the issue, add to the transaction costs, and make CDM projects less attractive to international investors (UNEP, 2004). Opinions from the opposite side argue that this makes for well-conceived and designed projects (UNEP, 2004).

Barriers and Benefits to JI projects

From the literature, it is apparent that the barriers to JI projects are very similar to these for CDM projects, however in particular, baseline uncertainty and complexity appears to be at the forefront of concerns. A number of approaches for baselines have been proposed such as project specific baselines, default matrix approach, technology matrix approach, benchmarking, investment analysis methods and a systems model approach (Begg *et al.*, 2001). Further research would be required into these models, as they may even be appropriate for CDM projects. As with all projects, project performance uncertainty is mentioned, as well as the accuracy of technical and financial data, and social, environmental and political factors. Some case study projects encountered some negative effects from JI projects such as increases in carbon monoxide emissions from oil to biomass conversions, increase in waste production from oil or gas conversion to biomass, and increases in transport requirements for some oil to biomass conversions (Begg *et al.*, 2001). Further risks to host countries (from JI projects), were equity issues especially where there was low institutional capacity, poor environmental regulations, and limited access to capital and resources.

Some of the benefits from JI projects (other than GHG emission-reductions), were noticeable reductions in sulphur dioxide and nitrogen oxide emissions. Suggestions for possible solutions to the baseline uncertainty issues included regular baseline revision, standardized assessment procedures, limited crediting life, partial credits and restriction of types of projects (to reduce uncertainty). Institutional safeguards were proposed in order to address the equity and lack of capital and resources constraints, highlighted above (Begg *et al.*, 2001). These solutions could certainly be considered for CDM projects, and the requirements for sustainable development could address this as well.

Table 3: Barriers that could be addressed by CDM investment (After EDRC, 2002, 7)

Potential Barriers	Examples
Technological	Risks for the provision of the technical service for equipment Technical risks such as technology performance, resource availability Technology has never been demonstrated in the host country
Organizational/ legal	Substantial obstacles to receiving direct investment Policies that subsidize coal, natural gas or heat
Financial	Lack of long-term risk capital High cost of capital Exchange rate risks High transaction costs and risk of not recovering pre-investment costs Demonstration of new business model(e.g. energy service company)
Market	Raw material supply risks Unpredictable price trends

These barriers and benefits will be explored more deeply through a detailed study of the CDM project cycle, and where possible, suggestions provided to overcome certain of these barriers.

2.5.1 Barriers to CDM projects in South Africa

Many of the barriers mentioned before apply to South Africa, but most noticeable would be the restricted capacity and supply of physical and human resources, as well as inefficient governance, limited leadership and decision-making processes (Kim, 2003). According to Kim (2003), other important factors would be the conflicting opinions of stakeholders and investors. Some stakeholders have not been convinced of the benefits of CDM projects for South Africa since they feel that developed countries might seize all the cheaper projects (“Low-hanging fruit”), leaving the more expensive opportunities for the host country to use when they need to take on emission targets. Also large private industries may potentially be threatened by the impact of CDM on the coal industry, as well as on locally developed technology (Kim, 2003). Other concerned stakeholders have felt that social and development issues should be the primary objective for CDM projects, while investors have indicated that financial benefits should be paramount. This could result in dysfunctional relationships between stakeholders and investors, and sabotage the effort behind the CDM (Kim, 2003).

2.6 Sustainable Development

Another very important distinguishing feature for CDM projects (which differs from J1 and ETS), and which ultimately determines its acceptance and success, is its adherence and compliance to the host country’s sustainable development goals and criteria (EDRC, 2002). Host countries have the mandate to screen and exclude projects that do not meet these criteria. At a local level, authorities can select projects that meet national development goals as well as providing economic development, social equity and environmental sustainability (UNEP, 2004). CDM projects could be rejected on the basis of their development additionality (Kim, 2003). Although the financial and environmental benefits are important, CDM projects are expected to address the social benefits as well.

Some of the sustainable development criteria (UNEP, 2004) (see Table 4) would include issues such as job creation, equity, empowerment, participation, poverty eradication, environmental improvement and enforcement of regulations. Other issues that should be covered are rural and human development and sustainability of projects. However, one of the constraints is that whatever host countries consider as their development priorities, will determine how sustainable development is applied, and this may not necessarily achieve the desired objective. Another hurdle to overcome, would be to ensure consensus is achieved between investors and stakeholders (Kim, 2003). Stakeholders (including government, industry and civil society) believe that the use of local skills, goods and services should be paramount whereas investors are more cautious. They insist that they would like to use the most effective workers, who are the most skilled. Many investors feel that it is easier to purchase local goods and services and provide training, than to employ local resources (Kim, 2003). Further to that, the UN commission on sustainable development proposed more than 100 indicators to assist host countries when evaluating their projects. These indicators have been designed to be comprehensive and reflective of the various dimensions, consistent with requirements, yet provable and measurable (UNEP, 2004).

Table 4: Examples of Sustainable Development Criteria identified by host countries (after UNEP, 2004, 18)

Social Criteria
Improve Quality of Life
Alleviate Poverty
Improve equity
Economic Criteria
Provide Financial returns to local entities
Result in a positive impact on balance of payments
Transfer a new technology
Environmental Criteria
Reduce Greenhouse Gas emissions and 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

2.6.1 Barriers to Sustainable Development and possible solutions to constraints

There does not seem to be a standardized, well-accepted approach or methodology for implementing sustainable development within any particular country (Holm Olsen, 2005). It appears as if the priorities for different stakeholders, are different and as a consequence, more powerful stakeholders entrench their views and beliefs, overriding the weaker, less powerful ones (Holm Olsen; Kim 2003). Conflicts may also arise owing to differences in expectations of local stakeholders and international investors (Kim, 2003). Another issue encountered is competition amongst developing countries for their share of the CDM investment resulting in less strict application of sustainable development criteria (Holm Olsen, 2005).

It also appears as if CDM projects with high development benefits struggle to find finance (Holm Olsen, 2005). This has led to the conclusion from the research done (Kim, 2003), that sustainable development benefits could be a hindrance to attaining the spirit of CDM. Some experts have argued that the evaluation of sustainable development impacts is simply an additional burden, and financially hamper the project by adding to the transaction costs. Others have come to the same conclusion and have said that application of inflexible sustainable development criteria could disperse potential investors (Holm Olsen, 2005). As a counter argument, many say that this would result in well-researched and better-designed projects, which ultimately align with national development goals (UNEP, 2004).

A growing body of evidence has also advocated a clear connection between CDM, access to energy and the Millennium Development Goals. Further to that, renewable energy projects, and energy-efficient projects aimed at households could minimize poverty (which is a sustainable development goal), as well as assist with achieving the Millennium Development Goals (inter-alia job creation, education, equality, rural health and environmental quality) (Singh, 2006). More research into this topic would certainly provide interesting results.

Possible Solutions to constraints around sustainable development

One possible solution to some of the constraints around criteria for sustainable development would be to apply the SouthSouthNorth (an NGO) matrix tool which uses a combination of a checklist and multi-criteria approaches (Holm Olsen, 2005). According to Holm Olsen (2005, 8), it is 'based on a scoring system, where quantitative values are assigned to each criterion based on selected quantifiable indicators. The scores can be added and generate a total score for each CDM project assuming equal weights to all indicators'. A criticism of the tool is that it is based on scores which are assigned subjectively (Holm Olsen, 2005). Another tool was designed by the World Wide Fund for Nature (WWF) called the Gold Standard. This varies the multi-criteria approach, and ensures that only high quality CDM projects are approved. It uses the sustainability assessment tool from the South South North Matrix tool, but requires that an EIA is done, and that stakeholders and the public are consulted.

Some experts feel that investors could pay a higher price for CERs which have conformed to the required sustainable development (SD) criteria, and use this to enhance their reputation. NGOs and academic or research institutions could inspect projects to ensure that high SD criteria are applied, while rewards could be administered to projects implementing the Gold Standard. Another option would be for international standards for SD to be negotiated which could become mandatory for these projects. (Holm Olsen, 2005) If proper, well-designed tools are used to assess sustainable development criteria, and assign specific weightings to them, this could assist with approval of CDM projects. Other suggestions to mitigate some of the barriers would be to provide dedicated investment funds for high quality carbon credits which have high-sustainable development benefits. Support for sectoral CDM, may be another option, where certain sectors which have high development benefits, are given preferential support (Holm Olsen, 2005).

Another interesting piece of research has suggested that it is likely that smaller projects (in developing countries like Nepal) such as biogas, improved cooking stoves, micro-hydropower, and improved water mills could significantly contribute to the Sustainable Development of a country. These projects (which have not been the focus of international organizations) have an overwhelming potential of meeting the criteria and objectives of the CDM by providing rural livelihoods, alleviating poverty, and contributing to improvement of health and education (Singh, 2006). This has been largely overlooked, and would be well worth further investigation.

Some of the institutions that have been instrumental, and have contributed greatly to the success of CDM projects, are expounded upon in Appendix 11. For further details please review this section.

Eligibility and participation

All parties (both Annex 1 and non-Annex 1), must meet the following criteria on order to participate in CDM: They must participate voluntarily, they must establish a national CDM authority (designated national authority or DNA), and they must have agreed to or ratified the Kyoto protocol. Over and above that, Annex 1 countries should have an assigned amount established, national allocation plans, have developed a national system for the estimation of greenhouse gases, a national registry, conduct annual inventories, and a financial system for the sale and purchase of emission-reductions. There are many requirements for CDM projects, but two fundamental ones are additionality and sustainable development. A definition from article 12 of the Kyoto protocol, states that additonality is “reductions in emissions that are additional to any that would occur in the absence of the activity”. This additionality is with reference to a baseline which is calculated as business as usual emissions. These projects must be relevant, provable, measurable and provide valid mitigation of climate change. Sustainable development is critical to the approval and success of these projects and encompasses social, economic and environmental factors.

Types of eligible projects, technology share and projects that could attract CDM investment

Nuclear energy projects do not qualify for CDM projects owing to their controversial nature. Sink projects that are acceptable would be afforestation and reforestation. Only 1% of the baseline emissions of Annex 1 countries are allowed to originate from sink projects. Table 5 below describes the types of projects that could attract CDM investment.

Spread of technology within eligible emission-reduction projects

In Figure 1 the spread of types of technology globally within emission-reduction projects is seen to be overwhelmingly based on Halofluorocarbon destruction, with methane and nitrous oxide second. Biomass energy, hydro and landfill gas capture are joint third.

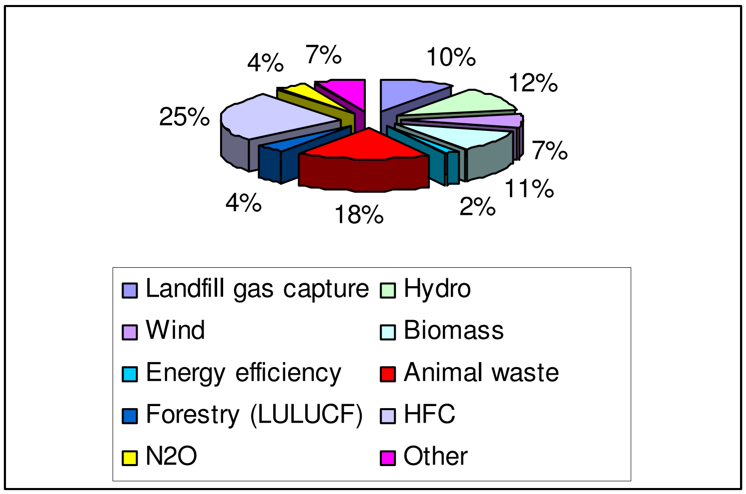

Figure 1: Technology Share of Emission-reduction Projects Jan 2004- April 2005 (in percent of total volume contracted)
(After IETA: States and Trends of the Carbon Market, 2005, 24)

In Southern Africa, and in particular South Africa there are a multitude of different types of projects that could justify CDM investments. Further to that, in Table 11, detailed project activities are described for each sector.

Table 5 Projects that could attract CDM investments (after EDRC, 2002, 3)

Energy Supply	Gas fire power generation
	Cleaner coal power generation technology
	Hydro-electricity to replace coal-fired power stations
	Co-generation (biomass or fossil fuel based)
	Renewable electricity (eg wind, photovoltaics, biomass) and other renewable energy(eg biogas)
	Switch of synthetic fuel feedstock from coal to gas
	Use of forest and agricultural waste to generate electricity and heat
Manufacturing	Conversion of boilers from coal to gas
	Industrial energy efficiency
	Structural change to less energy and emissions intensive industries
Mining	Industrial energy efficiency
	Reducing methane emissions from coal mines
	Control of dump fires
Agriculture and forestry	Afforestation and reforestation (during the first 2008-2012 commitment period)
	Improved management of natural woodlands (not yet included in the CDM)
	Control of fires (not yet included in the CDM)
Transport and communications	Improved public transport
	Improved urban planning and traffic management
	Improved vehicle efficiency
	Vehicle fuel switching
	Switching from road to rail transport
Residential, commercial and government buildings	Energy-efficient appliances
	Solar water heating
	Fuel switching in households and commercial boilers
	Energy-efficient building design
	Energy management

Buyers of Project-based credits

Governments and industry are the prime candidates for purchasing project-based emission-reductions, and from the research done until April 2005, most of the purchases have come from Europe. For further details see Appendix 8.

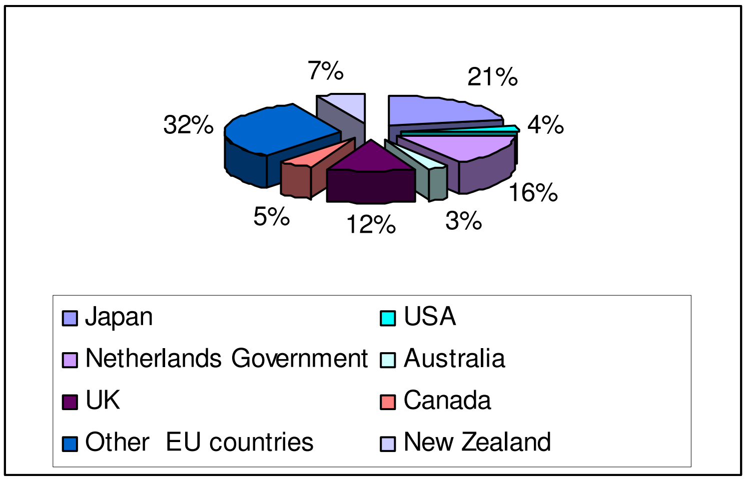

Figure 2: Market Buyers (Share of volume of emission-reductions purchased) Jan 2004 – April 2005 (After IETA: States and Trends of the Carbon Market, 2005, 21)

Sellers of project-based credits

As of April 2005, the largest seller of emission-reduction credits has been Asia (Approximately 45%), with Latin America second (approximately 35%). A large number of projects have been approved by the Indian DNA, but since these are unilateral CDM projects (no Annex B/1 buyer identified yet), they do not reflect as credits sold yet (IETA, 2005). From Figure 3, a graphical depiction of the projects which have been validated and registered with the CDM Executive Board, it can be seen that the three largest suppliers of projects are India, Brazil and Chile while Africa has been lagging. This picture has changed somewhat in that South

Africa and Uganda have recently registered a few CDM projects, with Nigeria, Ghana, Sierra Leone and Zambia actively working on some. In South Africa, local businesses such as SAB and Anglo American have embarked on unilateral CDM projects. The intention appears to be to use these to offset their emission targets in Europe, or to sell the credits to market buyers (Africainvestor, 2005). China and Mexico are emerging markets and have a large number of projects in the pipeline (IETA, 2005). China and India are expected to account for 60% of the CDM market share (Jotzo and Michaelowa, 2002).

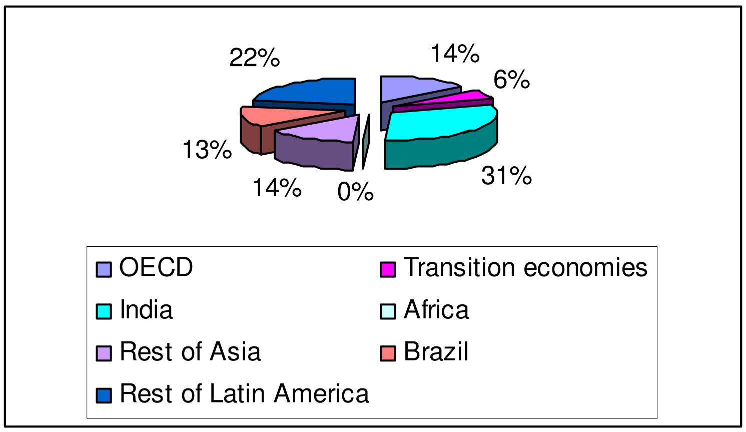

Figure 3: Location of Emission-reduction Projects (in share of volume supplied) (After IETA: States and Trends of the Carbon Market, 2005, 22)

2.7 CDM project cycle

Having given a detailed account of benefits and constraints of CDM projects internationally and in South Africa, attention now turns to a key focus of this report, which is the CDM project cycle. It has been labeled as complex, by some critics, but is nevertheless detailed and comprehensive. The CDM project cycle (as depicted in Figure 4) requires project design and formulation (through a project design document- PDD), host country approval (through the Designated National Authority – which is the DME in this case), validation by a certified Operational Entity, and registration with the CDM executive board, project financing (through investors), monitoring (through the project participants), verification and certification (by another independent operational entity), and the issuance of certificates from the CDM Executive Board (UNEP, 2004; EDRC, 2002; Cdmguide.net, 2005).

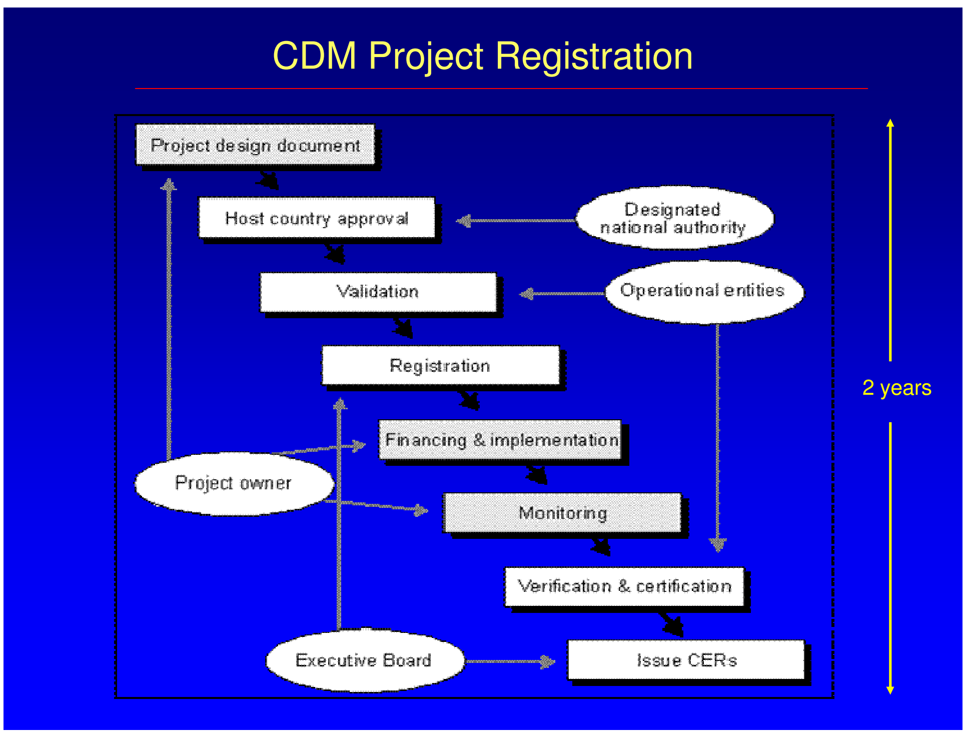

Figure 4: Graphical depiction of the CDM project cycle (Blignaut, 2005)

The PDD is a comprehensive document, and requires in-depth descriptions of the project activity, purpose, terms of operation of the project, list of parties involved, location and geographical information regarding the project, identification of project activity category, description of the transfer of safe and environmentally-friendly technology, details of how GHG emissions will be reduced, information on funding – either public or private funding (however if public funding , it should not divert official development assistance), and confirmation that the project is not a 'debundled' component of a larger project (UNEP, 2004).

The baseline methodology should include a justification on the choice of methodology, details of how this project reduces the emissions below the baseline (and is therefore additional), specific mention of the project boundaries, and an overview of the development of the baseline. Each new baseline methodology (as well as monitoring methodology) must be approved, by the Executive Board. Since a very select number of methodologies are available on the UNFCCC database, new baseline methodologies will be considered by the Methodology Panel. They will then undergo a desk review by a panel of experts, and be discussed at the next meeting of the Executive Board. Should the particular methodology be approved, then it can be used for the project, and subsequent CDM projects with similar characteristics, may implement it as well. The Executive Board is responsible for developing guidelines for these baseline methodologies which will assist in project preparation (CDMguide.net, 2005). These guidelines clearly describe the CDM rules, while ensuring consistency, transparency and predictability. They insist that reductions in emissions should be proveable, measureable and reflect reality. Baselines should be applicable to different geographic regions, project categories, and be applied in a standard manner. In particular, guidance is given on the definition of project categories that show similar methodological characteristics, and methodological tools which will ensure that relevant methodologies are selected. Advice is also given on boundary determination, national policies and scope of baselines (UNEP, 2004).

In addition when describing the baseline methodology, reference should be made to the project category (for small scale CDM) or methodology (normal CDM) from the UNFCCC CDM website. In all circumstances, (unless extensive justification is provided otherwise), an output-based (CO_2 –eq/ unit of output), or product-linked definition of baseline values should be used (UNEP, 2004).

The reasoning for the choice of methodology, should be clearly defined and it should be based on:

1. Existing actual or historical emissions
2. Emissions from an economically-attractive technology
3. Average emissions from similar project activities, whose performance rates in the top 20%, and that have occurred in similar circumstances and environments. (Small scale projects are afforded simplified calculations for baseline determination).

Business as usual baselines could be set artificially high, resulting in inaccurate emission calculations or overestimation of project credits (Figure 5). By the same token business as usual baselines could be set too low, resulting in a conservative project credit. Further to that, other inaccuracies could arise where the calculated baseline due to the project is higher than the true baseline which results in an underestimation of the project credits (Figure 5).

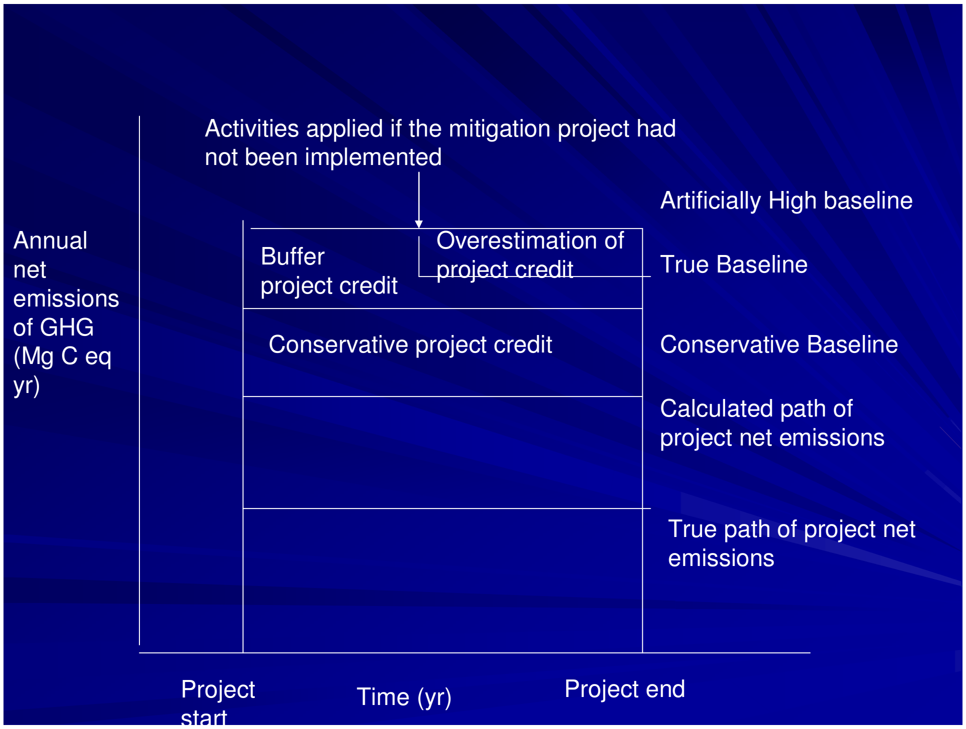

Figure 5: Activity scale showing the notional relationship between artificially high, true and conservative baselines, as well as calculated and true project net emission paths. An artificially high baseline results in an overestimated greenhouse gas credit (after Gustavsson, 2000, 941)

Additionality

There are two types of additionality testing – environmental and financial additionality (EDRC, 2002). The environmental additionality of a project should be able to show valid reduction of GHG, which is additional to any that would occur in the absence of the activity (UNEP, 2004; EDRC, 2002). To demonstrate the environmental additionality of a project, one could indicate that the project type is not common practice (UNEP, 2002), or alternatively do a qualitative or quantitative review of potential options, and a description of why the non-project option is more likely. Another way would be to prove that the technology used was the most appropriate for that project. Financial additionality on the other hand checks to see that there is no diversion of official development assistance - i.e., the funding must be additional to official development assistance (EDRC, 2002). In contrast, some studies have proposed that CDM can complement FDI investments and contribute to further carbon dioxide reductions. They believe that existing FDI could be invested in technology transfers of energy saving technologies (Kaneko *et al.*, 2006).

Since it is not possible to prove "what would have happened otherwise", uncertainties in baselines are not easily eliminated. They should however be environmentally feasible, providing long term emission-reduction benefits, be simple and relatively cheap to formulate, be verifiable, and provide economic benefit to investors (EDRC, 2002). A disproportionally high number of emission credits will be generated, if the baseline is set higher than the emission level that would have occurred in absence of the project. Conversely, the emission credits would be disproportionally small if the project baseline is set lower than the emissions level. This could result in disqualification of eligible projects. Finally it is important to note that baselines cannot be verified after the project has commenced, but the logic and assumptions can be monitored (EDRC, 2002).

Historical baselines appear to generate the most actual reductions (and therefore credits), while industry average over-allocates reductions compared to actual reductions. For large reductions, historical baselines provide the most credits, while for smaller reductions the industry average baseline produces the most (Fischer, 2005). Any quantifiable increase in emissions, either outside the boundary of the project or timeframe, owing to the project is known as leakage. (The project boundary is the defined area where emission-reductions or sequestration take place) (EDRC, 2002; UNEP, 2004). For example, in the case of biomass projects, the project could divert biomass from other users, resulting in increased fossil fuel use (Lehmann, 2004). If there is a positive leakage, i.e., reduced emissions outside the boundary, or after the project ends, this is known as spillover. Often leakage is an unintended consequence, for example where an extensive energy-efficiency program reduced the price of electricity, with a rebound increase in demand for power. In contrast, spillover may become an intended consequence of a project and marketed as such. In some cases, carbon reductions would have occurred without the presence of the CDM project. Here, additionality could not be proven, and the emission-reductions should be included as part of the baseline (EDRC, 2002). Some project developers have suggested that leakage effects are not comprehensively addressed (Lehmann, 2004).

Project specific baselines measure emission-reductions from one project. As with all baselines, they are complex to develop and considerable uncertainty surrounds their determination (EDRC, 2002). Multi-project baselines are baselines set for a group of similar projects. They are aggregated and set across geographical and sectoral areas. These baselines may only be appropriate for some project types. They are often used as benchmarks, activity indicators or intensity standards. Multi-project baselines offer some notable advantages since the burden of estimating emission-reductions is shifted either to the regulatory entity of a carbon trading scheme, or to another project consolidator (Sathaye *et al.*, 2004). This can largely reduce the transaction costs. Hybrid baselines are based on standardizing the method or value of one or more components of the baseline (EDRC, 2002). Static baselines are set for the duration of the project and so reduce the uncertainty around the amount of credits being generated by a project. They are also less onerous from a monitoring, reporting and administrative perspective, as well as reducing the costs. Dynamic baselines are regularly reviewed and are therefore more accurate, thus ensuring additionality of a project. Inherent in this is some uncertainty of number of credits that will be generated by the project (EDRC, 2002).

Host country approval

The host country is responsible for screening projects, and ensuring that it meets its own requirements. A Designated National Authority (DNA) has to be appointed for this, and in the South African case it is the DME. They have a number of tasks and duties to fulfill, which includes ensuring the project complies with national policy and regulatory regimes. They also have to develop national criteria to assess additionality and sustainability of projects, as well as elaboration of guidelines and procedures for project approval (UNEP, 2004). Most importantly, before the DNA approves the project, they need to ensure that the project developers have participated voluntarily in the project, and that the project conforms to the sustainable development goals. They should also provide CDM information within the country, train and develop capacity, promote the country as a CDM host, as well as promote financing of projects (OECD, 2004). Based on the above, a formal letter of approval is given to the project developer and that is submitted with the project design document, and supporting documentation to the DOE.

Validation

The project design document needs to be reviewed by an independent certified auditing or accounting firm (at this present moment only Price Waterhouse Coopers are certified in SA, although South African projects may utilize any DOE throughout the world). However, before this is done, they need to ensure that all participants in the project have approved and are in support of the Kyoto Protocol (UNEP, 2004). They would then request input and feedback from local communities, NGOs and other interested parties. In addition they will validate if the project activity will in fact reduce the GHG emissions, assess the assumptions and plans, including the monitoring plan and the baseline. An environmental impact analysis must have been done, and if significant impacts were found, a full environmental impact assessment should be done.

Registration

Once the DOE has validated a project, then the registration process is fairly seamless (EDRC, 2002). The Executive Board will register the project and publish a list of approved projects on their website. A registration Fee needs to be paid to the CDM Executive Board for registration of CDM projects. This ranges between 5000 USD (small Projects) to 30 000 USD (Large projects) (UNEP, 2004).

Project financing and funding

Loans, equities and grants are required to fund CDM projects. Loans and debts would primarily be sourced from financiers, public markets (bonds), bank loans etc. Company shareholders provide funding (equity), and this may be obtained internally (sponsors), or externally from public or private markets, while grants are provided by governments and institutions (these do not have to be repaid). These often only cover a percentage of the costs, and are provided if the project is aligned to the donor's goals and objectives. Another mechanism is upfront payment for CER purchases, although as part of the ERPA (emission-reduction purchase agreement), they are often required to pay on delivery of credits (UNEP, 2004).

Unilateral, bilateral, multilateral and a mixture of the previous three (open architecture) sources of funding could be used to develop CDM projects (EDRC, 2002). Diversion of official development assistance should not occur (UNEP, 2004). In unilateral sources of funding, the project owner assumes all the risk of design and implementation, as well as whether carbon credits will be generated.

With bilateral sources of funding, the owner partners with an investor (usually from an industrialized country).The investor can either provide upfront funding, and in essence purchases the credits prior to their issue, or the investor can purchase shares in the project, and benefit from the profits or losses, and receive the predetermined number of carbon credits when they are issued (EDRC, 2002).

The benefits of bilateral funding for the owner are that they would receive funding without having to take a loan, and the investor could also supply technology and expertise. The possible disadvantage is that the owner may have less control over the details and design of the project, and may lose if a fixed price for the carbon credit is agreed upon upfront. For this, an Emission-reduction Purchase Agreement (ERPA) is signed (EDRC, 2002).

Multilateral sources of funding are where multiple investors collaborate to form a joint CDM fund which will finance multiple projects. Any carbon credits from these projects will be distributed pro rata amongst the investors. The benefits for investors are that they can spread the risk across selected projects. The World Bank Prototype Carbon Fund (PCF), Community Development Fund and the Bio Carbon Fund are examples of multilateral sources of funding, where the World Bank acts as a fund manager (EDRC, 2002).

Monitoring

A monitoring plan needs to be developed which will ensure a systematic surveillance of the project’s performance, and to measure whether the objectives have been achieved according to relevant target indicators. Effectively, monitoring evaluates the project’s effect on greenhouse gas emissions and other non-emission factors such as costs - economic, social and environmental and looks to improve planning and measuring processes (EDRC, 2002). The plan should include a description on how the data will be collected, what type of data, and how it will be recorded and kept as evidence (UNEP, 2004; Cdmguide.net, 2005) .In particular, the data collected is needed to estimate the GHG emissions occurring within the project boundary and determine the baseline GHG emissions. Data is also required to assess the environmental impacts, including the impact across the boundaries (UNEP, 2004).

Monitoring methodologies need to be approved by the CDM executive board, before being implemented by project participants, and a justification for the choice of methodology for that project is especially necessary (UNEP, 2004; CDMguide.net, 2005)

Verification and Certification

A certified Designated Operation Entity (DOE) needs to review and audit the reductions in GHG emission, and the conformance with the monitoring plan. The measured and monitored reductions and results need to be periodically audited. It also needs to verify that the projected CERs have been achieved according to the initial validation of the report. Once a detailed study has been done, a verification report can be produced to certify the number of CERs produced. Owing to a requirement for transparency and to prevent fraud, one DOE cannot perform both the validation and verification/ certification on the same project Only in the case of small scale CDM projects, can a single DOE perform both processes (UNEP, 2004).

Certification is the written report that a specific project activity achieved the agreed GHG reductions in a specific timeframe. This serves as final acceptance of the project CERs and is made available to the public. The report includes a request for issuance of the necessary CERs (UNEP, 2004).

Issuance of CERs

The CDM Executive Board will issue the CERs to the respective parties. 2% of the value of the CERs will be paid to the CDM executive board for adaptation costs. The UNFCCC secretariat will keep track of all CERs being issued though a CDM Registry. Once the CERs have been issued, they are placed in a pending account and later moved to the owner's account (UNEP, 2004).

Finally, it is important to note that the crediting period for CDM credits (according to the "modalities and procedures for CDM"), is either a period of maximum 10 years, or a period of maximum 7 years, with a potential for renewal for two additional periods (UNEP, 2004). Credits obtained from the year 2000, may be used in the first commitment period. The crediting period starts after registration of the project. Most project developers prefer the longer crediting period –i.e., 7 years with option of renewing twice, however the risk is that the baseline may not be valid after 7 years. A DOE would need to revalidate this, but the project developer would be required to update the data used to set the baseline, rather than changing the whole baseline methodology (this should not be changed). Sink projects have a longer crediting period – either 30 years, or 3x 20 years. In some cases the project life may be shorter than the crediting period, and in this case it will no longer earn CERs (UNEP, 2004).

Risks for CDM projects

Every risk has an associated cost of mitigation and in particular, risks for CDM projects include the normal project risks, as well as CDM specific risks. Greenhouse gas trading is seen as higher risk, owing to the uniqueness of it currently (EDRC, 2002). A risk-mitigation plan should be included in a feasibility study and should describe how these risks are minimized or overcome. The risks should be identified, and importance with respect to financial or technical performance evaluated (EDRC, 2002).

Project risks would include: Construction risks (i.e. exceeding time and cost) and operational risks (technology performance, market risk, political, legal, environmental and financial) etc. These risks relate to the performance of the project, and impact the ability of the project to deliver the necessary quantity of CERs (UNEP, 2004; IETA, 2005. As a consequence, development-focused projects could exhibit the greatest risk of non performance of a technology (Ecosecurities, 2002). Legal risks are the most complex, and liability for errors in calculation of emission-reductions or fraudulent reporting could prevent the project from being implemented (EDRC, 2002). Financial risk involves the possibility of parties reneging on responsibilities to pay loans, and/ or provide guarantees or insurance policies amongst others. Also, projects often need upfront funding, and depending on the contract negotiated, this may be difficult to get (Ecosecurities, 2002). Political risks revolve around issues such as new property laws, taxes, currency or foreign exchange problems and export restrictions. Environmental risks include possibilities of fines and penalties for pollution, rehabilitation costs and environmental audits. Force Majeure and other unforeseen circumstances can also pose a risk, therefore it becomes necessary to take insurance cover to minimize the losses in the event of this happening (EDRC, 2002).

CDM risks include policy risks and market risks. Policy risks refer to cases where the host country does not comply with the requirement of the Kyoto protocol, or that baselines procedures are not approved , or policy shifts at local or international level (i.e., regulations or tax changes, subsidies on fossil fuels) (UNEP, 2004; EDRC, 2002). Market risks refer to the fact that prices for CERs are unpredictable, and determined by market forces. Speculation and collusion can dramatically affect prices. Mitigation of risk would be through insurances and use of financial tools (UNEP, 2004). Also, participants could hedge their regulatory risks by embarking on a variety of projects, while subsequent developers may prefer to focus on proven and widely acceptable technology types, which are cost effective to reduce risk (IETA, 2004)

As has been expounded on above, the CDM cycle is complex, yet at the same time comprehensive. Many stakeholders are involved, they are critical to the success of these projects, and they require in-depth knowledge of the intricacies of the carbon trading cycle in order to ensure each project produces the necessary credits.

2.8 Case studies of CDM projects in South Africa and Worldwide

In order to illustrate the broad acceptance of CDM projects worldwide, as well as the growing interest of these projects in South Africa, some potential case studies have been evaluated. Many of these projects deal with energy efficiency, which are by their nature easier to implement. Other good case studies, which have already been implemented, as managed by SouthSouthNorth (an NGO) are demonstrated below.

Volkswagen South Africa – reduced energy consumption (improved monitoring)

Volkswagen South Africa manufactures approximately 80 000 cars annually. The vehicle bodies are pressed and formed on site. The Engine blocks are machined and additional components are combined to form complete engines. Electricity is required for air compressors, cooling towers, refrigeration equipment and lighting - but heavy fuel oil, liquid petroleum gas and some paraffin is also consumed. Several areas were identified for energy efficiency since the annual energy consumption is about 177,360 MWh. Purely by repairing compressed air leaks, turning off air compressors and lighting when not required, this resulted in savings of R2 million/year with an initial investment of R130 000.00. The carbon dioxide emissions were reduced by 15 000 tonnes per year (The CDM: a guide for potential participants in South Africa, 2002).

Southern Electric plc – monitoring energy efficiency

Another example of monitoring energy efficiency was with a UK electricity company –Southern Electric plc. Southern Electric has approximately 600 major substation sites. In order to protect the contents from frost and condensation, as well as to provide a comfortable working environment, they are heated with an adjustable wall-mounted thermostat. However, these thermostats are rarely adjusted, resulting in continuous heating and wasting of energy. Southern Electric began a program in the 1990's to install electronic controls which maintained a lower temperature, unless a push button was pressed, which gave additional heating for a timed period. When the energy saving was monitored, it was found that the annual savings was about 32 000kWh year (The CDM: a guide for potential participants in South Africa, 2002).

Sasol Natural Gas Conversion Project

The Temane/Pande gas fields in Mozambique have been developed and a pipeline to South Africa has been established. At Sasol Chemical Industries in Sasolburg, natural gas will replace coal for production of synthetic gas and chemicals. At Secunda, the Sasol Synfuels gasification process will continue, using coal as a feedstock, but in the future, natural gas will be used. GHG reductions will be realized at both plants. (The CDM: a guide for potential participants in South Africa, 2002).

An apt illustration, of some of the CDM projects that are being run worldwide, is described by South South North (SSN). They are a Non-Governmental Organization (NGO) which was inspired by the passion and vision of mitigation of climate change through sustainable energy-efficient and clean energy projects (South South North, 2004). By coaxing investors into new ideas and drawing communities into trying new technologies, they managed to develop projects in Brazil (accounting for technology), Bangladesh (accounting for poverty), Indonesia (accounting for environment) and South Africa (accounting for people).These approaches covered the pillars of sustainable development (South South North, 2004).

South South North was born out of the view that if "Southern countries" were not to take their own destinies in hand, it would all happen in the North. It started as an exchange of technology and expertise between southern countries, and partnerships in the North. The concept of the South South North Project team is based on a partnership with a project developer. The team is composed of lawyers, bankers, scientists, engineers, community leaders and is led by a trained South South North project facilitator. In order to ensure transparency and strict adherence to the underlying principles, a person from helio international oversees the entire process (South South North, 2004).

Brazil

These projects are technically complex, and experimental. The first project is experimenting with ways of converting used cooking oil, from a fast food chain, into biodiesel to fuel the garbage trucks that transport the city's garbage to the dumps (a projected saving of 38500 tons of carbon dioxide over ten years). A second project harnesses biogas extracted from Rio's landfills and through this, generates electricity for operating the landfill (a projected saving of 35000 tons of carbon dioxide over ten years). The third project uses solid waste to fuel a technologically innovative power plant (a projected saving of 365000 tons of carbon dioxide over ten years) (South South North, 2004).

Bangladesh

Bangladesh is one of the poorest countries on earth, and emissions are almost negligible, so there is almost nothing to trade. In view of this, some challenging projects have been chosen by South South North, i.e., solar home systems in rural areas, and electric vehicles in Dahar city. The solar home systems should project savings of 8600 tons carbon dioxide annually. The electric vehicles for public transport should save between 11000 and 14000 tons of carbon dioxide annually (South South North, 2004).

Indonesia

Since it is an island nation, it is vulnerable to extreme weather, climate change and rising sea levels. SSN have chosen three projects to manage here. The first project proposes using cleaner engines, improved management of public transport, restructuring the routing and schedules and using alternative fuels. 9600 tons of carbon dioxide should be saved over seven years. The next project is the Bandarjaya rice husk power plant project, which will generate 3 megawatts of electricity. Ten small rice mills producing 60000 tons of rice husk will supply 8500 households with electricity. Emission-reductions will be about 14000 tons of carbon dioxide per year, for ten years. The last project uses combined solar, wind and biomass as an energy source for a processing unit, to dry food. Emission-reductions will be 9000 tons of carbon dioxide for ten years (South South North, 2004).

South Africa

South Africa will account for the people component of the sustainable development pillar. The first project fits low cost houses with ceilings, ceiling insulation, energy-efficient lamps and solar water heaters (projected savings are 5500 tons of carbon dioxide annually). Another project is spearheaded by paper and pulp producers (Mondi), to use renewable energy (biomass) for its own needs (two smaller projects will recover 704000 tons and 69000 tons respectively, per year for ten years). A third project uses methane from a city's landfill to provide clean fuel for local industries: projected savings are 900 tons, 1246 tons and 1277 tons of carbon dioxide annually, respectively for three separate project activities (South South North, 2004).

Durban landfill gas to energy project

The first emission-reductions purchase agreement in South Africa was signed for a landfill gas to energy project in Durban (PCF, 2004). Three landfill sites have been selected where gas will be collected. Electricity from the grid (mostly from coal-fired power stations) will be displaced by electricity generated from the landfill gas. The project consists of two components – the first is from the Mariannhill and La Mercy Landfill which will generate 700 000 tons of emission-reductions. The second is from the Bisasar road landfill which will generate 3,100 000 tons of emission-reductions. The project is run and managed by the department of cleansing and solid waste from eThekwini Municipality. The Prototype Carbon Fund will in addition pay 20 cents per ton for addressing the needs of the poor in Durban. Some of the activities that could be funded are waste management and recycling programs, training, education and skill enhancement, ultimately leading to job creation. The social benefits fund is expected to be approximately 760 000 USD, and will pave the way for developing the needs of the Durban communities (PCF, 2004).

Brazil

In addition to the South South North Projects in Brazil, there are other CDM projects running as well. Interestingly, carbon dioxide emissions in Brazil are amongst the lowest in the world (Ecosecurities, no date) relative to the large population and GDP. However, consequent to the economic growth, the emissions have been growing, owing to huge demands for energy. Brazil is a non-Annex 1 country, with no targets as yet, but nevertheless a signatory to the Kyoto Protocol. Currently hydro power produces approximately 97% of the national electricity, owing to few oil and coal reserves. In 1993, Brazil proposed that any new investments to initiate a decentralized approach to its power sector, would be based on fossil fuel thermal plants (Ecosecurities, no date). This, in conjunction with the fact that a large number of municipalities in the Amazon region are not connected to the electricity grid (they use diesel), provides great opportunities for CDM projects for off-grid electrification. The steel and iron industries, would also benefit from CDM projects. Carbon finance would ensure faster deployment of clean energy technologies. Also, the inclusion of sink projects under the CDM is likely to elevate Brazil's market share, along with other Latin American, tropical Asian countries and China (Jotzo and Michaelowa, 2002).

China

China is the second largest emitter of carbon dioxide (after the USA) and with a population of 1.3 billion people it is the most densely populated country (Tangen and Heggelund, 2003). As a consequence, it is the world's largest coal producer and consumer and based on the vast coal supply has grown rapidly. After China ratified the Kyoto Protocol at the World Summit for Sustainable Development in Johannesburg in 2002, four projects in quick succession were prepared and were ready to be implemented (Tangen and Heggelund, 2003). The one shortcoming was that an abundance of technical experts and engineers were involved in CDM projects, but market specialists and economists were conspicuously absent. Chinese authorities had not considered the huge opportunity for developing projects within Chinese companies and plants which would be more attractive to international investors and multinationals within China. Multinationals felt that the risk would be lower using well known suppliers and technologies on their own premises (Tangen and Heggelund, 2003).

Unilateral projects were also not widely investigated by Chinese authorities, since they felt that upfront investment from international investors, as well as technology transfer, would not occur. Also at that time, no institutional system had been established for identification, approval and implementation of CDM projects (Tangen and Heggelund, 2003). To a large extent, China has been a late starter in CDM projects, compounded by lack of institutional support, little involvement of potential project developers, and a very low level of CDM awareness within local communities (Tangen and Heggelund, 2003).

2.9 Conclusions

In this literature review, a study of the complexities of the CDM project cycle was undertaken, as well as the institutions and stakeholders which would contribute to the running of successful projects. The underlying benefits, constraints and potential solutions to the CDM cycle were investigated, and highlighted, with the view to comparing these international findings with local experiences.

Some of the noteworthy benefits of CDM projects are that currently CERs are cheaper to purchase than other emission-reduction units, and can be banked from the year 2000. Further benefits from CDM projects are based on the premise that developed countries could reduce their greenhouse gas abatement costs by investing in relatively cheaper projects in developing countries. Developing countries in turn benefit from increased financial inflow and returns, improved balance of payment, job creation, advancing national development goals, technology transfer and replacement of old inefficient technology with new sustainable and environmentally-friendly technologies.

Some barriers to CDM projects include the fact that CDM projects may potentially become more expensive than JI projects, if the stipulation that 2% of the value of the CERs should be set aside for adaptation and administration costs is applied. Taxes on CDM projects could limit CDM supply resulting in some developing countries not embarking on CDM projects if the credit prices are very low. Transaction costs increase as implementation costs increase, and since fixed costs are extensive, smaller projects could be at a disadvantage. Some researchers feel that the complex and lengthy approval process for CDM projects serves to increase the transaction costs. Limited capacity for running CDM projects and ineffective institutional frameworks, are other important factors. Lack of resources, time, knowledge and funding could limit the development of renewable energy projects. Other concerns relating to the certifying authority, have been that these third party monitors may know less about the complexities of these projects than the investing and recipients of the CERs. Finally, political stability is critical to the success of CDM projects.

Possible solutions for the notoriously slow approval of projects would be to limit the number of project participants to the major parties (as listed on the PDD). The newly developed additionality tool should assist the DNA and DOE in providing an objective assessment of projects, and simplify the process, providing some relief for resource and time constraints.

From the literature, it is apparent that the barriers to JI projects are very similar to CDM projects however, in particular, baseline uncertainty and complexity appears to be at the forefront of concerns. A number of approaches for baselines have been proposed such as project specific baselines, default matrix approach, technology matrix approach, benchmarking, investment analysis methods and a systems model approach. Further research would be required into these models, as they may even be appropriate for CDM projects. Some JI projects encountered some negative effects, such as increases in carbon monoxide emissions from oil to biomass conversions, increase in waste production from oil or gas conversion to biomass, and increases in transport requirements for some oil to biomass conversions.

Some of the benefits from JI projects (other than GHG emission-reductions), were noticeable reductions in sulphur dioxide and nitrogen oxide emissions. Suggestions for possible solutions to the baseline uncertainty issues, included regular baseline revision, standardized assessment procedures, limited crediting life, partial credits and restriction of types of projects (to reduce uncertainty).

Barriers to sustainable development are that there do not seem to be a standardized, well-accepted approaches or methodologies for implementing sustainable development within any particular country. Conflicts may also arise from differences in expectations of local stakeholders and international investors. Other issues encountered are competition amongst developing countries for their share of the CDM investment resulting in less strict application of sustainable development criteria. Some experts have argued that the evaluation of sustainable development impacts is simply an additional burden, and financially hamper the project by adding to the transaction costs.

One possible solution to some of the constraints around criteria for sustainable development would be to apply the South South North (an NGO) Matrix tool which uses a combination of a checklist and multi-criteria. Another tool was designed by the World Wide Fund for Nature (WWF) called the Gold Standard.

Many of the barriers mentioned before apply to South Africa, but most noticeable would be the restricted capacity and supply of physical and human resources, as well as inefficient governance, limited leadership and decision-making processes. Other important factors would be the conflicting opinions of stakeholders and investors. In addition large private industries may potentially be threatened by the impact of CDM on the coal industry (since renewable energy is more expensive, while energy derived from coal is cheaper), as well as on locally developed technology.

Having shown the barriers, benefits and possible solutions as described by international and local literature, the results (from a South African perspective) in Chapter 3 will be compared and contrasted to these international findings. The intention is for these discoveries to add to the existing body of knowledge.

CHAPTER THREE - RESULTS AND DISCUSSION

In order to establish the current South African perception of CDM projects, certain key questions were asked of experts in the field (for further details see Appendix 1). Some questions were designed to establish context, while others were particularly relating to the major area of research which was ascertaining the benefits, the bottlenecks, and possible solutions to problems encountered (for further details see Appendix 2). The key questions asked in Table 6 below were:

- What are the benefits and advantages of developing CDM Projects?
- What are the constraints or bottlenecks around registering or developing CDM projects?
- Do you have any suggestions that could improve or alleviate some of the concerns and constraints above?

Table 6 below therefore in essence describes the key questions asked, the responses and the number of correspondents that concurred with each answer. This was especially done to determine the importance or weighting of each answer.

Table 6: Interviewee perception of barriers, bottlenecks, benefits of the CDM project cycle and suggestions for improvements

Question	**No of respondents concurred**
What are the benefits and advantages of developing CDM projects	
Answers	
Foreign Direct Investment	4
Income from Carbon credits	3
Corporate Social responsibility	4

Question	No of respondents concurred
New environmentally friendly markets	5
Marginal projects can go ahead	5
Potential targets in 2012 – build capacity before subjected to penalties and taxes	1
Conservation of environment	5
All parties benefit (Win –Win)	1
Finance and technology upgrade	1
Hedge against risk	1
Sustainable development	3
Economic development	1
Job Creation	1
Mitigate climate change	2
Industry and politicians will become more aware of environmental matters	1
Incentive to develop environmentally friendly products and services	1
Meet Kyoto Protocol commitments	1
Increased awareness within financial communities	1
Question 2	
What are the constraints or bottlenecks around registering or developing CDM projects? What other concerns or issues do you have around these projects?	
Answer	
NGOs and Stakeholders could delay projects	1
Not all countries have signed the Kyoto Protocol	1
Ethical approach to CDM not always taken	1
Institutional knowledge to be improved	3
Technology transfer does not always happen	1
Private companies have worked largely on their own	1
Complicated CDM Process	5
Costly and time intensive CDM cycle, with high requirements	2
Bundling of projects produces no savings and increases risk	2
Difficult to convince company executive board of benefits of CDM	2
Resource and time intensive CDM process	9
Uncertainty and risk high owing to CDM being a new program	1
Unsure what to do with credits –i.e. sell, bank etc	2
Methodologies are limited, or unavailable, approval takes long with large risks and costs associated with them	6
Monitoring is an issue, with no local or international standards	1
Baselines complex and take at least 6 months to develop	3

Question	No of respondents concurred
Additionality is difficult to determine	5
Threat of “hot air”	1
Large Price differential between CDM and JI	1
Few projects and little experience in South Africa	1
Long sales cycle	5
Mismatched Project cycle to funding cycle	1
Internal rate of return takes longer owing to additionality	1
EIAs are rigorous and lengthy	5
Lack of upfront funding and cashflow	6
Limited number of DOEs	1
Lack of clarity from DNA on the national agenda	1
NGOs not forthcoming with information	1
Large companies have a conservative view and are slow to adopt the CDM opportunity	4
Top management do not delegate authority to technical people to allow them to make decisions	1
Shareholders not willing to hand over credits	1
Regulatory and compliance issues (Domestic approvals, CDM Executive Board bureaucracy, complex EIAs)	8
Uncertainty post 2012	7
High transaction costs	4
CDM Executive Board take too long	4
CDM Executive Board decisions not transparent	1
CDM Executive Board understaffed	1
Lack of public sector and municipal awareness	2
Delay of entry into force of Kyoto Protocol	1
Mismatch between CDM planners and business priorities	1
Lack of dialogue between scientists and academia	1
Smaller projects can fail since they are less sustainable	1
Projects can be contested internationally	1
Multiple decision points in CDM cycle	1
South Africa has a low cost of producing energy from coal	2
Lack of awareness in commercial sector of carbon finance	1
Sustainable development projects are good , but are too small	1
Since CDM is a new program, stakeholders don’t take it seriously	1
Calculation of emission factors and sourcing of information from power producers is difficult	1
Question 3	
Do you have any suggestions that could improve or alleviate some of the concerns and constraints above?	

Question	No of respondents concurred
Answer	
Sustainable development indicators should be weighted	1
Clearer guidelines on monitoring standards should be made available	1
Government should provide more leadership i.e. subsidise projects, intervene where needed	1
Awareness of CDM should be improved	3
South Africa should start planning for 2012	1
The DNA and role players should revisit sustainable development criteria after at least 10 projects	1
Taxation of CDM credits should be absolved	1
Restrictive Public Finance Management Act	1
Baselines are so complex, so suggest that benchmarks are used to simplify baseline	1
Programmatic CDM should provide an efficient strategy and incentive programs for CDM	1
Simplify CDM Cycle	1
Clearer guidelines on governance of CDM projects should be provided, especially additionality	
It is easier for public sector projects to become CDM projects than smaller ones	1
Fears around the CDM market, post 2012 should be allayed	1
Authorities should clearly indicate time frames associated with review processes and stick to them	1
Consider that not all projects should have to go through an EIA process (the EIA process causes significant delays)	1
Allow national accreditation agencies to accredit DOEs	1
Apply only gold standard certification	1
Communities should receive more benefits	1
Government agencies should help small community projects collaborate together	1
Sink projects should not be allowed, they are too risky	1
Industrial gases should be excluded in order to simplify process	1
Additionality should be simplified	1
The CDM Executive Board process should be speeded up	1
Sellers clearing houses should be developed	1
Financial institutions should help project developers more by providing upfront finance (to reduce the risk)	1
More donor and development funds should be provided	1
South African local DNA should interact more with international DNAs to swap best practices and methodologies	1
Better Funding of CDM Executive Board	1

Question	No of respondents concurred
Active CER Spot Market	1
Time taken to register projects should be shortened	1
Reduce transaction costs through incentive schemes	1
More assistance should be given to small scale projects i.e. to overcome barriers to entry	1

Discussion

Several issues emerge from the results in Table 6. Having reviewed the existing international literature it becomes apparent that the perception of the CDM project cycle amongst South African stakeholders, project developers, NGOs and selected companies is not unlike their international counterparts. In a detailed assessment below, the differences, trends and patterns will be described, compared and contrasted. Broadly, the benefits and advantages of CDM projects from a South African perspective are similar to international literature in that financial, social, environmental benefits are clearly evident.

Most respondents have indicated that foreign direct investment, income from carbon credits, development of new environmentally friendly markets, corporate social responsibility, sustainable development and conservation of the environment are key benefits to them (Figure 6 below). According to the Millennium Ecosystem assessment (a four year international scientific assessment of the consequences of ecosystem change for human well-being), loss of ecosystem services will affect the framework conditions within which businesses operate (Millennium Ecosystem Assessment, 2005). This has knock-on effects on stockholder expectations, customer preferences, regulatory regimes, governmental policies, staff satisfaction and accessible finance and insurance (Millennium Ecosystem Assessment, 2005).

Extensive business opportunities will emanate as demand for mitigation of climate impact, or more efficient use of ecosystem services, increases. Company endeavours should be advised by the best scientific evidence available. Businesses could use this to their competitive advantage and become market leaders and innovators in new burgeoning environmental markets (Millennium Ecosystem Assessment, 2005). Many companies are now recognizing their collective responsibility to the social and environmental facets of sustainable development. Reputation and image is becoming increasingly important for companies in order to attract key staff and customers who prefer working for, or purchasing products from socially and environmentally-responsible companies (Millennium Ecosystem Assessment, 2005). If ecosystem services can pay for themselves, through the economic benefits of carbon trading, and other similar mechanisms, the outcome will be extremely positive for all stakeholders, business and the environment.

Another important finding from the results of the above interviews is that marginal projects can now go ahead. This means that projects which otherwise would not have been profitable can be so now, owing to the additional revenue from carbon credits. This refers back to the above mentioned point, that companies are considering new environmental markets, as potential revenue streams, and if economic benefits from carbon credits attract their attention, then these markets will become main-stream. Others interviewees have intimated that it would be important to build capacity, and hedge against risk before being subjected to penalties and taxes post 2012, (while benefiting from the financial and technology upgrade from these new projects). They felt that economic development would incentivise companies to manufacture environmentally friendly products, mitigate climate change, meet Kyoto commitments, as well as create huge job opportunities. Increased awareness amongst industry, politicians and financial communities would be a beneficial consequence.

It is important to note that the key benefits, as highlighted by interviewees in Table 6, and illustrated in Figure 6 would be:

- Foreign direct investment (4 responses),
- Corporate social responsibility (4 responses),
- New environmentally friendly markets (5 responses),
- Marginal projects can now go ahead(5 responses)
- Sustainable development (3 responses)
- Conservation of the environment (5 responses)
- Income from carbon credits (3 responses)

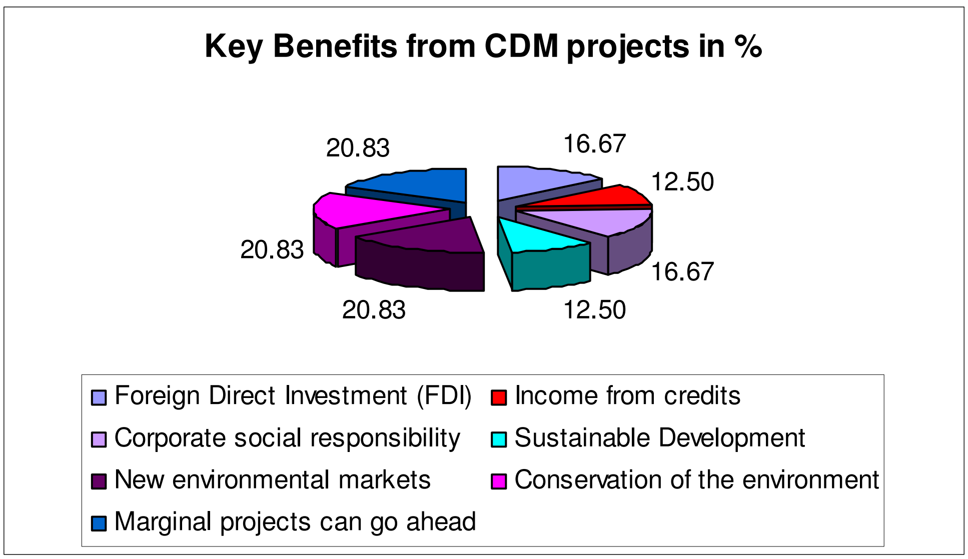

Figure 6: Key benefits from CDM projects in % (number of respondents concurred /total number of respondents)

In comparison, the international literature states that some of the noteworthy benefits of CDM projects are that currently CERs are cheaper to purchase than other emission-reduction units. They can be banked from the year 2000, are valid for both the first trading period (2005-2007), as well as for the first commitment period (2008-2012). This would imply that CDM credits therefore even have an advantage over JI projects (credits from JI projects can only be used from 2008 onwards) and can be sold throughout the world, not just in the EU. Further benefits from CDM projects are based on the premise that developed countries could reduce their greenhouse gas abatement costs by investing in relatively cheaper projects in developing countries.

The perceptions around constraints and bottlenecks in South Africa also do not deviate greatly from other research (see Figure 7 Below). Many interviewees have indicated that lack of resources, time and complexity of the CDM process could jeopardize the success of CDM projects. Since this is a relatively new initiative, skills and capacity are in short supply and need to be developed. Multiple decision points within projects also complicate matters, requiring in depth knowledge of project design, management, and the entire CDM project cycle.

Regulatory and compliance issues (8 responses as indicated in Table 6) owing to either absent or inadequate laws restricting emissions, slow domestic approval of projects (owing to lack of domestic capacity), and inadequate clarity on the national agenda deserve mention. If legislation governing carbon emissions were stricter, or targets were allocated to polluting industries, the adoption of market-based and other mechanisms would be greater.

Lack of upfront funding and cash flow for projects (6 responses as indicated in Table 6) has been mentioned by interviewees, which according to them, is a restricting factor, especially for smaller CDM projects. A suggestion has been for more government support, grants and loans to be made available. Another concern is that there is often a mismatched project cycle to funding cycle, where financing is made available too late, and project developers are forced to take the risk and cost themselves.

Uncertainty and substantially higher risk post 2012 (7 responses as indicated in Table 6) are hindrances to adoption of CDM projects. Since there has been no decision or communication regarding the validity of projects commencing post

2012, the window of opportunity for project developers to initiate projects is steadily decreasing. This has therefore not motivated prospective developers to search for opportunities that fall into this timeframe.

Unexpectedly high transaction costs (4 responses as indicated in Table 6), (Ecosecurities have estimated that transaction costs could amount to 70 000 euros) have inhibited most project developers. Transaction costs consist of pre-operational costs (upfront costs), implementation costs (cost spread over the entire period) and trading costs. Interviewees have indicated that these costs have dissuaded many potential participants who were not willing to take the risk or cost.

An extremely long sales cycle (5 responses, as indicated in Table 6) (some interviewees have quoted up to two years before any carbon revenue is made available) has been perturbing. Some project developers (2 responses, as indicated in Table 6) are not sure whether to sell or bank the credits, once received. Increasing awareness and training of actions to be taken during and after the project cycle would assist greatly.

Complex baselines (3 responses from Table 6) and additionality calculations (5 responses from Table 6) rank high in interviewee concerns. (These findings were also mentioned widely in the literature). Insufficient skill and knowledge in these matters often hinder project developers. Methodologies are limited, or unavailable (6 responses from Table 6), while approval takes long, with large risks and costs associated with them. Methodologies are available on the UNFCCC website, but until then are clouded in secrecy, slowing the adoption by other similar projects. Furthermore, no local or international standards seem to be available for monitoring. Although the international literature has advocated that transfer of technology (1 response from Table 6) is a key benefit of CDM projects, this does not seem to have taken place in South African CDM projects

Other criticisms have been directed at the CDM Executive Board who have taken too long to approve projects (4 responses from Table 6), possibly through understaffing and whose decisions have not been entirely transparent. Other complications arise owing to the fact that they do not meet as regularly as is desired. Pipeline projects can wait for long periods before being approved. In a similar vein, the interviewees have indicated that especially in South Africa, where there is only one DOE (Price Waterhouse Coopers), there is also an extensive wait for assistance from them (1 response from Table 6).

The threat of “hot air” from excess allowances in Russia and the Ukraine, and a large price differential between CDM and JI projects has been mentioned as an encumbrance (JI ERUs are priced higher than CDM CERs possibly owing to the perceived higher risk in CDM projects). Finally, calculation of emission factors and sourcing of information from power producers has appeared to be rather difficult.

Again in comparison, the international literature suggests that barriers to CDM projects include the fact that CDM projects may potentially become more expensive than JI projects, if the stipulation that 2% of the value of the CERs should be set aside for adaptation and administration costs is applied. Taxes on the profits of CDM projects could limit CDM supply resulting in some developing countries not embarking on CDM projects if the credit prices are very low. Transaction costs increase as implementation costs increase, and since fixed costs are extensive, smaller projects could be at a disadvantage. Respondents to international interviews also feel that the complex and lengthy approval process for CDM projects serves to increase the transaction costs. Limited capacity for running CDM projects and ineffective institutional frameworks, are other important factors. Lack of resources, time, knowledge and funding could limit the development of renewable energy projects. Other concerns relating to the certifying authority, have been that these third party monitors may know less about the complexities of these projects than the investing and recipients of the CERs. Finally, political stability is critical to the success of CDM projects.

An notable pattern which has not appeared in the literature, is the slow adoption (in South Africa) of large companies and acceptance of the benefits of CDM, difficulty in convincing company executives to embark on CDM projects, as well as unwillingness to delegate authority to technical staff. They are not easily convinced of the benefits of embarking on CDM projects. Private companies have worked largely on their own, with little sharing of best practices with other market players and NGOs have not always been forthcoming with information. More research has to be done in this area, since these would be missed opportunities and manifest as loss of market share compared to early adopters.

Another interesting trend is a mismatch of opinion between scientists, academics and business as to the value of the CDM. More work has to be done in this area, in order to align viewpoints and mindset. South Africa is also in a unique position in that it is the forth largest producer of coal, produces 90% of its energy from fossil fuels (and inexpensively from coal), so unless the incentives for renewable energy and other energy-efficient technologies are emphasized, South Africa will continue to lag in the CDM market. As a consequence, there seems to be too few projects and little experience compared to other developing countries (South America, India and even Asia have been innovative in this regard).

Sustainable development projects (see page 41 for detailed review of sustainable development) in South Africa appear to be controversial in that they either are too small or lack support and funding. An interesting constraint has been mentioned, where projects can be contested internationally, and could result in long delays in projects and perhaps even failure. Smaller projects seem to be less sustainable and more likely to fail. Further to that, few projects seem to be available, compounded by lack of experience, and methodologies (as mentioned above). Insufficient awareness in the commercial, municipal and public sector around CDM projects, seems to be prevalent. As a result some stakeholders have not taken CDM seriously. Funding (especially upfront) and cash flow as mentioned above seems to be particularly troublesome for project developers, increasing their risk and insecurity.

Barriers to sustainable development in the international literature corroborate the above South African findings in that there does not seem to be a standardized, well-accepted approach or methodology for implementing sustainable development within any particular country. It appears as if the priorities for different stakeholders are different and as a consequence, more powerful stakeholders, override the weaker ones. Conflicts may also arise owing to differences in expectations of local stakeholders and international investors. Other issues encountered are competition amongst developing countries for their share of the CDM investment resulting in less strict application of sustainable development criteria. Some experts have argued that the evaluation of sustainable development impacts is simply an additional burden, and financially hamper the project by adding to the transaction costs.

The international literature proposes that small project activities can be bundled (in order to reduce costs), or grouped together so that key aspects of CDM rules such as design, registration and verification can be addressed for the whole bundle rather than the individual projects. Also the following cost-reducing mechanisms would apply to small scale projects: simpler requirements for the project design document; simpler methodologies for developing the project baseline; simpler requirements for monitoring emissions; lastly, a single 3rd party verifier may undertake validation, verification and certification of small projects to reduce costs.

In contrast to references from international literature, bundling of projects in South Africa does not appear to produce cost savings; on the contrary, it actually increases the risk. This is another area which would deserve further research, since many South African projects are small scale, and should bundling prove to be unhelpful, this could certainly constrain CDM projects in South Africa.

Institutional knowledge and experience have been mentioned as a concern, and lack of clarity regarding decisions and policies has been highlighted. Inter-relationships between stakeholders have on occasion been problematic, with ethics issues and some reticence in collaboration amongst stakeholders, apparent. Shareholders often seem unwilling to hand over credits, while some stakeholders have tried to delay certain projects.

Therefore the key constraints as highlighted in Table 6 and illustrated in Figure 7 would be:

- Complicated CDM process (5 respondents)
- Resource and time intensive CDM process (9 respondents)
- Limited methodologies with large risks and costs (6 respondents)
- Complex baselines (3 respondents)
- Additionality difficult to determine (5 respondents)
- Long sales cycle (5 respondents)
- EIAs rigorous and lengthy (5 respondents)
- Lack of upfront funding and cash flow (6 respondents)
- Large companies slow to adopt CDM opportunities (4 respondents)
- Regulatory and compliance issues (8 respondents)
- Uncertainty post 2012 (7 respondents)
- High transaction costs (4 respondents)
- CDM Executive Board takes too long (4 respondents)

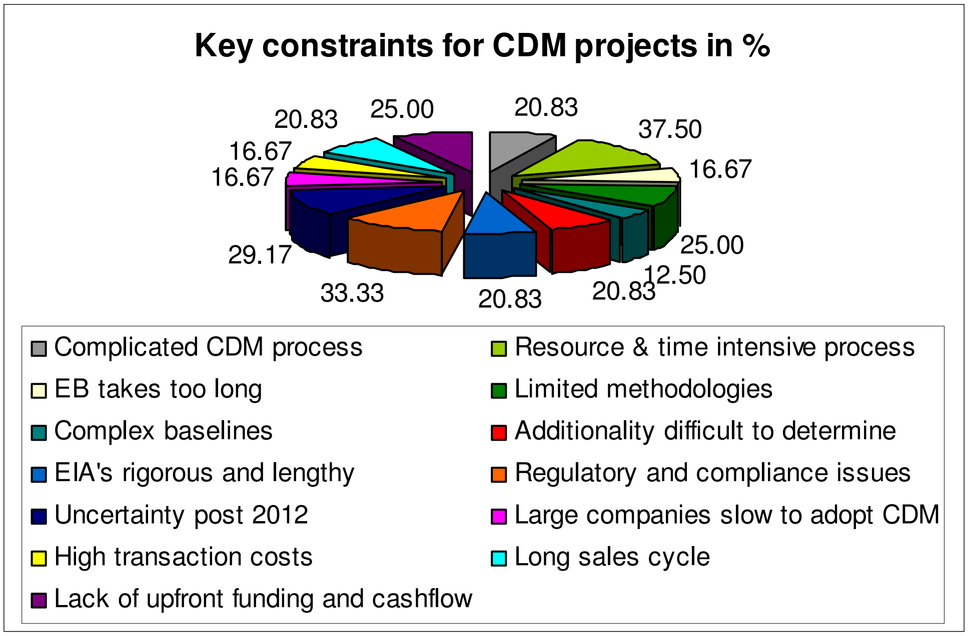

Figure 7: Key constraints for CDM projects in % (number of respondents concurred /total number of respondents)

Suggestions from interviewees for improvement have been illuminating (see Figure 8 below). Most notable (owing to the credibility of the interviewee) is a weighting for sustainable development indicators (certain important indicators would count more than others), benchmarks to be used to simplify baselines (here comparisons against international best practices would be helpful) or, sink projects to be excluded owing to their risk (storage of carbon in forests is temporary by nature, therefore risky).

Other suggestions have been sellers clearing houses, industrial gases to be excluded to simplify the process, and programmatic CDM to provide an efficient strategy and incentive program for CDM. In particular, seller's clearing houses involves pooling of credits, in order to increase the price for sellers, and provides a single portal for buyers to acquire them. Programmatic CDM refers to multiple similar projects being run under one PDD, utilizing the same methodology (this would reduce the transaction costs). Industrial gases have been controversial, since in some countries, these fugitive emissions have been legislated against (especially HFCs), or even taxed so the additionality and sustainable development value is questionable.

Another important suggestion is that taxation of the profits from CDM credits should be abandoned, and the apparently restrictive Public Finance Management Act to be improved. Since South Africa has a rather strict and rigorous EIA process causing significant delays, interviewees have proposed that not all projects should go through this process, but some other method be used to ensure that environmental criteria are met.

Similar recommendations have been made to those from the international literature including simplifying the CDM cycle and additionality process, as well as shortening the time taken for registration of projects. In addition the speed of the CDM Executive Board process has been notoriously slow, and requests to improve on this have been raised.

From a South African perspective, requests for more donor and development funds, subsidies from government and more assistance to small scale projects to overcome barriers to entry have been mentioned, while financial institutions should assist project developers with more upfront finance. Incentive schemes to reduce transaction costs, gold standard certification (based on best practice) and national accreditation agencies to accredit DOEs (which would allow more DOEs to be accredited) have been proposed to alleviate some of the barriers. Clearer guidelines on monitoring standards (also based on best practices), governance and additionality seem to be required.

Most importantly, awareness and marketing of CDM should be improved especially in order to prepare for post 2012. More obvious leadership from government is necessary, with interventions where needed as well as clear indications of time frames for approvals, which are then adhered to. A proposal has been that the South African DNA should revisit Sustainable Development criteria regularly (possibly after ten projects or so), as well as to interact more with international DNA's to swap best practices and methodologies. Finally a CER spot market should be more active.

One possible solution, from the international literature to some of the constraints around criteria for sustainable development would be to apply the SouthSouthNorth (an NGO) Matrix tool to which uses a combination of a checklist and multi-criteria approaches. These checklists would provide benchmarks for evaluation to ensure the project conforms to the necessary sustainable development criteria. Another tool was designed by the World Wide Fund for Nature (WWF) called the Gold Standard. This varies the multi-criteria approach, and ensures that only high quality CDM projects are approved. It uses the sustainability assessment tool from the SouthSouthNorth Matrix tool, but requires that an EIA is done, and that stakeholders and the public are consulted.

The key suggestions for improvements from Table 6 and illustrated in Figure 8 would be:

- Awareness of CDM to be improved (3 respondents)

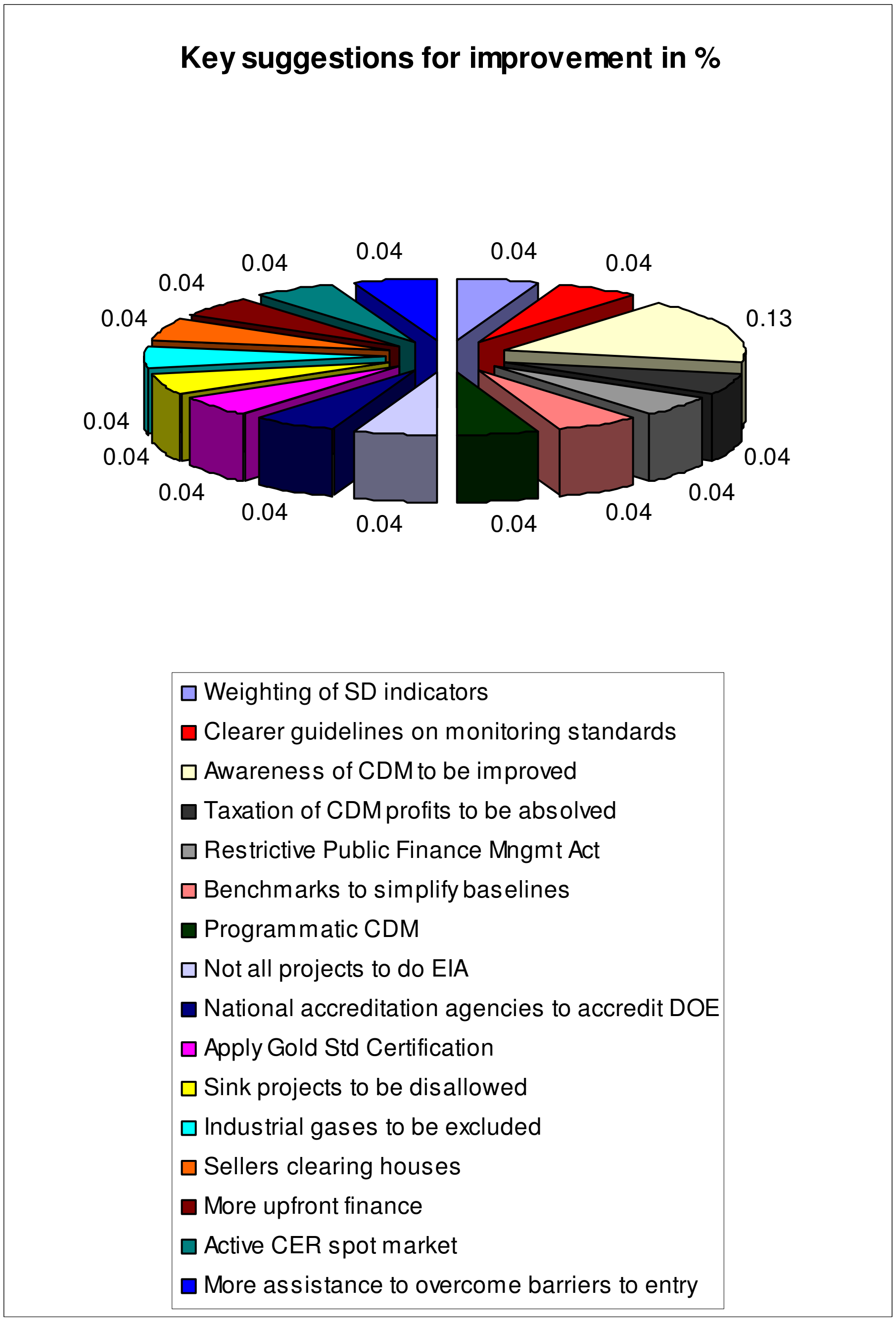

Figure 8: Key Suggestions for improvement in % (number of respondents concurred /total number of respondents)

3.1 Conclusions

In conclusion, compared with the international literature, the barriers to CDM projects in South Africa are similar, but some deviations such as slow adoption of

CDM by companies, inter-personal issues between stakeholders, and mismatch of opinion between scientists, academics and businessman have been noted. Suggestions from interviewees for improvement have been illuminating. Most notable is a weighting for sustainable development indicators, benchmarks to be used to simplify baselines or, sink projects to be excluded owing to their risk. Other suggestions have been sellers clearing houses, industrial gases to be excluded to simplify the process, and programmatic CDM to provide an efficient strategy and incentive program for CDM.

In closing, these barriers do not seem to have changed dramatically over time, nor have the benefits, but there have been many new innovative suggestions for improvement, which may be well worth further study and research in the future.

CHAPTER FOUR - CONCLUSION

The Kyoto Protocol, signed at the third conference of the parties (COP3), established commitments and greenhouse gas emission-reduction targets for industrialized countries for the period 2008- 2012. Carbon dioxide emissions are by far the greatest contributor to greenhouse gas emissions and the view is that they will continue to contribute the most for the foreseeable future; therefore they have been the main focus in all mitigation actions. Carbon dioxide emissions are produced almost entirely from fossil fuel use and therefore relatively easy to measure and monitor. Moreover, this agreement requires industrialized countries to consider ways to minimize adverse effects on developing countries (whose economies are dependent on export and consumption of fossil fuels), through mechanisms such as funding, insurance and transfer of technology. Importantly, this market-based mechanism would serve to limit the liability associated with a corporate or nation's release of carbon into the atmosphere. The responsibilities of developing countries in mitigation of climate change are becoming increasingly significant, yet fraught with political controversy. Their projected greenhouse gas emissions are expected to exceed those of developed countries by 2020. Naturally, developed countries have requested that developing countries take considerably stronger action in order to prevent or at least alleviate these emissions.

There is a growing viewpoint, that GHG emission targets could be set for companies or sectors through incentives and regulations within South Africa and other developing countries. It is also possible that GHG mitigation could be required by law and so carbon trading could become an important practice for companies. As a consequence, companies could pre-emptively include costs of GHG mitigation in new projects, consider renewable energy and energy efficiency and develop new energy-efficient technologies. They could also set emission targets for themselves and monitor their performance against these targets, as well as construct carbon trading systems within their companies.

Environmental concerns for South Africa are that certain areas of the country will become hotter and drier, while other areas will become wetter. It is also possible that crop production may be affected, with the maize triangle at great risk of non-existence within the next two generations.

South Africa has, in light of the above concerns, developed a national climate strategy, which is based on a number of principles: first and foremost, it recognizes that climate change will have adverse impacts, and adaptation is necessary. Development is an ever present requirement, as is growing the economy with the proviso that it remains competitive, therefore South Africa's emissions will continue to increase. Sustainable social, economic and environmental development needs have to be promoted, while using locally available resources. In addition, poverty eradication and job creation will be addressed. This integrated climate response strategy should ensure that climate issues are part of government policies and practices.

South Africa is very vulnerable since it is based on a fossil fuel economy, exports coal, and has not developed sufficient alternative technologies. In 1998, 90% of carbon dioxide emissions from fuel combustion originated from coal. South Africa produced approximately 194 TWh of electricity in 2000. This was mostly from coal-fired power stations which are largely owned and operated by Eskom.

Furthermore, South Africa would be well placed to host Clean Development Mechanism projects owing to its extensive network of roads and rail, at least seven deep water ports and large amount of natural mineral resources. In addition to that, it is the most technologically and economically advanced country in Africa. South Africa's emission intensity is quite high, in relation to other developing countries and emitted 0.96kg carbon dioxide per dollar of GDP, while other non OECD countries emitted an average of 0.66. Despite a small population, South Africa is one of the top 20 emitters of greenhouse gases, and this is attributed to its dependence on coal, production of synthetic liquid fuels from coal, large mining and industries heavily reliant on energy, as well as wastage of energy. From calculations done, it appears as if “South Africa consumes half of Africa’s electricity, with only 5% of its population”.

As a result many industry associations have been researching climate change issues, in particular Sasol, Eskom, The chamber of Mines and the Chemical and Allied Industry Association (CAIA). Eskom is one of the largest national energy suppliers and dominates bulk electricity sales. It has been able to provide inexpensive electricity from the country’s plentiful coal supplies.

Considering the above environmental concerns, potential emission-reduction targets, dependence on coal, excessive consumption of energy (compared to other developing nations), as well as the favourable conditions for hosting CDM projects, this study was launched in order to identify the possible barriers, constraints and possible suggestions for improvement.

From the literature survey, as well as from discussions with experts in the field, it appears as if the issues we have encountered in South Africa have been experienced in other parts of the world. Commonly occurring concerns, seem to be that the baseline setting, additionality and entire CDM project cycle is complex. Resource and time constraints could jeopardize projects, transaction costs have been prohibitive (in some projects), compounded by lack of initial upfront funding. Bureaucracy from the CDM executive board has frustrated attempts to move projects along swiftly, and in some cases, the sustainable development criteria have been applied too strictly. Lack of methodologies, as well as huge risk and cost in developing new ones have been obstacles for project developers while clear guidelines on monitoring, governance and additionality have been conspicuously absent. Uncertainty around technical and financial data as well as project performance has clouded implementation of projects. Suggestions for improvement have been regular baseline revision, standard assessment procedures, limited crediting life, restriction of certain types of credits, or partial credits. Application of the gold standard, and an additionality tool have been relatively new proposals to overcome certain of these constraints.

Complexities around sustainable development include competition amongst developing countries for their share of the CDM investment, conflict and differing expectations of local shareholders and investors, powerful players overriding weaker ones, and no standardized, well-accepted approach to sustainable development criteria. Suggestions for improvement are that international standards should be negotiated for sustainable development, sectoral CDM should be applied where certain sectors with high development benefits are given preferential support and use of a sustainability assessment tool. Other suggestions have been to provide institutional safeguards to address equity issues, resource constraints and lack of capital. Thankfully there are also many benefits that have been highlighted in international circles. These include financial inflows, and returns, improved balance of payment, technology transfer and replacement of inefficient technology. Cost savings through energy conservation and job creation have also been mentioned.

It is important to note at this juncture that the key benefits, as highlighted by interviewees in Table 6, would be:

- Foreign direct investment (4 responses),
- Corporate social responsibility (4 responses),
- New environmentally friendly markets (5 responses),
- Marginal projects can now go ahead(5 responses)
- Sustainable development (3 responses)
- Conservation of the environment (5 responses)
- Income from carbon credits (3 responses)

Issues that seem to be uniquely particular to South Africa are the slow adoption of large companies to accept the benefits of CDM, difficulty in convincing company executives to embark on CDM projects, as well as unwillingness to delegate authority to technical staff. More research has to be done in this area, since these would be missed opportunities and manifest as loss of market share compared to early adopters. Mismatch of opinion between scientists, academics and business should result in more research in this area, in order to align viewpoints and mindset.

South Africa is also in a unique position in that it is the forth largest producer of coal, produces 90% of its energy from fossil fuels (and inexpensively from coal), so unless the incentives for renewable energy and other energy-efficient technologies are emphasized, South Africa will continue to lag in the CDM market. As a consequence, there seems to be too few projects and little experience compared to other developing countries. Institutional knowledge and experience have been mentioned as a concern, as well as inter-relationships between stakeholders, ethics and some reticence in collaboration amongst stakeholders. Shareholders also seem reluctant to hand over credits. Notable suggestions for improvement have been a weighting for sustainable development indicators, benchmarks to be used to simplify baselines, sink projects to be disallowed owing to their risk, sellers clearing houses, industrial gases to be excluded to simplify the process, and programmatic CDM to provide an efficient strategy and incentive program for CDM. Another important suggestion is that taxation of CDM credits should be abandoned, CER spot markets to be encouraged and the apparently restrictive Public Finance Management Act to be improved.

Observations which deserve mention and which contradict international views, are that technology transfer does not always happen, and bundling of projects produce no savings but in fact increase risk. Since South Africa has an abundance of smaller projects which potentially could be combined, this is an important issue to consider and further research is required. More assistance should be given to small scale projects to overcome these barriers to entry. In addition, technology transfer is a critical factor, so should this not occur, it would impact the success and sustainability of projects. EIA regulations in South Africa are particularly stringent, and cause significant delays especially for smaller projects, which potentially don't need such detailed assessments. Some of the interviewees have suggested that not all projects should have to undergo full EIAs. In comparison with international literature, the barriers and benefits in South Africa concur with international ones (although there have been some differences). Strangely enough, they seem not to have changed dramatically over time, but there have been many innovative suggestions for improvement, which may be well worth further study and research in the future.

Therefore, finally, the research from interviews in South Africa has indicated that the key constraints (which is highlighted in Chapter Three (Table 6)) would be:

- Complicated CDM process (5 respondents)
- Resource and time intensive CDM process (9 respondents)
- Limited methodologies with large risks and costs (6 respondents)
- Complex baselines (3 respondents)
- Additionality difficult to determine (5 respondents)
- Long sales cycle (5 respondents)
- EIAs rigorous and lengthy (5 respondents)
- Lack of upfront funding and cash flow (6 respondents)
- Large companies slow to adopt CDM opportunities (4 respondents)
- Regulatory and compliance issues (8 respondents)
- Uncertainty post 2012 (7 respondents)
- High transaction costs (4 respondents)
- CDM Executive Board takes too long (4 respondents)

The key suggestions for improvements from Table 6 would be:

- Awareness of CDM to be improved (3 respondents)

In summary, the top five constraints for CDM projects are resource and time intensive process, regulatory and compliance issues, uncertainty post 2012, lack of upfront funding and cash flow, and limited methodologies. Compared with the international literature, the barriers to CDM projects in South Africa are similar, but some deviations such as slow adoption of CDM by companies, inter-personal issues between stakeholders, and mismatch of opinion between scientists, academics and businessman have been noted.

Future Trends and further recommendations for research

As for future trends, the EU Commission has predicted, that based on current trends, more than half of the current member states could exceed their agreed share of allowed emissions under the Kyoto Protocol. The commission also anticipates that by 2010, the total GHG emissions would have increased by 1%, and carbon dioxide emissions would have increased by 4% as compared to the base year of 1990 (as apposed to an 8% reduction). Considering the penalty for non-compliance was set at $ 50 per ton carbon dioxide, or twice the market price for the pre-kyoto period (2005-2007), and $100 per ton carbon dioxide for 2008 onwards, the consequences for non-compliance could be dire. In the light of these findings, emission trading could be fundamental to ensuring member states do comply with allocated emission targets (Christiansen and Wettestad, 2003).

Carbon taxes have been proposed, either as alternatives to emission trading, or to form part of a hybrid mechanism (Zhang and Baranzini, 2004). Several European countries have implemented either carbon taxes or energy taxes to reduce carbon emissions. The criticism of carbon taxes is that it could impact competitiveness and distribution of income. Other opponents of the carbon tax system feel that an emission trading mechanism allows policy makers to set fixed targets for GHG abatement, at a lower cost, while a carbon tax could result in uncertain outputs and abatement costs (Christiansen and Wettestad, 2003). However the recommendation is that if it was used as a compliance mechanism, with the tax rates being higher than the emission-reduction credit price, it will operate more as an excess emissions tax, and dissuade polluting industries from doing so (Zhang and Baranzini, 2004).

Increases in the costs of energy products, effectively creates an incentive to reduce greenhouse gas emissions, while indirectly increasing the cost of other goods and services (Gupta and Bhandari, 1999). Hopefully this will initiate technological innovation to mitigate these higher costs, and instigate modification of consumer behavior. The additional revenue created through carbon/ energy taxes could be put to good use especially to offset any distributional issues (Gupta and Bhandari, 1999).

Given the fact that developing countries might be allocated emission-reduction targets in 2012, it would be prudent to consider further research in this area. Some research has been done, which has proposed an emissions-trading budget for developing countries (Philibert, 2000). Many developing countries have rejected legally binding targets or limits as they fear it will constrain their economic growth. A few options have been proposed which hope to prevent excess “hot air” being traded – this is mostly because “hot air” allowances cost nothing and would be traded first. One of the options proposed is that as soon as a country with an emissions budget tries to sell credits or allowances, it is subjected to a real limit on its emissions (Philibert, 2000). Another option would be to establish two targets for a country – one binding and the other non-binding. The non-binding one would be instated at a lower level (in order to reduce hot air), while the binding one would be instated at a higher level (to prevent limiting economic growth). The developing country would be expected to buy allowances if its emissions were above the higher (binding target), and sell allowances if its emissions were below the lower (non-binding target). However this system could be open to abuse, since the particular country could sell the budgeted allowances or credits above its non-binding target, but below its binding target without fear of penalty. This is obviously not the approved course of action, but it could occur, and the expectation is that countries would act in good faith.

A third option is proposed whereby countries with emission budgets only trade at the end of the commitment period after the actual surplus has been verified. The detraction, is that one would not know if the credits for emission-reductions would be accepted and eventually traded. A fourth option requires buy back of allowances or credits sold should they bring about an excess in emissions. A "no-regrets" option was postulated by the Centre for Clean Air Policy which stated that developing countries emission-reductions would not be capped, but allowed to rise provided that their GHG emissions grew at a rate below their economic growth. They were required to improve the "carbon efficiency" of their growth (Philibert, 2000).

Another possibility for setting emission targets for developing countries is based on the "contraction and convergence" view, whereby emission rights are allocated or lead to a "convergence" of per capita levels. The premise of this view is that all humans are entitled to an equal share of a scarce common resource – the global atmosphere. This is still a rather contentious issue, and further research and debate is required to resolve it.

In conclusion, these constraints highlighted above are typical of findings described in the international literature and the research undertaken in South Africa corroborates this. Some deviations such as slow adoption of CDM by companies, inter-personal issues between stakeholders, and mismatch of opinion between scientists, academics and businessman have been noted.

There is a growing viewpoint, that GHG emission targets could be set for companies or sectors through incentives and regulations within South Africa and other developing countries. It is also possible that GHG mitigation could be required by law and so carbon trading could become an important practice for companies. As a consequence, companies could pre-emptively include costs of GHG mitigation in new projects, consider renewable energy and energy efficiency and develop new energy-efficient technologies. They could also set emission targets for themselves and monitor their performance against these targets, as well as construct carbon trading systems within their companies.

Extensive business opportunities will emanate as demand for mitigation of climate impact, or more efficient use of ecosystem services, increases. Company endeavours should be advised by the best scientific evidence available. Businesses could use this to their competitive advantage and become market leaders and innovators in new burgeoning environmental markets. Many companies are now recognizing their collective responsibility to the social and environmental facets of sustainable development. Reputation and image is becoming increasingly important for companies in order to attract key staff and customers who prefer working for, or purchasing products from socially and environmentally-responsible companies. If ecosystem services can pay for themselves, through the economic benefits of carbon trading, and other similar mechanisms, the outcome will be extremely positive for all stakeholders, business and the environment.

Finally, this study has attempted to highlight significant issues, with the view to improving the current knowledge and advance the possibility of solving or at least alleviating some of these burdening issues. Although the CDM and Carbon Trading is at the pioneering stage, there is an initiative to globally regulate Greenhouse gases for all developing and developed countries by 2012. It is therefore essential that we investigate as many issues around these activities as possible, as it is likely that CDM will play a major role in the future.

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Appendix 1- Interviewee Details

Interviewee Number	Stakeholder Group	Organization
1	Trading, Financing	Standard Bank
2	Project Developer	Bateman Africa
3	Project and Economic Analyst	Econ SA
4	Financing	Development Bank of South Africa
5	Energy Consultant	Nano Energy
6	Project Developer	Nu Planet Energy
7	Project Developer	Eskom
8	Project Developer/ Advisor	CDM Africa
9	Project Developer	AEL
10	Project Developer	Sappi
11	DOE	PWC
12	Consultant/ Advisor	PACE
13	Consultant/ Advisor	Imbewu
14	Consultant/ Project developer	CBLA
15	Project Developer	Palmer Development Group
16	Project Developer/NGO	SouthSouthNorth
17	Research/ Consulting	EDRC (Energy and Development Research Centre)
18	Government	Designated National Authority
19	Project Developer	Chemical and Allied Workers Association
20	Project Developer	SAB
21	Research/ Project Developement	University of Pretoria
22	Environmentalist	Ecocity
23	Project developer	Jones & Wagener consulting civil engineers
24	Structuring Carbon Investment products/Trading	Sterling Waterford

Appendix 2 Questionnaire for interviewees Carbon Trading and the Clean Development Mechanism in South Africa

	Question:	Answer:
1	Name:	
2	Designation	
3	Telephone number	
4	Fax number	
5	Work address	
6	Email address	
7	What is your scope of work and degree of involvement in Carbon trading and CDM projects?	
8	What is your motivation for being involved in the above program?	
9	What role do you perform with regards to CDM development – (i.e. are you a project developer creating projects on behalf of specific industries/ or local authorities, or are you the actual owner of the potential emission credit within industry or local government). Do you perhaps perform another role?	
10	Do you have a CDM project registered, or alternatively at which stage is the registration process?	
11	What are the benefits and advantages of developing CDM projects?	
12	What are the constraints or bottlenecks around registering or developing CDM projects? What other concerns or issues do you have around these projects?	
14	Are these projects sustainable? Please could you elaborate a bit further on this.	
15	Do you have any suggestions that could improve or alleviate some of the concerns and constraints above?	

Appendix 3 Technological options for mitigation of carbon dioxide and Sink Projects

Technological options

Some of the technological options would encompass more efficient conversion of fossil fuels (i.e. increasing power station efficiency from 30% to 60% and the use of cogeneration plants for separate generation of power and heat), switching to low carbon fossil fuels (i.e. combined gas turbine technology), decarbonisation of fuels and increasing use of renewable sources of energy (Sims *et al.*, 2003).

Intermittent renewable energy technologies such as wind, solar, tidal and wave energy may require storage of energy to ensure a constant flow of energy. Hydro-electricity is the most advanced, but is limited by societal and environmental barriers. The other constraint for hydro is that the remote location for hydro sites translates into high upfront costs. Wind power is a newer addition to the fold, but as a result of its intermittent supply of energy, it only supplies 0.1% of global energy (Sims et al., 2003). In the future, many wind turbines will be situated off shore, will be more reliable, and be cheaper to operate. Solar radiation is a good idea, but the technology is still quite expensive, there are seasonal fluctuations and it is insufficient for large scale energy supply (Sims *et al.*, 2003).

Carbon sequestration includes biological sinks (discussed below), and physical sequestration i.e. capture and storage of carbon dioxide in underground reservoirs (oil, gas or deep saline ones), or storage in the deep ocean. Other options include capture from fuel gas before combustion, or after combustion using amine solvents (Sims *et al.*, 2003). New capture techniques involve cryogenics, membranes and adsorption. As with all physical and biological techniques, the permanency of storage, retention time and verification becomes complex.

Biomass is widely available, and could provide poorer communities with a constant supply of renewable energy. It includes waste from agriculture and forestry, landfill gas and municipal solid waste. There is a good financial and market potential for bagasse, rice husks, bark and sawdust since they have disposal costs, and the use of these products for energy dispenses of that need.

Sink Projects

An annex to existing modalities and procedures for sink projects was adopted at COP 9 in Milan. Sink projects that are acceptable are afforestation and deforestation. Afforestation is defined as the "direct human induced conversion of land that has not been forested for a period of at least 50 years, into forested land through planting or seeding". Reforestation in the first commitment period (2008- 2012) is defined as "land that did not contain forest on 31 December 1989" (UNEP, 2004, 36). The modalities and procedures have provided some rules for sink projects to adhere to. The credits produced should not contribute more than 1% of 1990 emission levels. Additionally, other sinks such as revegetation, forest management, cropland management and grazing land management are not acceptable for CDM projects, but could be utilized for joint implementation projects (J1). The crediting period for sink projects is longer, and the benefits accumulate over longer periods. The crediting period begins at inception of the reforestation or afforestation activity and can last for either a maximum of 20 years (renewable twice, provided a DOE has used new data and the baseline is still valid), or alternatively a maximum of 30 years.

The carbon stored in all the carbon pools must be accounted for. Above ground biomass, dead wood, litter, below ground biomass and soil organic carbon are recognized as carbon pools (UNEP, 2004). As with normal CDM projects, the baseline and monitoring methodologies must be approved by the executive board. There are however some differences, in that the new methodologies should be based on "existing or historical changes in carbon stocks and carbon pools within the project boundary", or "changes in carbon stocks within the project boundary”. These are some of the approaches that should be adopted (UNEP, 2004). Importantly, the project description should contain the exact geographic location, details on carbon pools selected, current environmental status, the legal title of the land, land tenure and right of access. Community and social involvement is required and environmental impacts should be done. Since carbon stores can fluctuate with time, timeous monitoring and verification of data should be carefully considered. Sinks are inherently temporary, and the carbon stored in them is susceptible to losses owing to fires, disease and pests. In accordance with this, different approaches for crediting can be followed, either to select temporary credits (tCERs) which expire at the end of the commitment period or long term credits (lCERs) which expire at the end of the crediting period. Verification for both could take place every 5 years (UNEP, 2004).

Given the temporary nature of these credits, some controversy has surrounded implementation of these projects, while there is also concern that possible social and institutional restrictions imposed through the negotiation process might complicate matters further (Forner and Jotzo, 2002). The quality of sink projects has been raised by critics as well as the fact that they may not meet the sustainable development objectives of the CDM. Other issues include technical difficulties in baseline setting, additionality, monitoring, leakage, and verifiability. In addition, displacement of non-sink projects could become a barrier to technology transfer (Forner and Jotzo, 2002).

Small scale CDM sink projects have slighter more flexibility, in that avoided deforestation is acceptable as long as it can be proven that the technology (i.e. efficient woodstoves) would minimize the deforestation. On the other hand small scale CDM projects are restricted to less than 8 ktCO_2/ year greenhouse gas removal, and the projects must be formulated and managed by low income communities.

Appendix 4 Other Players in the Carbon Market

Prototype Carbon Fund (PCF)

This fund is a partnership of approximately six governments and seventeen private sector companies and has ventured into the project-based mechanism of the carbon market in order to generate credits for reduction in greenhouse gases. It has been the leader in the creation of the carbon market, utilizing the CDM and JI to assist and facilitate developed countries achieve their emission-reduction targets (PCF, 2004). In 2004, it was preparing 32 projects with an emission-reduction potential of 165 Million USD. It diversifies its selection of projects based on technological and geographical factors. Renewable energy and waste to energy technologies have been in the majority, and geographically there is currently more of a balance ranging from Latin America to East Asia (PCF, 2004). It has three main objectives: To demonstrate how project-based mechanisms can contribute to sustainable development and reduce compliance costs; through the development of policies, rules and business processes, teach interested parties how to learn by doing; show how partnerships with government and private companies can address climate change issues (Kessels, 2001).

The PCF has in fact contributed greatly to development of CDM methodologies as well as sharing its experiences, issues, solutions and lessons learnt with all parties in the UNFCCC. It has submitted many baseline methodologies especially on waste management and renewable energy projects and regularly commented on draft papers and issues prepared by the methodology panel. The PCF has mostly purchased Verified Emission-reductions (where the purchaser assumes most of the Kyoto related risk), as apposed to Certified Emission-reductions, where the project sponsor assumes the Kyoto related risk. In order to mitigate the risk of non delivery of Verified Emission-reductions, the PCF has embarked on a rigorous process of project screening, transaction structuring, portfolio risk management and monitoring (PCF, 2004).

According to the PCF many fundamental decisions on methodologies still need to be made since CDM projects are still exposed to regulatory risk. They believe its not clear how national and sectoral policies will be consulted when assessing baseline methodologies. Also they are not clear on how additionality will applied and what will transpire when economic justifications or baselines have changed. Other issues they are concerned about are how small scale projects will operate in the waste management sector, how simplified methodologies would be applied to very small projects and methodologies for afforestation and deforestation (PCF, 2004).

Dutch ERUPT

The Dutch Carbon purchasing program (ERUPT – Emissions Reduction Unit Procurement Tender) is part of the Dutch government's commitment to invest about US$ 600 million through a series of GHG mitigation programs and initiatives. It is a scheme where carbon credits are purchased by public tenders. The requirements include host country approval, accurate and validated baselines, as well as the project being feasible. Projects such as renewable energy, fuel switching (oil to gas, coal to gas), energy efficiency, forestry and waste to energy are eligible projects.

In 2002, 36 Million Euro was spent on a tender for central and Eastern Europe and approximately 8 Euro/ t CO2 was paid. Two additional tenders were supplied in 2002 for clean energy projects (under CDM), and mini energy projects for on and off-grid wind, solar, mini Hydro and geothermal energy (Ecosecurities, 2002).

UK emission trading scheme

The UK has a voluntary trading scheme, which has operated since March 2002. The incentive for companies to join, was to receive an 80% discount on the climate change levy which is a local UK tax on industrial and commercial energy consumption. In order to benefit from this discount, industry is expected to accept an absolute or rate-based limitation on either their greenhouse gas emissions or their energy consumption. Depending on which option they select, this will determine which rules and regulations affect their participation in the market, and when they will receive their allocation of allowances from the government (IETA, 2005).

Chicago Climate Exchange (CCX)

The Chicago Climate Exchange is a pilot cap and trade system for greenhouse gases. In this trading scheme, companies volunteered to reduce their emissions from 2003 to 2006. They could either reduce their emissions from internal projects, purchase allowances from other companies, or from external projects (IETA, 2005).

The New South Wales GHG Abatement scheme

This scheme began in January 2003, and is valid until 2012. It requires GHG benchmarks to be applied to all electricity retailers and other parties. Based on this benchmark, all involved parties are expected to reduce their GHG emissions to that level, and any excess would require surrender of abatement certificates (which have previously been allocated to the respective companies). At the end of the compliance year, any excess emissions that have not been covered by these abatement certificates (called a greenhouse shortfall) are penalized (IETA, 2005).

Appendix 5 Carbon revenue for projects

Carbon revenue for projects

In order to calculate the carbon revenue, that each project will generate, the following formula is used:

Carbon revenue($/yr)= carbon credits(tonnes/yr) X carbon price($/tonne)

And the carbon credits are calculated by:

Carbon credits = Baseline emissions – Actual emissions

Other greenhouse gases are converted into carbon dioxide equivalence, in order to use these formulas (EDRC, 2002).

Two indicators are important for the viability of a CDM project – these are net present value (NPV) and internal rate of return (IRR). The net present value is the present value of cash flows, the costs, and revenues throughout the project lifetime (EDRC, 2002). The net present value effectively represents the total financial value created by the project, while the cash flows demonstrate the revenues and costs for that year. The net present value (NPV) must be positive for the project to be attractive to the investor. The discount rate represents the time value of money (money is worth more now than in the future).The internal rate of return (IRR) is the discount rate that makes the net present value = 0. This means that when the net present value (NPV) is zero, the discount rate is equal to the internal rate of return (IRR). Formulas are used to calculate all of the above:

PV=Vn/ (1+r)n

PV = present value of costs

r= discount rate

n=number of years

Vn= value in year n

and

NPV= ∑(PV(annual cash flow))

(i.e. the sum of all cash flows over the lifetime of the project)

These may seem complicated, but in essence, it means that if the internal rate of return (IRR) is positive, then the project is going to be profitable (EDRC, 2002) (IETA, 2004).

Some critics have indicated that use of the above mechanisms (IRR and NPV) to demonstrate additionality of a project can be subject to manipulation. They feel that financial calculations can be presented differently, depending on the investor and a false sense of objectivity is given (Lehmann, 2004).

Both CDM and JI projects are likely to incur considerable transaction costs owing to the fact that multiple approval steps are required (Fichtner *et al.*, 2003). Costs of project development and costs of dealing with government representatives are noteworthy. Two categories of transaction costs have been defined such as costs of undertaking projects in foreign countries, and costs for attaining CDM credits. The sum of both, being the total project transaction costs. Further to that, specific costs have been illuminated in a formula below:

Specific cost =

(production cost + transaction cost)/ Amount of emissions reduced

Other studies indicate that transaction costs can account for about 20% of total project costs, and even as much as 50%. Certainly the research shows that the component of transaction costs in production costs (costs of investment into technical systems) is higher than expected. Also, from analysis of the samples taken, they found that total project transaction costs could account for 6-53% of total project costs (Fichtner et al., 2003). Further analysis indicates that technical assistance could account for 50% of transaction costs, administration 36%, follow up 12% and reporting costs 2%. When considering reducing of transaction costs, technical assistance and administration costs seem a good place to start. Economies of scale are also important since it is well known that transaction costs, in terms of costs per ton of carbon dioxide reduced, are cheaper in larger projects- this is mostly owing to the important role of fixed costs within the project (Michaelowa et al., 2003). Of total project costs, indirect costs relate to negotiation costs, consulting fees, insurance amongst other things. Indirect costs could amount to 40% of total project costs (Fichtner *et al.,* 2003).

Appendix 6 Market potential of CDM credits and typical transaction costs

CDM projects can realize revenues from the normal project cycle, as well as carbon credits, but in addition have extra transaction costs associated with design of the project document, approval, and then costs associated with each step within the CDM project cycle (EDRC, 2002). There are mechanisms to reduce these costs, discussed later, but all of the above costs must be taken into account when embarking on these types of projects. Some experts believe that registration, monitoring and verification costs could be as much as 5-10% of the project budget (EDRC, 2002). It is important to note that the value of the carbon credits, overall transaction costs (see Table 7 and 8 for typical CDM transaction costs), and upfront transaction costs can affect project viability (UNEP, 2004). It is also widely believed that approximately 5 to 7% of the net present value of revenue can be expected to finance upfront transaction costs, while 10 to 12% of net present value of revenue would finance total transaction costs. Previous studies and carbon market models indicate that transaction costs can range between 0.25 $US/t C02 and 4.00 $US/t CO2 (Krey, 2005). However, based on research of transaction costs of CDM projects in India, they do not seem to be unacceptably high (Krey, 2005).

Pricing of carbon credits is set by market forces, and depending on whether this project is a CDM or J1 Project, will determine the price. Issues such as project risks, political stability, sustainable development criteria, technology type and transaction costs would affect the viability of the project, as well as the tradable price. The prototype Carbon Fund (PCF) considers issues such as government guarantees, delivery of social benefits and transaction costs as part of preparation for the project, while the Dutch Government consider technology type when pricing carbon credits. Market prices are also affected by interactions and dynamics of supply and demand. Traders evaluate factors such as level of demand by investors, and the ability of the Executive Board to process and approve CDM projects.

Other issues under consideration are speculation on possible tightening of regulations, innovation of new technologies and volume and schedules of large government purchases (Natsource, 2004). The forecast price is approximately 4 USD -11 USD per ton of carbon dioxide, and also depends on when the credits fall due – i.e. earlier credits are cheaper than ones that fall due during the period (2008-2012) (UNEP, 2004). Many predictive models have suggested that the price would probably be below 10 USD per ton of carbon dioxide (Springer and Varilek, 2004). Holding of CERs by non-Annex 1 parties would both increase the price and total number of CERs, although some models have predicted that holding of 10% of CERs by non-Annex 1 countries could cause less than 1US$/tC price increase, but a 10MtC fall in the CERs issued to Annex 1 parties owing to domestic reduction actions and JI projects (Chen, 2003). If this does in fact occur, it would be an interesting research exercise to pursue as more CDM projects develop.

It should be noted that Renewable energy projects, can fetch higher prices and are used as the reference price. Biomass and Energy-efficient projects are priced approximately 20% lower, while fuel switching and Methane projects are usually priced 40% lower than renewable energy projects. However, owing to the fact that methane has a global warming potential of 21 times that of Carbon Dioxide, and can therefore generate more credits (albeit at a lower price), methane capture projects are more enticing to project developers (UNEP, 2004; IETA, 2004). Residential and commercial energy-efficient projects, owing to the above would require many participants to ensure sufficient emission-reductions, and sometimes generate less emissions than would be expected. As a consequence, the administrative costs could be higher owing to particular institutional requirements (IETA, 2004). Since energy-efficient measures are frequently cost effective, they may have happened anyway, and it may be difficult to prove additionality.

An interesting piece of research has illuminated the issue of displacement of renewable energy projects to beyond EU borders. From the research done, it was proposed that it would be cheaper for European power companies to deploy renewable energy projects through the CDM and JI mechanism, than within the EU borders. A complication of this would be that some of the benefits of renewable energy would not be available to the EU locally (de Rio Gonzalez *et al.*, 2005).

Mechanisms of reducing costs

There are standardised approval processes and procedures (especially relating to whether projects conform to sustainable development criteria), which could reduce planning, search costs, uncertainty and even costs of administration. Standardised methods for setting baselines, standard emission factors and other predetermined values would be useful for reducing transaction costs (Fichter *et al.*, 2003). Other suggestions would be to do verification and certification at longer intervals (as apposed to annually), embark on unilateral CDM projects that reduce search and negotiation costs, standardise the information required for each step of the cycle, provide smaller projects with exemptions (i.e. bundling projects , reduction of certain required steps, smaller fees from the executive board). Mini and Micro projects should receive even more assistance (projects below 1000 tCO2) (Michaelowa *et al.*, 2003). Some of the typical CDM costs are depicted in the table below, while the following table provides estimates of specific CDM project tasks.

Table 7: CDM Transaction costs (After UNEP, 2004)

Pre-operational phase design	Search Costs	Costs incurred by investors and hosts as they seek out partners for mutually advantageous projects
	Negotiation costs	Includes those costs incurred in the preparation of the project design document. This process also documents assignment and scheduling of benefits over the project time period. It also includes the expenses in organizing public consultation with key stakeholders
	Baseline determination	Development of a baseline
	Approval costs	Costs of authorization from host country
	Validation costs	Costs incurred in reviewing and revising the project design document by operational entity
	Review costs	Costs of reviewing a validation document
	Registration costs	Registration by UNFCCC Executive Board/J1 Supervisory committee
Operational phaze	Monitoring costs	Costs to collect data
	Verification costs	Costs to hire an operational entity and to report to the UNFCCC Executive Board/ Supervisory committee
	Review costs	Costs of reviewing a verification
	Certification costs	Includes costs in the issuance of Certified Emission-reduction units (ERUs for J1) by UNFCCC Executive Board
	Enforcement costs	Includes administrative and legal costs incurred in enforcing transaction agreements

Trading	Transfer costs	Brokerage costs
	Registration costs	Costs to hold an account in national registry

Transaction costs are those that are a result of initiating and completing transactions to secure CERs. They are comprised of pre-operational costs (or upfront costs), implementation costs (costs spread out over the entire crediting period), and trading costs. Pre-operational costs involve direct expenses for search, negotiation, validation and approval. Implementation costs are those incurred for monitoring, certification and enforcement, while trading costs refer to brokerage costs, and costs to hold an account in a national registry. In table 8 below, The Prototype Carbon fund suggest that the pre-operational transaction costs could be as much as 229 thousand euros (265 thousand USD), while Ecosecurities believe that the pre-operational transaction costs could be about 70 thousand euros(42 000 pounds) (UNEP, 2004).

Table 8: CDM Transaction Cost Estimates (after UNEP, 2004)

CDM Transaction Costs Estimates	Ecosecurities Estimates (Pounds)	PCF Estimates (USD)
Preparation and Review	...	40 000.00
Baseline Study	12 000.00 – 15 000.00	20 000.00
Monitoring Plan	5000.00 – 10 000.00	20 000.00
Environmental Assessment		
Stakeholder consultation		
Approval		
Validation	10 000.00 – 20 000.00	30 000.00
Consultation and project Appraisal		105 000.00

CDM Transaction Costs Estimates	Ecosecurities Estimates (Pounds)	PCF Estimates (USD)
Legal and Contractual arrangements	15 000.00- 25 000.00	50 000.00
Sales of CERs	5%-15% of CER value	
Adaptation Levy	2% of CER value Annually	
Risk Mitigation	1%-3% of CER value annually	
Verification	5000.00 per audit	25 000.00 (initial) 10 000.00- 25 000.00
Executive Board Administration		

In Summary, the financial inflows from the sale of the CERs must exceed the transaction costs and the costs of emission-reductions to be a viable project (IETA, 2004). The higher the transaction costs, the fewer projects will be economically acceptable, and therefore not even enter the CDM project pipeline. Some experts believe projects classified as large (wind power, energy efficiency, solar and thermal -20 000 to 200 000 tCO2e/year) or very large (Large hydro, gas power, landfill methane capture, large scale afforestation and geothermal – over 200 000 tCO2e/year) would be financially successful (IETA, 2004). From their research, it appears that production costs and transaction costs are minimized in larger projects. Even though a large part of the transaction costs are fixed, the simplified modalities and procedures for small scale projects (see above), have lowered the transaction costs for them.

The market potential for emission-reductions in 2010 is approximately 400 MtCO2e, and this necessitates an annual investment of about 10 Billion USD. If one combines the minimum demand by industry and government the potential demand for CERs (CDM) and ERUs (J1), could be about 100 MtCO2e (IETA, 2004). "Carbon credits can contribute approximately 5-10% of the capital costs of clean energy projects" (Ecosecurities, no date, 14). Other research done by the OECD indicates that CDM projects could generate approximately 32 Million tons of CO2-eq/ year during the first commitment period (2008-2012) (OECD, 2004). They also suggest that the increase in energy related carbon dioxide emissions between 1990 and 2010 could reach 7.4 billion tons. Of this amount, non-Annex 1 countries are expected to produce the majority (5.2 billion tons or 70%) based on a business as usual scenario. In 2010, total energy related emissions are projected to be 27.5 billion tons of carbon dioxide. Emissions from non- OECD countries are predicted to rise, from 45% in 2000 to 57% in 2030, while in China the expected emissions increase are particularly concerning – doubling from 3.1 to 6.7 billion tons over the same period. In addition, the energy sector is expected to need an investment of 16 trillion dollars by 2030, in order to satisfy the ever increasing need for energy goods and services (OECD, 2004).

Project activity is distributed currently more around Latin America, possibly owing to more foreign direct investment, while other areas have far less activity. Asia, and especially China could be a huge market for CDM projects (IETA, 2004).

Table 9: Examples of impact of CERs on project IRR (after UNEP, 2002)

Country	Project	IRR without Carbon Finance (%)	IRR with Carbon Finance (%)
Costa Rica	Wind power	9.7	10.6
Jamaica	Wind Power	17.0	18.0
Morocco	Wind Power	12.7	14.0
Chile	Hydro	9.2	10.4
Costa Rica	Hydro	7.1	9.7
Guyana	Bagasse	7.2	7.7
Brazil	Biomass	8.3	13.5
India	Solid Waste	13.8	18.7

From the above Table 9 it can be seen that Biomass and Solid waste projects benefit the most from additional carbon finance – i.e. carbon credits, with a larger Internal Rate of Return (IRR), and hence greater profitability.

There are other factors which can affect prices. The greater the guarantee that can be provided regarding the delivery of validated, verified and certified CERs within the stipulated timeframe and according to the agreed quantity, the higher the price will be (IETA, 2005). Issues such as the experience of the project developer and creditworthiness of the sponsor will affect the viability of the project. Forward contracts (upfront purchases before credits are delivered) for CERs are cheaper than spot contracts (purchases for actual credits being delivered). If an upfront payment is negotiated, then discount rates often apply, and in most contracts the seller also incurs liability should the project fail to deliver (IETA, 2005). All of these above factors can affect the final CER price.

Appendix 7 Small Scale projects and mechanisms of reducing costs

In the case of small scale projects (see Table 10 for examples of these), simpler requirements have been established for cost reduction. The following projects would comply:

Type 1 – small renewable energy activities up to 15 Megawatts (or equivalent)
Type 11 – small energy efficiency improvements which reduce energy consumption by up to 15 gigawatt hours per year
Type 111- other project activities that both reduce emissions caused by human activities and produce less than 15 Kilotonnes of carbon dioxide (or equivalent for other gases) annually.

Table 10: The Executive Board's current version of small-scale CDM project activity (after UNEP, 2004)

Project Types	Small scale CDM project Activity categories
Type 1: Renewable energy projects	A. Electricity Generation by the user B. Mechanical energy for the user C. Thermal energy for the user D. Renewable electricity generation for a grid
Type 11: Energy efficiency improvement projects	A. Supply side efficiency improvements- transmission and distribution B. Supply side energy-efficient improvements – generation C. Demand side energy efficiency programs for specific technologies D. Energy efficiency and fuel switching measures for industrial facilities E. Energy efficiency and fuel switching measures for buildings
Type 111:Other project activities	A. Agriculture B. Switching fossil fuels

Project Types	Small scale CDM project Activity categories
Type 1: Renewable energy projects	A. Electricity Generation by the user B. Mechanical energy for the user C. Thermal energy for the user D. Renewable electricity generation for a grid
	C. Emission-reductions by low greenhouse gas emission vehicles D. Methane recovery E. Methane avoidance
Types 1-111	Other small scale projects

From the above table it can be seen that sink projects, do not qualify for small scale projects, and that these categories are mutually exclusive, in that projects can only qualify for one , or another, but not for all three. If the project consists of both renewable and non-renewable components then the 15MW limit only applies to the renewable component (UNEP, 2004)

Developers of small-scale CDM projects can propose additional categories, for projects, especially if the project does not belong to any of the existing categories. These can be sent directly to the Executive Board without going through a DOE. A description of how a simplified baseline and monitoring methodology could be applied to the new project category, must be supplied. If accepted by the Executive Board, this new category will be appended to the small-scale modalities and procedures, and this category can be used.

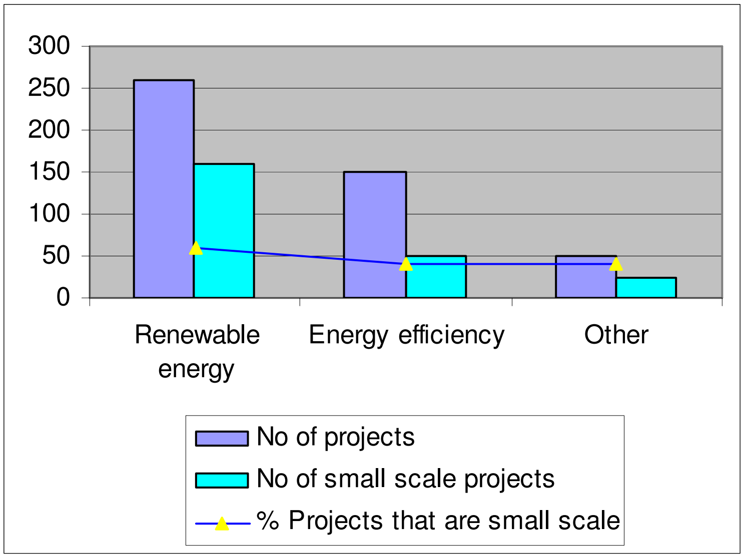

Figure 9: Percentage of projects that fall under the definitions of small scale (after Ecosecurities CDM: Simplified Modalities and Procedures for Small –Scale Projects, 2002, 35)

From Figure 9, one can clearly see that of approximately 268 renewable energy projects, 187 fell into the small scale category. A similar pattern was seen for energy efficiency and other projects. (Most small scale projects are 5MW.GWh or Kilotonnes of carbon dioxide).

Small project activities can be bundled (in order to reduce costs), or grouped together so that key aspects of CDM rules such as design, registration and verification can be addressed for the whole bundle rather than the individual projects. Also the following cost-reducing mechanisms would apply to small scale projects: simpler requirements for the project design document; simpler methodologies for developing the project baseline; simpler requirements for monitoring emissions; lastly, a single 3rd party verifier may undertake validation, verification and certification of small projects to reduce costs (CDMguide.net, 2005).

Furthermore the CDM executive board may lower admin fees charged to small projects. According to UNEP (2004, 45), the registration costs would be 5000.00 USD (small scale projects) as apposed to 30 000.00 USD (normal CDM projects). Small-scale project activities submitted as a bundle, can submit a single project design document as long as the participants and location of activities are described for each project, and an overall monitoring plan is provided (separate monitoring plans can be provided if so desired).The proviso here is that projects can be bundled as long as the total size is below the limits for a single project. Small-scale projects cannot be debundled components of a larger project. This is easily verified by checking to see if there is another small-scale project registered, or an application to register a project that has the same participants, falls in the same category, has been registered in the previous two years, or whose boundary is within 1km of the proposed small-scale activity (UNEP, 2004). In addition validation of the activities can be carried out for all the projects together, while verification and certification can be carried out against this overall monitoring plan. Standardized baselines have been proposed for some of the project categories in order to simplify the procedures, and leakage calculations are not necessary unless the project utilizes equipment from another site. Further to that, when monitoring small-scale projects, relatively small samples which are reflective of the devices installed i.e. energy saving lamps, need to be taken (UNEP, 2004).

Appendix 8 Buyers and Sellers of project-based credits

Buyers of Project-based credits

Annex 1 (or B) countries have legally binding targets, and are therefore obliged to meet their commitments through domestic emission-reductions (approximately 50%) (UNEP, 2004), while the rest could come from purchasing emission-reductions. Governments and industry are the prime candidates for purchasing project-based emission-reductions, and from the research done until April 2005, most of the purchases have come from Europe. Of the European buyers, 75% of the purchases have come from industry, while only 25% has been from governments (In particular the Dutch, Danish, Swedish and Austrian) (IETA, 2005). Governments have been conspicuously slower in purchasing, but perhaps that has been owing to budgeting cycles, regulatory uncertainty and that inevitably larger volumes are sought (IETA, 2005).

2.10 Sellers of project-based credits

As of April 2005, the largest seller of emission-reduction credits has been Asia (Approximately 45%), with Latin America second (approximately 35%). A large number of projects have been approved by the Indian DNA, but since these are unilateral CDM projects (no Annex B/1 buyer identified yet), they do not reflect as credits sold yet (IETA, 2005). In Figure 3, a graphical depiction of the projects which have been validated and registered with the CDM Executive Board, it can be seen that the three largest suppliers of projects are India, Brazil and Chile while Africa has been lagging. This picture has changed somewhat in that South Africa and Uganda have recently registered a few CDM projects, with Nigeria, Ghana, Sierra Leone and Zambia actively working on some. In South Africa, local businesses such as SAB and Anglo American have embarked on unilateral CDM projects. The intention appears to be to use these to offset their emission targets in Europe, or to sell the credits to market buyers (Africainvestor, 2005).

China and Mexico are emerging markets and have a large number of projects in the pipeline (IETA, 2005). China and India are expected to account for 60% of the CDM market share (Jotzo and Michaelowa, 2002).

Appendix 9 Enforcement Mechanisms for non compliant countries

There is a risk of non-compliance so the design of enforcement mechanisms, (in the event of non compliant countries), was agreed at COP7 by the parties to the Kyoto Protocol. Two bodies were created to ensure implementation of these mechanisms – a Facilitative branch and an Enforcement branch. The Facilitative branch's tasks and duties are to consult, and advise the parties to the protocol, while the Enforcement branch is tasked with deciding if a country is in compliance. Each branch must be composed of 10 members elected from the conference of the parties. One representative from each of the five UN regions, one from the small island developing states and two from Annex 1 and non-Annex 1 parties should be represented within each branch. A three quarters majority is required to ratify decisions from the facilitative branch, as apposed to a three quarters majority, and a double majority of both Annex 1 and non-Annex 1 parties for the Enforcement branch. Sanctions are automatically applied if a party has not complied. They include deducting a number of tonnes equal to 1.3 times the amount in excess emissions from the parties assigned amount, for the second commitment period, a compliance action plan has to be developed by the non compliant party, and its eligibility to sell permits is suspended (Hagem *et al.*, 2005).

Should a non compliant country (that is a net buyer of permits) withdraw from the agreement, after being penalized with sanctions, the international permit price could fall. Conversely, if it chose to completely comply with its commitments and applied sanctions, the permit price could increase. A further effect could be that should a certain country withdraw after sanctions, it could trigger other countries to do so as well. Future research is required in this area, since it may have an important impact on the success of the emission trading system (Hagem *et al.*, 2005).

Appendix 10 Institutions that have contributed to the development of CDM

The parties to the Kyoto Protocol are empowered to define, develop, review and implement the rules of the CDM. Delegates from each country represented, meet to make decisions regarding the Kyoto Protocol and the CDM. This meeting is known as the Conference of the Parties (COP), which serves as the Meeting of the Parties to the protocol (MOP) (CDMguide.net, 2005). The COP/ MOP has ultimate control over the CDM, and therefore provides guidance to the CDM Executive Board on the rules of the CDM, rules of procedure and the accreditation of designated operational entities (DOE). In essence, they perform an overall governing function. Some of the tasks and duties of COP/ MOP would be to review the annual report from the CDM Executive Board, review regional distribution of the designated operational entities, facilitate accreditation of these entities, monitor distribution of project activities to identify constraints to their development, and even arrange funding where possible for these projects.

The CDM Executive Board supervises the day to day operations of the CDM. The Executive Board consists of ten members drawn from developing and developed countries. One representative from each of the five UN regions (Africa, Asia, Latin America and the Caribbean, Central Eastern Europe and OECD), one from the small island developing states and two from Annex 1 and non-Annex 1 states each, are expected to participate. The UN pays for the costs of participation of all members, including alternate members. The powers of the Executive Board range from rejection of registration of CDM projects to denying CDM project credits. In addition it checks to see if projects conform to the CDM rules as well as deciding how projects are managed and regulated. Another critical function of the Executive Board is to develope guidelines for baseline methodologies, advise the COP/MOP on new modalities, procedures and guidelines, and approve new methodologies for baselines, monitoring plans and project boundaries (Wilder, 2004). It considers and evaluates validation and certification decisions taken by Designated Operational Entities (DOEs) and adjudicates those actions. These Designated Operational Entities act as independent auditors who validate the prospective CDM projects, verify the emission-reductions and certify them as Certified Emission-reductions. The Executive Board can also suspend designated operational entities that no longer conform to the accreditation standards or CDM rules (CDMguide.net, 2005).

Other tasks and duties of the CDM Executive Board include the construction of new policies for the functioning of small scale CDM activities, especially simplified modalities and procedures. It performs administrative duties as well, in that it is expected to maintain a public list of accredited Designated Operational Entities, a database of CDM project activities as well as description of approved rules, procedures, methodologies and standards. The CDM registry, which keeps track of all the Certified Emission-reductions, ensures that issuance, holding, transfer and acquisition of CDM credits is correctly accounted for. Its structure and design should allow for accurate, transparent and efficient exchange of data between national registries, the CDM registry and an independent transaction log. Separate accounts for each project participant will be held, and track is kept of which stages the projects are currently in. Serial numbers are assigned to each credit to ensure accurate data is kept, and each credit will only be held in one account, in one registry at any given time. The registry administrator, upon instruction from the Executive Board, will issue the exact quantity of credits into a pending account, while withholding approximately 2% (of the value of the credits) for adaptation and administration expenses. The remaining credits will be deposited into the registry accounts of the project participants and other stakeholders, if necessary. Information which is not confidential is made available to the public (CDMguide.net, 2005; UNEP, 2004).

Some of the criticisms lodged against the Executive Board have related to their level of bureaucracy and risk-averse attitude. It appears as if they have dragged their heels in approving certain baseline and monitoring methodologies (Lehmann and Telnes, 2004). This may have a lot to do with a lack of capacity but it has compounded the problem of an already negative perception amongst companies with potential CDM projects (Emsley, 2004). The view is that an inflexible, unclear, and pedantic additionality process has complicated matters further resulting in high transaction costs without the guarantee that the project will be deemed additional (Emsley, 2004; Lehmann, 2004). A possible solution, is that the Executive Board has developed an additionality tool, which is intended to provide an objective assessment of the project. However, it is not perfect as yet (Lehmann, 2004).

Designated operational entities (DOE)

These Operational Entities are appointed by the CDM Executive Board and are typically private auditing and accounting companies or consulting and law firms which are accredited and capable of performing independent audits of emission-reductions. Each of these entities need to apply for accreditation, and while they are undergoing this process, they are called Applicant Entities (AE) and are listed on the UNFCCC website. They can be accredited for 15 sectoral scopes (UNEP, 2004), which is listed in the table below. A CDM assessment team which has been assigned by the CDM assessment Panel will carry out the review of the Applicant Entity to decide if it has the applicable qualifications to become a DOE. If successful, the Applicant Entity will become a DOE and also be listed on the UNFCCC website.

Both an Applicant Entity and DOE can propose new sectoral scopes (see Table 11 for examples of this), as well as baseline and monitoring methodologies to the Executive Board. They must furnish the necessary procedural reports and documentary evidence for each new methodology submitted to the Executive Board for approval. (Any prospective project participant should select the appropriate scope under which their project best falls and choose a DOE who has been accredited for that scope). Once they have been accredited the DOE must validate CDM projects before they are submitted to the Executive Board for registration. Once the project is in operation, another independent DOE should verify the emission estimates, check the projects documentation to ensure it conforms with the CDM rules, carry out on site inspections, assess monitoring results, verify that the monitoring methodologies have been followed without deviation, and formulate a verification report. Certification follows, which is the “written assurance that the project achieved the stated level of emission-reductions” (CDMguide.net, 2005).

Table 11: Sectoral Scopes for which AEs and DOEs can be accredited (after UNEP, 2004, 43)

1	Energy Industries (renewable-/ non renewable sources)
2	Energy Distribution
3	Energy Demand
4	Manufacturing industries
5	Chemical Industries
6	Construction
7	Transport
8	Mining/ Mineral production
9	Metal production
10	Fugitive emissions from fuels(solid, oil and gas)
11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride
12	Solvents use
13	Waste Handling and disposal
14	Afforestation and reforestation
15	Agriculture

The general consensus is that the effectiveness of the DOE is often limited by lack of resources and time constraints. In South Africa there is only one accredited DOE (Price Waterhouse Coopers), and this corroborates the international view of limited resources and time available that DOEs have for validation and verification.

The use of the above-mentioned additionality tool would be helpful to the DOE when evaluating projects however, they have not had faith until now, that the tool is 100% accurate. Other factors such as investment, institutional and technology barriers have been used to convince the Executive Board that the project would not have gone ahead without the CDM advantages (Lehmann, 2004).

Designated National Authority (DNA)

In order to participate in CDM projects, host countries must establish a designated national authority to develop national criteria for assessment and approval of projects and to ensure projects conform to national policy, regulations and to national development goals. The DNA should decide whether each project conforms to its sustainable development goals and if the country agrees to participate in the project (UNEP, 2002). To ensure that potential CDM investors elect to participate, host countries should design rapid, standardized, effective, transparent procedures to assess, screen, evaluate and approve projects. The regulatory framework and legal environment should be conducive to preparing and conducting projects in that particular country. This would include developing guidelines and procedures for project approval. In South Africa the Department of Mineral affairs and Energy (DME) are the designated national authority.

Approvals and acceptance of projects have been notoriously slow and one of the suggestions has been to limit the number of project participants as listed on the PDD to the major parties, in order to speed up the process (Lehmann, 2004). Since in most cases, the DNA and project developers share common goals, it is quite apparent that DNAs worldwide have been very willing to assist project developers, and other interested stakeholders in developing CDM projects.

NGOs

These organizations can potentially fund and manage CDM projects, and their focus is often on sustainable development. Internationally the World Wildlife fund and the Nature Conservancy are very active, while in South Africa SouthSouth North are very involved in projects.

Financial Institutions

Local commercial banks provide much of the bilateral funding, and in South Africa, the Development Bank of SA have been involved in project financing.

Emission Brokers

Their primary task is to facilitate transactions between buyers and sellers. Forward contracts and Spot (immediate purchase) contracts are often facilitated by these brokers.

Insurers

The project owner may feel the need to mitigate some of the risk in case the project fails to deliver the contractually agreed number of carbon credits. In this case, the owner may purchase insurance cover from insurance companies.

Project Owners

The primary developer of the project, who formulates the project design document, is the project owner (EDRC, 2002). The owner is usually situated in the host country, and could be the host government, a private company, NGO or even a partnership of owners. Once the project owner has found an investor, (often in a developed country) they in turn could form a new partnership.

Stakeholders

While the DOE is conducting the validation, the project design document must be made available to the public. All stakeholders, including NGOs have a 30 day period to comment on the project design document. Stakeholders would encompass anyone who is affected by the project, or who would participate in it (EDRC, 2002), After that, a detailed account of how comments from stakeholders were obtained, summaries of comments and a report on the above, should be provided to the Executive Board (UNEP, 2004). Often capacity building is required especially if modification of community behaviour is required (EDRC, 2002). Even the process of doing Environmental Impact Assessments requires consultation with stakeholders. All stakeholders can also comment on validation reports at an international level and dispute registration of CDM projects. Host countries should consult with stakeholders, in order to prioritise sectors for CDM projects (Ecosecurities, 2002). Consequently if local communities and stakeholders support the project at inception, it is more likely to be successful and provide the expected credits and benefits. Some obstacles can occur when the project design document is placed on a web page, to which rural stakeholders have no access. Further to that, there are often language barriers where stakeholders are not able to understand the content of the document (UNEP, 2004). Also conflict can arise between stakeholders, if broad consultation has not taken place (Ecosecurities, 2002).

Appendix 11 Wits ethics committee application form and protocol

HREC (2005)
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

APPLICATION TO THE HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL) FOR CLEARANCE OF RESEARCH INVOLVING HUMAN SUBJECTS

Unless applications are received by the 15th of the month, they will be carried forward to the following month for consideration. Please note incomplete applications will NOT be considered at all.

PROTOCOL NUMBER (for office use only):
____

This application must be typed or handwritten in capitals

NAME :Prof/Dr/Mr/Mrs/Ms/Miss **Anne du Toit**

DEPARTMENT/INSTITUTION **Dept of Geography & Environmental Stud**

FULL TIME OR PART-TIME **Part time**

TELEPHONE NO. AND EXTENSION **011 652 7439/ 083 458 8051**

E-MAIL **Anne.dutoit@Siemens.com**

Name and Tel number of Supervisor **Prof C Vogel - 011 717 6510**

TITLE OF RESEARCH PROJECT
Carbon Trading, the Clean Development Mechanism and the perceived benefits for South Africa

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Is this research for degree purposes ? If so, for what degree, and has it been approved by the relevant higher degrees committee or other relevant unit?

Research is for MSC – Higher degree committee has approved

WHERE WILL THE RESEARCH BE CARRIED OUT?

South Africa

–

OBJECTIVES OF THE RESEARCH (Please list)

The aim and objective of the study is to identify the current implementation and effectiveness of the Clean Development Mechanism, as well as the possible opportunities and constraints. The intention is to improve the body of knowledge in order to mitigate these issues/ constraints that key stakeholders may be having and share best practices/ benefits in order to develop the market further.

WHO ARE THE RESEARCHERS AND WHO WILL SUPERVISE THE PROJECT?

Researcher – Anne du Toit
Supervisor – Prof Coleen Vogel

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Protocols submitted to the Committee must have the information that will enable it to judge the safety of procedures or confidentiality of information for research on participants.

The following questions have been designed for this purpose and should therefore be answered as fully as possible.

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1. Give a brief outline of the proposed research including a definition of procedures

The study will involve a literature survey and field research, through the use of a questionnaire. Where possible face to face interviews will be conducted, but in other cases the questionnaire will be emailed or faxed to participants. The Literature survey will include journal articles, books, World Wide Web articles as well as other articles published by climate change research consultants. Field research will involve one on one interviews and emailed questionnaires in order to gather the data.

2. What type of information is to be gathered? Where a scale, questionnaire or interview schedule will be used, please attach a copy

A literature survey involves analysis and study of the last 5-8 years published journal articles. In particular, Climate Policy and Energy Policy journals will be reviewed, as well as Nature, Scientific American and IPCC reports amongst others. Books on global warming and articles from IETA, PCF (Prototype Carbon Fund) CDM field guides, World Bank articles etc, will also be used. Many articles from climate research consultants are available on the World Wide Web, as well as being published.

3. How will informed consent be obtained?

By direct request - personal and in writing.

3.1 Please attach participants' information sheet, informed consent form and questionnaire or interview format if any

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4. Who will the participants be?

Key stakeholders and project developers of CDM projects.

4.1 State the age ranges of the participants

25-60 yrs

4.2 How will the participants be selected and exactly what will they be told when asked to participate in the research?

The DME (Dept of Mineral Affairs and Energy) have supplied me with a list of project developers, and I have received other names from energy consultants. These are all key players in the CDM market.

4.3 Are the participants considered to be vulnerable individuals (including pregnant women, orphans, etc)?

No

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5. Will the research be of any direct benefit to the participants?

YES / NO (delete whichever is not applicable)

If 'YES' elaborate briefly.

The intention is to improve the body of knowledge in order to mitigate these issues/constraints that key stakeholders may be having, and share best practices/ benefits in order to develop the market further.

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6. Are there any risks involved for the participants? (For example – legal, psychological, financial or physical risks) If "yes", please identify them and explain how they will be minimized.

There are no physical risks, but since the information obtained is confidential, it will be treated with absolute circumspection. Participants are free to withdraw at any time or refuse to answer some questions.

7. How is confidentiality to be guaranteed?
The information obtained will be held in the strictest of confidence, but when analyzed, only trends and patterns will be published in a thesis. No names or institutions will be published, nor any information which could be damaging to individuals, groups or organizations.

8. Has permission been obtained from the relevant authorities: e.g. Gauteng Dept of Education? (Please attach copy).

A letter of approval of the research being done will be obtained from the DME – Dept of Mineral Affairs and Energy, as well as permission from interviewees.

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9. What is to be done with the raw research data after completion of the project?

The data remains with the researcher, but trends and patterns will be made available to participants and published in my MSc thesis.

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10. How will the end results be reported, and to whom?

End results, trends and patterns will be made available to participants who request feedback. The primary report will be my Msc thesis, published by Wits University

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- **In signing this form, I, the supervisor of this project, undertake to ensure that any amendments to this project that are required by the Human Research Ethics Committee are made before the project commences.**

Please print name:

DATE : ____________ **SUPERVISOR'S SIGNATURE : _________________________**

DATE : 13 January 2006 **APPLICANT'S SIGNATURE : _________________________**

DATE : ____________ **DEPARTMENT/UNIT HEAD'S SIGNATURE : _________________________**

Revised November 2005