South African Business Opportunities under the Clean Development Mechanism and Barriers to Investment

Nigel Darnley Beck

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

Johannesburg, 2009

ABSTRACT

The need to reduce the global carbon footprint and mitigate the adverse effects of global warming led to the Kyoto Protocol, an international action plan set up under the United Nations Framework Convention on Climate Change. Under the Protocol, South African industry stands to benefit financially, if businesses were to register and successfully implement Clean Development Mechanism (CDM) projects through which they would reduce their Green House Gas emissions. Theoretical projections show that South Africa's CDM potential ranks alongside that of China, India, Brazil, Argentina and Mexico. However, in practice, South African projects still represent a low fraction of the entire CDM pipeline.

This study builds upon the limited existing body of knowledge on the CDM within South Africa. Specifically, it aims to determine the relative importance of barriers that currently exist, or are perceived to exist, and which have resulted in limited investment in the CDM in South Africa.

The research performed was largely qualitative and used a questionnaire-based descriptive survey method to solicit opinion from key South African CDM experts across all spectra of the industry.

Based on responses, the main GHGs that are likely to be reduced by investment in the CDM within South Africa are CO_2 and then methane. Reduction of these gases is most likely to occur through investment in energy efficiency, renewable energy (such as wind, biomass and solar power) along with methane recovery and utilisation, predominantly from landfill gases and animal waste. The research examined the critically important barriers to investment in such projects, which were found to include: lack of clarity of the Kyoto Protocol post 2012, complicated project identification and validation, lack of awareness within industry, low and volatile Certified Emission Reduction (CER) prices and high transaction costs.

Other factors deemed important, but not necessarily critical, included poor national policy and legislation and delays in decisions by the Executive Board. Factors such as tax on cash streams from registered CER sales, approval

process of Designated National Authority (DNA) and CDM project opportunities within South Africa did not appear to have a major influence on investment in the CDM within South Africa.

Given the uncertainty and confusion around the CDM market within South Africa it is suggested that government provide provisional CDM guidelines to facilitate the smooth implementation of key CDM project types. This would raise awareness of CDM projects to local/national development banks and other commercial entities, and thus facilitate increased engagement and investment by the business community.

Within South Africa, it appears the critical mechanism to ensure that CDM becomes embedded in business models is the replacement for the Kyoto Protocol post 2012 (when it is due to expire). This is likely to facilitate increased investment in the CDM, as well as to demonstrate a continued commitment by South Africa, and global governments, to address climate change through a replacement mechanism. Such a mechanism provides a platform through which business can play a crucial role to ensure success of the Kyoto replacement and actively address climate change. South African Government will have an integral role in negotiating the replacement within the global arena, and will subsequently need to establish national priorities to facilitate the long term policy implementation and national success of carbon markets.

DECLARATION

I, _____, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Nigel Darnley Beck

Signed at ……

On the …….. day of …… 2009

DEDICATION

This research report is dedicated to my parents (Angela and Richard) who always encouraged me to pursue a career of personal interest.

ACKNOWLEDGEMENTS

Prof. John Luiz (my supervisor) you break the mould of academics in your ability to consistently, and timeously, communicate and turn around reviews. Your commitment and support was much appreciated.

Dr Anthony Stacey your assistance in data analysis was invaluable particularly during a trying time of your life.

Dad and Nicky Clarke your review and editorial skills were essential for a well rounded research report.

Tammie thanks for your patience and support, as well as your aesthetic contribution to figures. I really did lean on you, sometimes probably more than I should.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF BOXES

CHAPTER 1: INTRODUCTION

1.1 Purpose of the study

This study builds upon existing research undertaken by Luiz and Muller (2008) and Little, Maxwell and Sutherland (2007), whose results, shortly after the implementation of the Clean Development Mechanism (CDM) identified a number of factors considered to be 'facilitating and inhibiting' of CDM opportunities within South Africa. Given the existing body of knowledge, and the additional experience gained over the past three years, the aim is to determine the relative importance of potential barriers that currently exist, or are perceived to exist, and which have resulted in limited investment in the CDM in South Africa (SA).

1.2 Context of the study

Increasingly, global corporations are being asked by shareholders and government for regular and detailed information on how they are positioning themselves to maintain a competitive advantage in a future carbon constrained world. In 2008, as part of the Carbon Disclosure Project, South Africa's top 40 listed companies were targeted by investors to disclose how they are managing risks and opportunities presented by climate change (Schneider 2008a). This highlighted what may be a disconnection between awareness of climate change and action on the issue linked with economic benefits.

The need to reduce the global carbon footprint and mitigate the adverse effects of global warming led to the Kyoto Protocol, an international action plan set up under the United Nations Framework Convention on Climate Change. Ratified by 183 nations (including SA), developed country signatories have undertaken to reduce greenhouse gas (GHG) emissions to 5.2% below 1990 levels by 2012 (*Kyoto Protocol to the United Nations Framework Convention on Climate Change* 2005).

South Africa is a carbon-intensive nation, with 89% of the country's primary energy needs derived from fossil fuels (Naidoo 2009). Given the increasingly

intensive global focus on climate change, there is growing realisation that South Africa is going to need to adopt a lower carbon energy trajectory, if it hopes to avoid the financial and social penalties that appear inevitable (Naidoo 2009).

However, under the Kyoto Protocol, there are clear benefits to businesses, to bring about environmental change within developing countries (Smrcka 2009). South African industry stands to benefit financially if businesses were to register and successfully implement CDM projects through which they would reduce their GHG emissions (Muller and Luiz 2008). The CDM seeks to reduce GHGs by allowing businesses in developed countries to meet some of their emissions targets by investing in GHG reduction projects in developing countries where reduction costs are lower. Being the most developed country in Africa, South Africa has the potential to be a significant recipient of such emissions finance, but it lags far behind other developing countries in the development of such projects. Of the 1 533 registered CDM projects worldwide, only 15 are South African, China has 507, followed by India with 413 and Brazil with 157 (*CDM Project Database* 2009). Evidently the CDM does not feature high on corporate South Africa's list of priorities or that of international investors.

The key factors affecting the poor investment in the CDM in South Africa are to be addressed within this study.

1.3 Problem statement

1.3.1 *Main problem*

Determine the key factors that are perceived to discourage business investment in the Clean Development Mechanism (CDM) in South Africa, and their relative importance.

1.4 Significance of the study

The study will determine which greenhouse gases (GHGs) are most likely to be reduced through investment within the CDM in South Africa, and therefore determine which CDM project types are best suited for the South African economy.

This will raise awareness within business and industry (locally and internationally) of opportunities that may exist to generate fiscal returns from reducing GHGs. It will look at the key factors currently perceived to be barriers to investment in the CDM in South Africa and establish their relative importance. In addition, it will provide guidance to South African Government and new business initiatives as to what factors need to be addressed in order to encourage and facilitate investment in CDM. Organisations considering investment in CDM will be in a position to properly assess the advantages and disadvantages and implement mitigation measures, where possible, that may be factored into longer term business plans.

1.5 Delimitations of the study

This study will be undertaken from the perspective of factors that are perceived barriers to investment in CDM in the South African economy, and is thus limited to the South African context. Some of the key contributing factors are currently under review by the government, i.e. climate change policies and tax incentives, potential changes cannot therefore be accounted for within this study. The main focus will be on the poor uptake of CDM until present.

This study will not focus on the effects of economic growth on GHGs or on potential outcomes for the Kyoto Protocol post 2012.

1.6 Definition of terms

Annex B Countries: Industrialised, developed countries that are not allowed to benefit from GHG reduction according to the Kyoto Protocol.

Carbon sink projects: A carbon sink project (or sequestration project) removes or sequesters carbon directly from the atmosphere, such as aforestation or underground storage of concentrated carbon dioxide.

CDM: Clean Development Mechanism of the Kyoto Protocol.

CER: A Certified Emissions Reduction that is issued when a registered CDM project is completed and the amount of GHG reduction as a result of the project is proven and validated.

CH_4: Methane is a greenhouse gas for which CERs can be earned.

CO_2: Carbon Dioxide is a greenhouse gas for which CERs can be earned.

CO_2e: Carbon Dioxide Equivalent is a unit used to compare the effect of different greenhouse gases with each other. Their effect is compared to that of CO_2 and therefore the effect is stated as an equivalent of CO_2.

DNA: The Designated National Authority is a local authority that should give approval to potential CDM projects before they are lodged with the CDM EB internationally.

DOE: The Designated Operational Entity is registered as an entity that can verify whether potential CDM projects are viable, and also verify what the proven GHG reduction is for a specific time period.

EB: The Executive Board of the CDM is a body that is in place to approve or reject potential CDM projects.

ETS: The Emissions Trading Scheme is in place to enable the trading of carbon emissions.

EU: European Union

EUA: A European Union Allowance is the allowed carbon emissions allocated to a country in the European Union in their attempt to reduce GHG emissions.

GHG: Greenhouse gas – these are gases that absorb radiation that is reflected from the earth's surface and therefore has the effect of increasing the temperature of the earth.

GWP: Global Warming Potential refers to the global warming effect that a GHG has. For example, the fact that N_2O has a GWP of 310 suggests that the global warming effect of a unit of N_2O is 310 times more than that of a unit of CO_2.

HFC: Hydro-fluorocarbons are greenhouse gasses for which CERS can be earned.

NGO: Non-Governmental Organisation.

Non-Annex B countries: Developing countries, such as South Africa, that can benefit from GHG reduction (earn CERs) according to the Kyoto Protocol.

N_2O: Nitrous Oxide is a greenhouse gas for which CER's can be earned.

PFC: Per-fluorocarbons are greenhouse gases for which CERs can be earned.

PDD: A Project Design Document is a document that discusses the details around a potential CDM project. It must be completed by the company that wants to register a CDM project and submitted to the CDM EB for registration.

ROI: Return on Investment

SF_6: Sulphur hexafluoride is a greenhouse gas for which CERs can be earned.

UNFCCC: United Nations Framework Convention on Climate Change.

1.7 Assumptions

The first assumption made is that CDM projects have the ability to generate fiscal returns, and that South Africa has the potential for CDM investment.

The second assumption is that experts interviewed in this study will present their honest view, sharing their concerns and suggestions in an open manner.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This section provides a summary of the literature, which has been developed and gathered, around the problem statements in Chapter 1. The purpose of this literature review is to determine the range of CDM projects globally, and therefore identify those most suited to South Africa by providing opportunities to reduce GHG emissions. The review formulates an understanding of climate change, and the Kyoto Protocol, and establishes the extent to which CDM can be a flexible mechanism to address climate change through which developing countries can achieve fiscal returns. The subsequent Section 2.7 explores the key factors providing barriers to investment in the CDM in South Africa. The scope of literature available within a South African context is limited, consequently information is drawn from the global arena in order to better understand the relevant barriers.

2.2. Climate change and the Kyoto Protocol

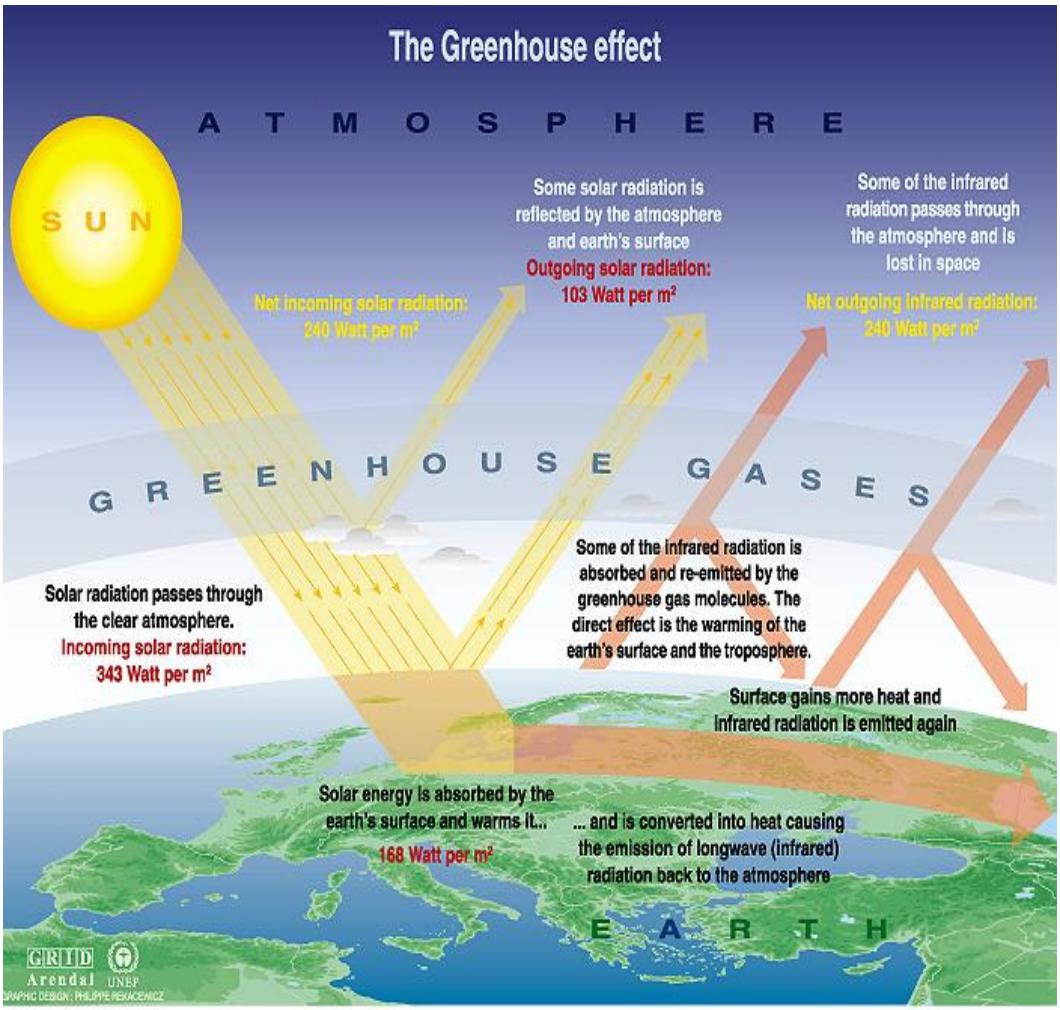
2.2.1 *Climate change*

Climate change is one of the most vital global concerns of the current century (Shukla, Sivaraman and Yajnik 2004; Kulovesi 2007). It occurs largely due to the increase of six GHGs in the atmosphere; Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorcarbon (HFC), Perflourocarbon (PFC), and Sulphurhexafluoride (SF_6). These six gases trap the suns radiation within the earth's atmosphere causing the warming effect commonly termed global warming and schematically shown in Figure 1.

Kulovesi (2007) estimates that the atmospheric concentrations of GHGs have increased markedly as a result of anthropogenic activities, and now far exceed pre-industrial levels. These heightened emissions are thought to be largely linked

to the consumption orientated lifestyles of populations living in developed countries, as well as the economic growth currently occurring in developing countries (including, inter alia, China, India, Brazil and South Africa).

Figure 1: The effect of greenhouse gases on climate change



Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

(source: UNEP and WMO 1996)

2.2.2 *History of the Kyoto Protocol*

As a result of increased awareness around climate change, and the potential impacts (such as melting icecaps, rising sea levels and the wholesale loss of biodiversity) there has been a marked international response. International climate

policy originated with the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) at the United Nations conference in Rio de Janeiro in 1992 (Pinkse 2007). This policy was a broad plan of action with unclear targets for the reduction of GHG emissions other than an objective of stabilisation by the year 2000 at the 1990 level. The next major progress date was in 1997 where countries agreed on a more detailed, differentiated reduction target and the Kyoto Protocol was adopted on 11 December 1997 in Kyoto, Japan. In early 2001 major setbacks began, and its rejection by the United States (out of belief that it would be detrimental to the US economy) threatened the bringing into force of the Protocol. However, later that same year at the Congress of the Parties 7 (COP 7) in Marrakech, the political agreement was turned into a legal text that enabled ratification of the Kyoto Protocol (Pinkse 2007). Following Marrakech, most parties including the EU, Japan, Canada and Russia ratified the Protocol, with the US and Australia withdrawing from the process, none the less the positive steps were being made to a practical response to climate change. Following a change of government on 3 December 2007, Australia ratified the protocol leaving the United States as the most notable non-member.

2.2.3 *The Kyoto Protocol*

The Kyoto Protocol is an international and legally binding agreement to reduce GHGs which was adopted on the 11 December 1997, and came into force on the 16 February 2005 (*Kyoto Protocol to the United Nations Framework Convention on Climate Change* 2005). As of the beginning of 2009, 183 countries had ultimately ratified the Protocol including South Africa who readily accepted on the 31 July 2002.

The Protocol was primarily developed in order to limit the collective emissions of the six GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6) from Annex B countries (Industrialised countries and the European Community that ratified the Kyoto Protocol [Appendix A]). There is a legally binding commitment for these countries to reduce their GHG emissions by an average of 5.2% from the 1990 levels, during the first commitment period 2008 – 2012 (Kulovesi 2007).

The Conference of the Parties (COP) serves as a meeting of the parties to the Protocol. Through the COP decisions are made that outline the path to future international action on climate change. The Parties to the Kyoto Protocol also formally adopt the “rulebook” of the 1997 Kyoto Protocol, the so-called ‘Marrakesh accords’, which sets the framework for implementation of the Protocol.

Under the agreement, Annex B countries must meet their targets primarily through national measures. However, the Protocol offers them an additional means of meeting their targets by way of three market-based mechanisms. The stance of developing countries, such as South Africa, (non-Annex B parties) is that developed countries must finance the incremental costs of whatever actions the developing nations undertake to address climate change. This has led to increased business interest in the issue of climate change, having identified the prospective environmental and economic benefits (Pinkse 2007). The result is the establishment of three flexible mechanisms for the creation and transfer of Kyoto units (Emissions Reduction Units and Certified Emission Reductions) namely; Joint Implementation (JI), International Emissions Trading (IET) and the Clean Development Mechanism (CDM). These flexible mechanisms are regarded by Kulovesi (2007) as the most innovative and successful aspect of the Kyoto Protocol as they actively engage the private sector in the implementation of the Kyoto Protocol.

Joint Implementation (JI)

This is the implementation of reduction or sink enhancement projects by Annex B parties, in order to achieve emissions reduction units (ERUs) for emissions reduction achieved (Erik Haites and Yamin 2004). This mechanism helps the host party meet its emissions limitation commitment.

International Emissions trading (IET)

Any Annex B party can transfer Kyoto units to another Annex B party through the international emissions trading scheme (Erik Haites and Yamin 2004). This cap and trade system is simplistically demonstrated within Box 1.

Box 1: Cap and Trade

Assume the combined annual emissions from a participating economy comprising 10 greenhouse gas emitters are capped at 10 tonnes $C0_2$ per year. Under a cap and trade system the government may issue each emitter with an annual emissions allowance of 1 tonne $C0_2$. Company X knows it will generate 2 tonnes of CO_2. To meet its target Company X can either reduce emissions (through operational efficiencies – clean technology) or buy an allowance from Company Y (whose emission would thus have to be zero). If the allowance costs less than the price of modification of Companies X plant it has a money saving opportunity, while Company Y can profit from its investment in clean technology.

(source: Schmidt 2009)

Clean Development Mechanism (CDM)

The purpose of the Clean Development Mechanism (CDM) is to enable emissions reduction by non-Annex B parties (developing countries) thereby earning certified emission reduction (CERs) that can be used by Annex B countries to meet their respective emissions limitation commitments. The quantity of CERs earned by a project is the difference between the project's actual emissions and the approved baseline scenario of emissions (status quo), that would have occurred within the absence of the project, while meeting the sustainable development objectives of the developing country (Roy, Das, Sathaye and Price 2002).

2.3. Clean Develop Mechanism

The Clean Development Mechanism (CDM), defined in article 12 of the Kyoto Protocol, first became operational at the beginning of 2006 (*Kyoto Protocol to the United Nations Framework Convention on Climate Change* 2005). This flexible mechanism is considered a fundamental instrument to enlist developing country participation in emissions reduction (Repetto 2001; Parikh and Parikh 2004). It seeks to reduce GHGs by allowing businesses in developed countries to meet some of their emissions targets by investing in GHG reduction projects in

developing countries where reduction costs are lower (Clean Development Mechanisms Can they work? 2007). This provides a way of transferring financial and technological resources to developing nations in exchange for emissions reductions (Repetto 2001; Szymanski 2002). For developing countries, CDM is an opportunity to attract more foreign investment while providing a more cost effective solution for local environmental problems. Consequently, the potential to implement 'green' projects under the CDM has raised expectations among policy makers and planners in both developed and developing countries.

In essence, the mechanism works because it is cheaper to construct low-carbon infrastructure from the start in developing countries than to modify or replace existing technology in developed countries. The CDM is essentially market based, allowing projects in developing countries to generate certified emission reductions (CER), the equivalent to one tonne of CO_2, which can then be traded on the global carbon market.

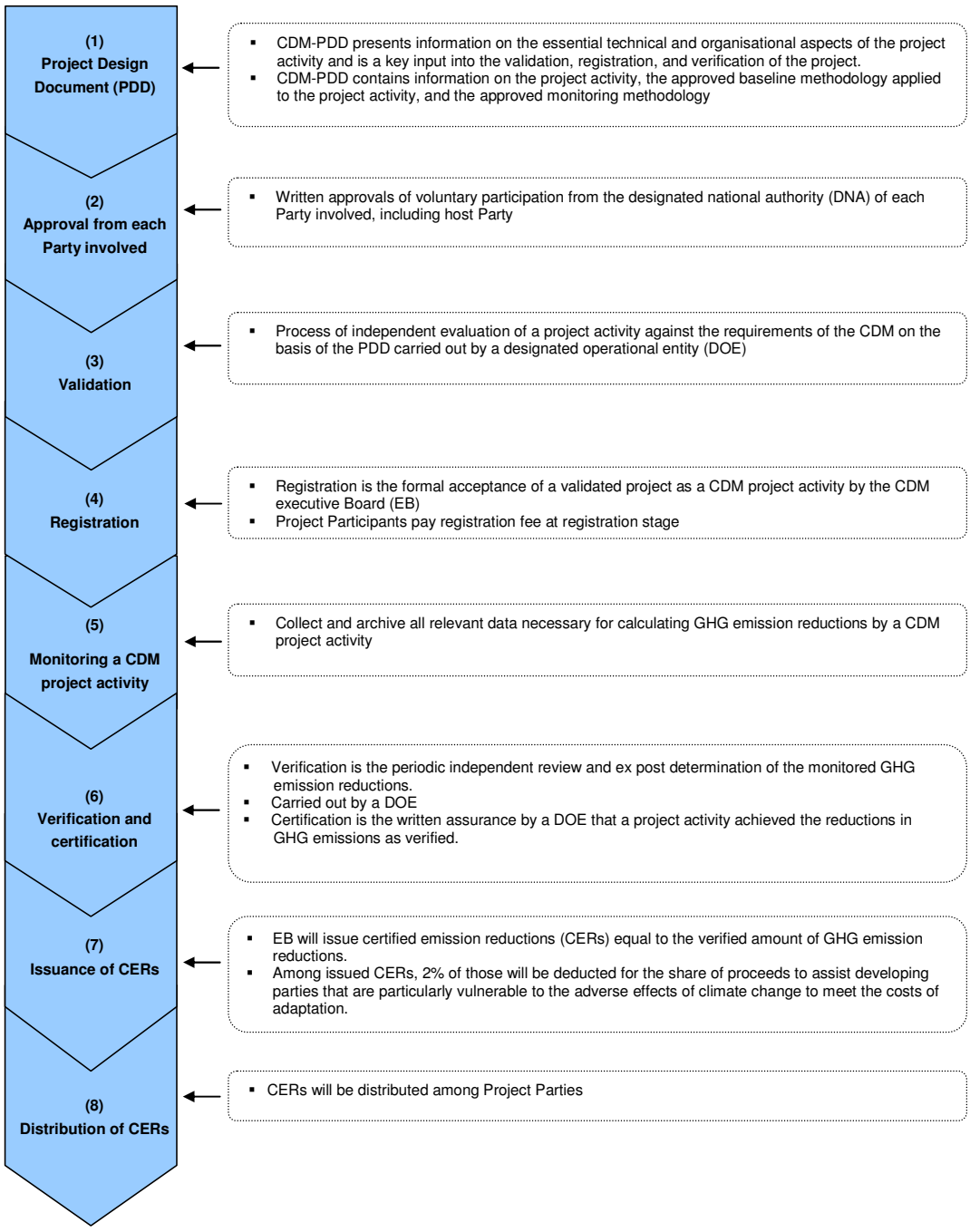
2.3.1 *CDM Project Cycle*

In order to qualify as a CDM, a project needs to initially demonstrate that it meets the below criteria. It must be:

- Additional – activities that would not have happened in the absence of a CER incentive;
- Quantifiable – measurably reduce emissions using an emissions baseline used to calculate the GHG emission that would have been generated if the CDM project had not gone ahead;
- Permanent – the GHGs they keep out of the atmosphere will not be released later; and
- Real – verified by third-party inspectors.

The generic global project cycle for a CDM consists of key steps shown in Figure 2 and described below:

Figure 2: CDM Project cycle



(source adapted from: Erik Haites and Yamin 2004; CDM in Charts Ver 7 2009)

Project description

The proposed project is described using the project design document (PDD). This includes a description of the project, the baseline methodology, project duration and crediting period, monitoring plan, calculation of emissions reductions, environmental impacts and stakeholder comment. The project participants must obtain written approval for the project from the DNA of each party involved, including confirmation by the host government that it assists in achieving sustainable development. Within South Africa, the DNA is the Department of Minerals and Energy.

Validation and registration

The proposed participants must retain a Designated Operational Entity (DOE) accredited by the CDM Executive Board to validate the proposed project. This ensures the project meets eligibility criteria as well as having the approval of the host government. DOEs validate proposed CDM projects by checking to ensure they conform with all the requirements for a CDM project and verify and certify the emissions reductions achieved by projects. Within South Africa, the current DOE is undertaken by PricewaterhouseCoopers (PwC) and Environmental Resource Management (ERM). A DOE is accredited only for specified project types and must be re-accredited every three years (Erik Haites and Yamin 2004).

Monitoring

Once operational the project participants must implement the approved monitoring plan to collect, and archive data, on actual GHG emissions.

Verification and certification

The project participants retain a DOE to monitor and verify the actual emission reductions achieved by the project. However, DOE's that have validated a project may not verify and certify the emissions reduction for the same project to avoid potential conflicts of interest (Erik Haites and Yamin 2004). Certification is then the

written assurance by the DOE that a project activity achieved the reductions in GHG emissions as verified.

Certified Emission Reductions (CERs)

Certified emission reductions (CERs) are calculated as the difference between the projected business-as-usual baseline emissions (status quo) and the project's actual emissions. A company successfully registering and implementing a CDM project may generate CERs. A certification report by the DOE constitutes a request to the Executive Board to issue CERs equal to the verified emissions reductions (below the business as usual baseline). The EXECUTIVE BOARD in turn instructs the CDM registry administrator to issues the specific number of CERs. Some CERs (2%) are retained to cover the share of the proceeds for administrative expenses and adaptation.

CERs can ultimately be used by governments to meet compliance under the Kyoto Protocol, or by installations covered by Emissions Trading Scheme regulations (e.g. European Union Emissions Trading Scheme [EU ETS], proposed Australian Emissions Trading Scheme [AUS ETS]). Banks financing CDM projects can 'forward purchase' the emission rights, potentially reducing the cost of capital for funding project implementation. Those available to be bought directly from the CDM project are called 'Primary CERs'. With a Primary CER the purchaser also shares the risk related to the project (project risk, credit risk, technology risk, delivery risk, market risk etc.).

Companies who have bought large quantities of primary CERs may sell part of their own CER portfolio onto third parties, which are then called Secondary CERs. These Secondary CERs may be sold on a guaranteed delivery basis, which come without the initial risks of a Primary CER, and are therefore are generally priced at a premium to primary CERs. The secondary CER price is also transparent, because it is a standardised product which can be traded on an exchange or over-the-counter. This means that losses in an event of default can easily be calculated and compensated for. Currently secondary CERs are priced at approximately €11 per tonne CO_2e, as shown in Figure 8 (*European Climate Exchange* 2009).

2.4. CDM Market

It is widely considered that the CDM is a new channel for financial assistance and investments to promote sustainable development through technology transfer and the promotion of equity (Repetto 2001). Originally designed to help the Organisation for Economic Co-Operation and Development (OECD) governments and businesses to fight climate change more affordably, it has quickly grown to be a significant investment. Wara (2007) found that gains to non-Annex B countries from participation within GHG mitigation might vary from US$6 billion to US$29 billion, about 7% - 20% of the global carbon market gains. Originally perceived as most likely to benefit smaller and poorer developing countries, this has not been the case with more project implementation occurring in developing countries with stable political systems, institutions and better economies (Painuly 2001; Kulovesi 2007).

According to Davis (2008) the carbon market has the potential to become one of the world's largest commodity markets within the next few years, having seen unprecedented growth from US$ 4.5 million in February 2005 to US$ 36 billion over three years. The major developing nations including China, India, Brazil and South Africa are considered to have a high potential for CDM all having diversified and fast growing economies with good project potential in the energy, transport, forestry, agriculture, waste and industrial sectors. China and India were initially sceptical of the benefits afforded by the CDM, but having experienced actual successes have subsequently entered the market with vigour (Wara 2007). Conversely, Africa and South Africa have been comparatively slow in moving into the CDM market. Africa accounts for 1.7% of global CDM projects, of this South Africa accounts for about 70% (Davis 2008).

2.4.1 *Greenhouse Gas Reductions*

Of the six gases of the Kyoto Protocol, there are a number of generic CDM project types that facilitate reductions of each gas (Table 1.) Carbon dioxide and

methane, being the most significant GHG contributors by volume, have a number of project types suited to various industries.

Not all GHGs are equal and for accounting purposes all six GHG emissions are related to a carbon dioxide equivalent (CO_2e). To formulate this relationship, each GHG is weighted by its respective Global Warming Potential (GWP). GWP is a measure of the effect of that particular gas in warming the atmosphere, compared to the value of one unit of carbon dioxide (CO_2). Carstanjen (2004) determined the GWP values based on the effects of GHGs over a 100 year time period, as shown in Table 1. Using the table it is evident that the global warming effect of nitrous oxide is 310 times more than CO_2, and that Sulphur hexafluoride is 23,900 times more than CO_2.

In 2004, South Africa was ranked 12th worldwide, contributing 1.6% to the global CO_2 emissions, on a par with Mexico, and only China, India, and South Korea being emerging markets emitting more CO_2 (Boden 2007). Of the three main greenhouse gases (CO_2, CH_4, and N_2O), carbon dioxide (CO_2) is the most significant in South Africa due to the country's dependence on energy generation from fossil fuels. Carbon dioxide contributed 83.2% of the total South African CO_2 equivalent emissions in 1994, while CH_4 and N_2O contributed 11.4% and 5.4%, respectively (DEAT 2005). South Africa's GHG emissions per capita are about twice as high as other developing countries such as Cuba, Mexico, and Argentina (DEAT 2005). The per capita emission rates are similar to those of some developed countries (Austria and Spain). The total local GHG emissions (CO_2e) increased by 9.4% between 1990 and 1994 mainly due to a substantial increase in emissions from the energy sector and the waste sector (DEAT 2005). Consequently, South Africa has the highest CO_2 emissions of all the SADC countries.

Table 1: Greenhouse gases and CDM project types

Greenhouse Gas	PRCC GWP 1995	CDM Project Type
Carbon Dioxide (CO_2)	1	Hydro Power
		Biomass
		Wind Power
		Waste Gas/ Heat utilisation
		Energy Efficiency
		Fuel switch Cement
		Afforestation/Reforestation
		Transportation
		Other renewable energy
The primary GHG that exists in the atmosphere for 50 to 200 years. The main anthropogenic source of CO_2 is burning of fossil fuels for energy production and transport. Changes in land use and deforestation also contribute significantly. Trees are natural 'carbon sinks' - they absorb carbon dioxide while alive and when they are destroyed, carbon dioxide is released into the atmosphere.		
Methane (CH_4)	21	Methane Avoidance
		Methane recovery & utilisation (landfill gas & coal mine)
		Biogas (livestock & wastewater)
Second biggest contributing GHG with atmospheric lifetime of 12 years. Used in electrical generation by burning it as a fuel in gas turbines or steam boilers and may be transported as a refrigerated liquid (liquefied natural gas, or LNG). Sources include; natural gas fields, biogas generated by the fermentation of organic matter including manure, wastewater sludge, municipal solid waste (including landfills), or any other biodegradable feedstock, under anaerobic conditions. Methane emitted from coal mines can be converted to electricity.		
Hydrofluorocarbons (HFC's)		HFC Reduction
HFC-23	11,700	
HFC-32	650	
HFC-41	150	
HFC-43-10mee	1,300	
HFC-125	2,800	
HFC-134	1,000	
HFC-134a	1,300	
HFC-152a	140	

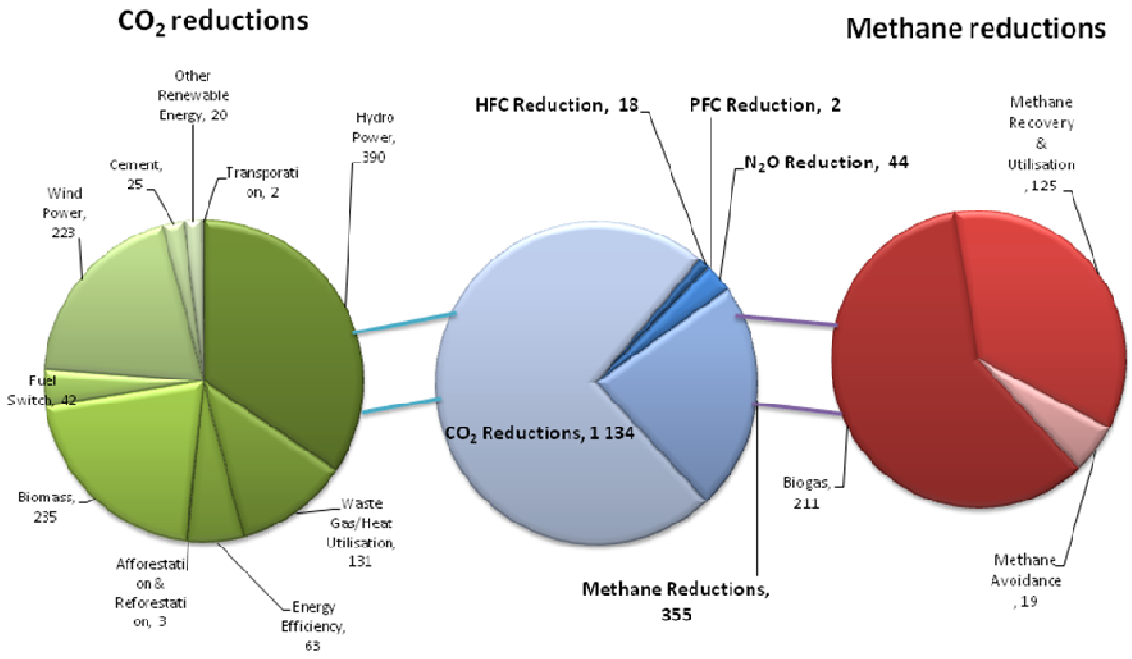
Greenhouse Gas	PRCC GWP 1995	CDM Project Type
Hydrofluorocarbons (HFC's) continued		HFC Reduction
HFC-143a	3,800	
HFC-227ea	2,900	
HFC-236fa	6,300	
HFC-245ca	550	
Small portion of GHG emissions with atmospheric lifetime of 260 years. Used in commercial and domestic refrigeration, air conditioning, and foam blowing equipment such as fire extinguishers.		
Perfluorocarbons (PFC's)		PFC Reduction
Perfluoromethane	6,500	
Perfluoroethane	9,200	
Perfluoropropane	7,000	
Perfluorobutane	7,000	
Perfluorocyclobutane	8,700	
Perfluoropentane	7,500	
Perfluorohexane	7,400	
Powerful GHG, emitted in small quantities, with an atmospheric lifetime of 50,000 years. Produced as by-product of aluminium smelting, semi-conductor manufacture, and as substitutes for ozone depleting chemicals.		
Nitrous Oxide (N_2O)	310	N_20 Decomposition
Powerful GHG that remains in the atmosphere for 114 years. Naturally emitted from oceans and soils. Anthropogenic sources include; agriculture (nitrogen fertilisers), industrial activities and during the combustion of fossils fuels and other organic matter.		
Sulphur Hexafluoride (SF_6)	23,900	SF_6 Reduction
The most potent GHG with an atmospheric lifespan of 3,200 years. Emitted in limited amounts, it has a number of uses including in Nike Air shoes, car tyres, for electrical insulation, semiconductor manufacture, and in the magnesium industry.		

(source adapted from: Carstanjen 2004)

2.4.2 *CDM Projects*

At present 1,533 CDM projects have been registered globally, and over 272 million CERs issued (*CDM Project Database* 2009). The majority of these projects address CO_2 (1,134) and methane (355) reductions, with HFC (18), PFC (2) and N_2O (44) reductions making up the difference (Figure 3).

Figure 3: CDM projects registered worldwide



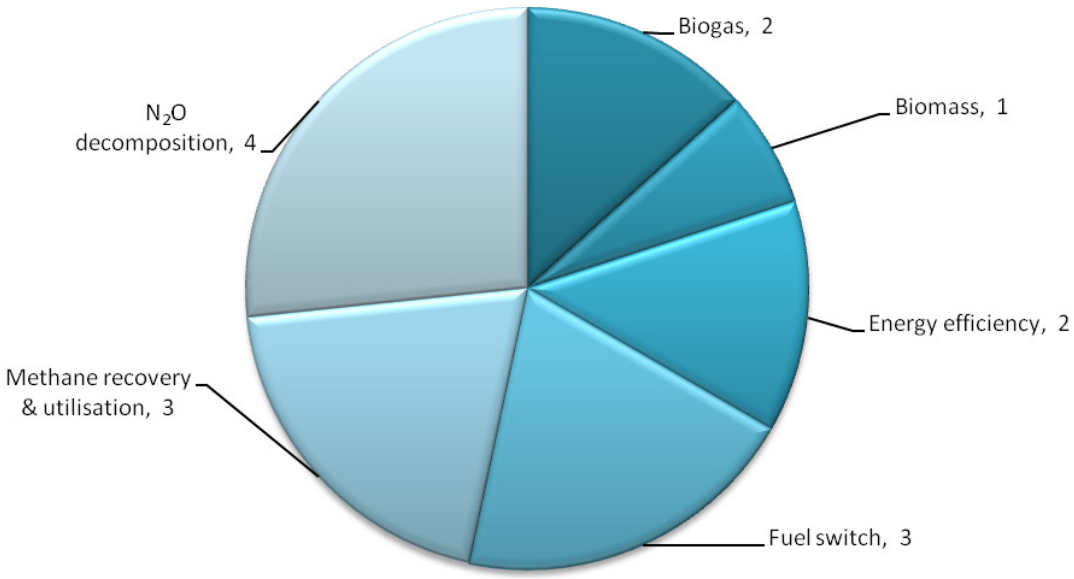
(source adapted from: CDM Project Database 2009)

Worldwide, CO_2 reduction projects account for 70% of the CDMs registered having a wider spectrum of project types than the other GHGs. The majority of these projects are renewable energy, largely hydro power (33%), biomass (21%) and wind power (20%). Methane reduction projects are composed predominately of biogas (60%) and methane recovery and utilisation (35%).

South Africa's CDM project portfolio of 15 projects currently has a focus on N_2O and Methane reductions therefore differing from the global norm. Local CO_2 reductions are unexpectedly low for a 'high carbon economy' with only 5

registered projects consisting of biomass, energy efficiency and fuel switching (Figure 4).

Figure 4: CDM projects registered in South Africa



(source adapted from: CDM Project Database 2009)

2.5. CDM Economics

The introduction of the CDM as a new environmental tool to combat climate change has been one of the most important outcomes of the Kyoto Protocol (Pinkse 2007). CDM projects require investment in land, equipment, buildings and other items that will lead to emissions reductions. The emissions reduction return of a project that replaces, for example, a proposed coal-fired power station with a biomass plant is often only a fraction of the total investment. However, investment flows are available in South Africa for such development and technology change from both foreign and domestic sources. Domestic capital could be used to support CDM investment through a unilateral CDM approach. However, these are less likely to have technology transfer benefits equal to those of foreign direct investments. The World Bank indicates that carbon finance is between 12 and

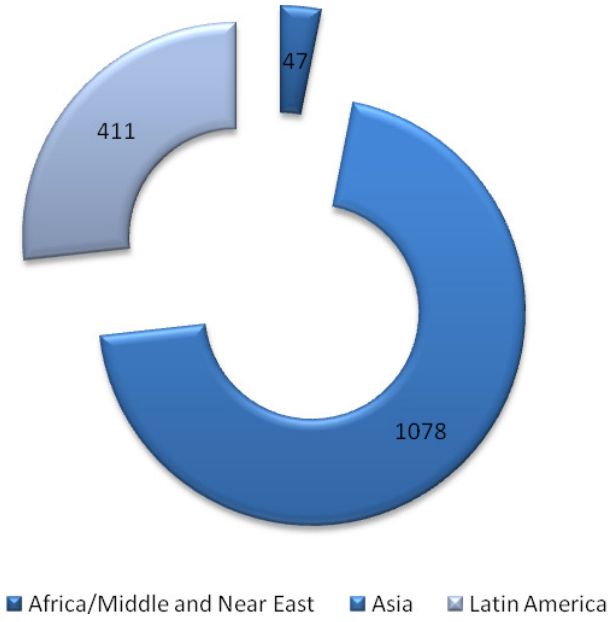
16% of the project cost (Ellis, Winkler, Corfee-Morlot and Gagnon-Lebrun 2007). Thus if US$ 2 billion is allocated to CDM in the coming years, this would result in investment stimulated by the CDM of US$ 12 – 14 billion.

On the basis of economic cost effectiveness, the cost of implementing a CDM project in Africa is considered lower than the same project in other developing regions (Karani 2002). This is largely twofold; firstly due to the Development Financial Institutions 'African focus' on industrial growth, and the well developed infrastructure (banking, utilities) and secondly, the diversity of renewable energy opportunities. Therefore, the potential for investment within such projects, resulting in positive financial returns, is vast. In reality however, current examples of CDM in South Africa indicate very small volumes of carbon offsets. According to Swanepoel (2008) South Africa has the potential to be a significant recipient of emissions finance, but it lags far behind other emerging nations in the development of such projects.

2.5.1 *Geographic Distribution*

Evidently there is an uneven geographical distribution of CDM projects, and it is expected that by 2012 China, India, Brazil, Korea and Mexico will account for 84% of the CDM credits globally (Clean Development Mechanisms Can they work? 2007). Highlighted in Figure 5, Africa is notably behind the other continents in participating effectively in the CDM market with only 47 of the 1,533 registered projects. In comparison, Asia is dominating the carbon market with 1078 projects followed by Latin America with 411 projects. As emphasised by Gantsho and Karani (2007) the total emissions reduction from Africa are barely the equivalent of one CDM project in Brazil, Mexico, India or China.

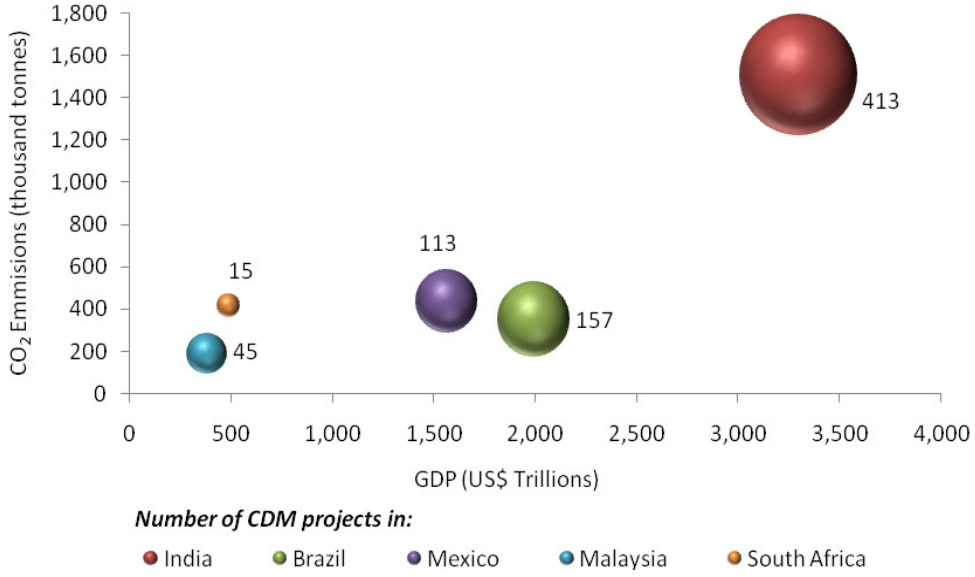
Figure 5: Total registered CDM projects by continent



(source adapted from: CDM Project Database 2009)

Figure 6 illustrates the limited investment in CDM projects in South Africa against comparable countries. Chile and Malaysia, both lower CO_2 emitters, and with lower Gross Domestic Product (GDP) have double and triple the number of CDM projects in relation to South Africa. Mexico and Brazil whose CO_2 emissions are on a par with South Africa have 113 and 157 CDM project respectively, compared to South Africa's 15. At the time of writing only 1% of the CDM projects currently registered were located in South Africa, while India (33%), Brazil (13%), Mexico (9%) and China (41%) made up the majority.

Figure 6: Total registered CDM projects by country in relation to CO_2 emissions and GDP



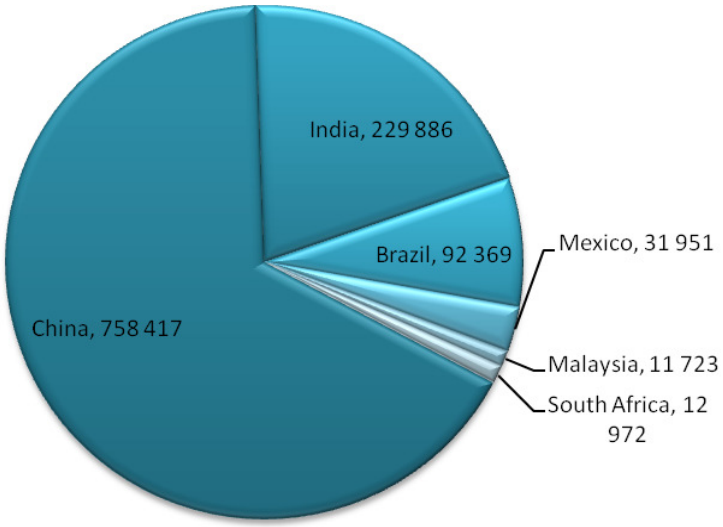
(source adapted from: Boden 2007; CDM Project Database 2009; Country Comparison: GDP 2009)

2.6. South Africa's potential

South Africa is Africa's largest power producer and consumer, with a strong dependence on coal-based electric power generation (Ehlers and Wiekert 2006). Consequently, the country ranks 12th worldwide for CO_2 emissions, meaning it should be in a position to attract a large portion of Africa's CDM projects and garner a large share of investment in GHG reduction technology (Warra 2007; Schneider 2008b). Significant opportunity therefore exists for businesses to benefit financially through the identification, registration and successful implementation of such projects. According to Ehlers and Wiekert (2006) it is estimated that CERs amounting to 130 million tonnes of CO_2 could annually be generated in South Africa. This estimation, at the current CER price, would result in a potential annual South Africa carbon market of €1,430 million. This largely untapped market therefore has the potential to attract international and local investment in numerous CDM projects, through the identification of appropriate projects suited to the South Africa economy.

In March 2006, PricewaterhouseCoopers estimated that at least ZAR 5.8 billion could be earned for SA business by 2012 from the sale of South African emissions certificates (CERs) (Ehlers and Wiekert 2006). However, with only 15 projects registered in South Africa to date, the reality is considerably below the international standard. The South African economy is failing to exploit potential fiscal returns through the generation and sale of CERs. Under the current CDM project portfolio, South Africa is forecast to generate 12,972 CERs or approximately ZAR 2 million at today's CER price by 2012 (*European Climate Exchange* 2009) (Figure 7). This is well short of original projections by Jung (2006) of generating 3.8 million CERs or approximately ZAR 59 billion by 2012. According to Jung (2006) South Africa has the potential to generate three times more CERs than Mexico and approximately four times more than Malaysia until 2012.

Figure 7: Expected CERs generated by 2012 from registered CDMs project per country



(source adapted from: CDM Project Database 2009)

2.7. Barriers to Investment in the CDM

South African projects still represent a low fraction of the entire CDM pipeline. According to Davis (2008) the slow investment in the CDM within South Africa can be attributed to the complicated regulatory systems, under the Designated National Authority (DNA), and the 2012 horizon for the Kyoto Protocol after which its future, and ultimately the CDM, is uncertain. He feels that the slow uptake, due to complicated regulations, has left prospective investors with a limited timeframe until the expiry of the mechanism in 2012.

Kim (2003) found that some of the barriers that exist include the profound scepticism that prevails amongst stakeholders about climate change resulting in a reactive approach, particularly during the introduction of CDM. In particular, the gap between CDM stakeholders and potential investors regarding the sustainable development benefits that accrue, are a stumbling block, due to a lack of awareness. The South African policy to attach requirements around local employment and other sustainable development objectives may be at odds with investment, adding an additional challenge to the successful implementation of the CDM.

Research undertaken by Luiz and Muller (2008) shortly after the establishment of the CDM within South Africa identified 46 factors thought to influence GHG emissions from South African industry. They divided the factors into positive (those that would drive industry to implement CDM projects) and negative (those which would prevent industry from implementing CDM projects). They concluded that a combination of the following factors would drive industry to reduce GHG emissions:

- Stringent air emissions legislation and polices;
- CDM success stories in South Africa;
- Leadership from industry and government;
- USA ratifying the Protocol;

- Improved GHG monitoring expertise in South Africa;
- An increase in the value of CERs; and
- Post 2012 commitment period to the Kyoto Protocol.

However, this research was based on the limited practical knowledge of CDM at the time (having only recently been implemented) and their research states that *"there is a relatively high likelihood that the CDM would result in reduced GHG emissions from the existing South African industry".* Empirical evidence suggests that this has not been the case and that rather than a large number of factors affecting investment in the CDM, there are a few key factors that act as barriers to investment in such projects in South Africa.

Little, Maxwell and Sutherland (2007) analysed 56 issues identified as 'facilitating and inhibiting' factors of CDM opportunities within South African industry. They undertook a cluster analysis to determine 11 macro factors of which 6 clusters were considered inhibiting as shown in Table 2. Their findings support the evidence that South Africa is an ideal country for the implementation of industrial CDM projects, but it lags behind many other countries.

Table 2: Clustered factors (inhibitors)

Clustered factor	Stakeholder issue	Classification
Kyoto Protocol requirements and processes	Additionality	Inhibiting
	Post 2012 uncertainty	
	Expensive to keep up to date with CDM	
	Complexity of CDM process	
	Methodologies applicable to SA	
	Bureaucratic process	
	Transaction costs	
	USA & Australia outside Kyoto	
SA Energy infrastructure	Cheap coal power	Inhibiting
	Eskom policies	

Clustered factor	Stakeholder issue	Classification
SA Government infrastructure	No direct legislation covering CDM	Inhibiting
	No formal incentives to industry to implement CDM	
	EIA/IPP processes	
	Potential taxation of CERs	
	Government leadership	
SA industry CDM response	Industry leadership	Inhibiting
	Industry understanding of CDM process	
	Technology transfer	
	Identification of correct projects	
	Business priorities elsewhere (not CDM)	
	Lack of success stories/critical CDM mass	
Industry/government interface	Government: industry cooperation	Inhibiting
Public & media perception	Climate change is a real issue	Inhibiting
	Increased media coverage of global warming issues	
	Lack of awareness of CDM process	
	Mixed messages on CDM & climate change	
	South Africa does not perceive climate as a real issue	

(source adapted from: Little et al. 2007)

Drawing on the above, and additional global studies, a review of factors that appear to have the strongest influence in inhibiting investment in the CDM in South Africa now follows.

2.7.1 *National Policy and Legislation*

The South African economy is energy-intensive, with a relatively large energy input for every rand of economic output (DEAT 2006). Coal fuels 93% of South African energy production, and being cheap in comparison to other forms of energy generation, translates into lower energy costs, particularly for electricity. This low cost energy has helped South Africa gain a competitive advantage in energy intensive industries such as mining and aluminium smelting. However, the production and use of energy in South Africa has considerable local, national and

international environmental impacts which are not incorporated into this cost. GHG emissions and air pollution result from such energy generation which are managed, and controlled, through costly technical processes. Therefore, this cheap energy does not reflect the real costs of generation, as it does not internalise the externalities (the environmental costs of production). The current high carbon economy of SA has stifled the emphasis on climate change. Little et al. (2007) found that there is a disincentive to save energy in comparison to many other countries and that global warming and climate change do not enjoy national priority.

Government development of climate change strategies, and policies, helps to identify the risks that companies may face setting the agenda for the future. These strategies and policies, facilitate development of opportunities for new markets and products that may result from a carbon-constrained economy (Kenney 2008). Climate policy has historically encouraged particular industries to reduce emissions, putting them ahead of competing industries (Pinkse 2007). Accordingly, climate policy particularly encourages energy related industries to reduce emissions, stimulating their interest in emissions trading and giving them an advantage. China has attached great importance to energy policies as part of their sustainable development strategy including; improved energy efficiency, improved energy consumption and encouraging renewable energy (Maosheng and Haites 2006). The Clean Development Mechanism was seen by the Chinese Government as a core instrument to achieving these policies and goals, through improved energy efficiency and encouraging renewable energy generation. The CDM market therefore demonstrates the potential to deliver real emissions cuts, and fiscal incentives, by working in tandem with regulatory approaches.

Current energy efficiency legislation in South Africa does not specify any legal limit to GHG emissions (J. Luiz and Muller 2008). There are no regulations and compliance requirements for South African companies to report on GHG emissions and consequently little incentive to explore opportunities around the CDM. However, new laws may be in the pipeline for South Africa to address climate change, following the Finance Minister's budget speech on 11 February,

2009. His announcement flows from the draft policy paper "Framework for Considering Market-Based Instruments to Support Environmental Fiscal Reform in South Africa", published by the Treasury in 2006 (Tucker and Mandlana 2009). This states that GHG emissions will have to stabilise between 2020 – 2025, and begin to fall in absolute terms from 2030 – 2035. The introduction of such a policy may be too late to encourage investment within the CDM pre-2012, but might go some way to encourage investment in the future.

2.7.2 *Awareness within industry*

Implementing the CDM is considered challenging as it involves many interest groups with limited knowledge and understanding of the institutional, financial, technical and legislative aspects of the mechanism (Shuang 2004). In India, in order to raise awareness around CDM, workshops were held and capacity provided in support of project preparation. According to Parikh and Parikh (2004) this resulted is considerable interest among policy makers and the business community in the public and private sectors, NGOs, and universities.

According to Maosheng and Haites (2006) Chinese banks did not initially formulate rules or procedures for CDM projects due to the limited awareness of CDM within the financial sector. Added to this the CDM knowledge and awareness of policymakers at the local level needed to be enhanced, with specific capacity building in the energy sector. This resulted in an initially hesitant approach by China into the market. However, once awareness was raised, and systems implemented to develop capacity, considerable progress was made.

A lack of understanding and a conservative approach to non-core business initiatives does not encourage investment in CDM projects within South Africa (Little et al. 2007). The general perception within South African industry is that CDM is not a major consideration of government, and empirical evidence from environmental engineers demonstrates that few industries are aware what the CDM is, and how it could be applied to their respective industries. Confirming this Little et al. (2007) and Kim (2003) found communication and collaboration gaps

exist between industry and government around awareness and synergies on CDM projects.

2.7.3 *Project identification and validation*

According to Shukla et al.(2004) the main threat to CDM, are the complexities that can "mystify and lock-in the operation of the mechanism", thereby over complicating registration and discouraging investment. Similarly, complications surrounding the CDM identification and validation process have been found by Painuly (2001) to adversely affect the potential benefits of CDM. The low level of CDM registration globally is often attributed to the complexities involved in this process. Investors have consistently voiced concerns about lengthy and complex approval process, particularly in demonstrating additionality (Cosbey et al. 2005)

Parikh and Parikh (2004) found that South African businesses lack the internal expertise needed to develop CDM projects, particularly project identification and compilation of the project design document, involving application of the approved baseline methodology. Accordingly there must be "hundreds of CDM consultants" waiting to get a piece of the CDM pie through service provision. They suggest that the cost of such consultants maybe prohibitive, especially when the project is merely exploring the option of CDM. The local body of knowledge is thus limited and priced at a premium, further contributing to poor awareness around potential CDM project opportunities.

2.7.4 *Approval process of the Designated National Authority (DNA)*

Jung (2006) and Greene (2006) state that effective government CDM processes are a prerequisite for the implementation of CDM projects. Each host government has established its own procedures for approving proposed CDM projects, within South Africa the DNA is the Department of Minerals and Energy.

Repetto (2001) predicted that excessive government intervention may delay registration, thereby raising transaction costs, consequently limiting market activities under the CDM. This was confirmed by Shrestha (2004) who postulates

that the economic potential of CDM in developing countries may be curtailed due to the existence of institutional and regulatory barriers, which either increase the CDM project cost or make the projects practically infeasible.

According to Shukla et al. (2004) the Government of India initially created an expedient arrangement for the DNA, called the National Clean Development Mechanism, within the Ministry of Environment and Forests, with limited commitment of resources or long term institutional strategy. Consequently, CDM registration was initially plagued by “red tape” and professional incompetence. More recently, according to Parikh and Parikh (2004), the process of attracting CDM’s in India has begun to improve with increased awareness raising, resulting in a case to build a DNA that could function as an autonomous institution with adequate expert support and financial independence.

Initially China lagged behind other developing countries (India and Brazil) in implementing systems for CDM approval (Maosheng and Haites 2006). However, based on experience gained through project approvals and stakeholder feedback, the government issued the Measures for Operation and Management of the Clean Development Mechanism. Responsibilities were divided between the National Coordination Committee on Climate Change (NCCCC), who became responsible for the review and coordination of China’s CDM policies and the National Development and Reform Commission (NDRC) being the DNA, who reviewed CDM projects. According to Moerman, Weller and Zheng (2008b) under the updated system the CDM project approval process takes less than 2 months. Consequently, at the end of May 2008, China had approved 1,388 CDM projects since inception in 2005, of which 66% were approved after May 2007 (Moerman, Weller and Zheng 2008a).

Swanepoel (2008) suggests that one of the greatest hurdles to the development of CDM within South Africa is the complex regulatory regime. This complex regulatory regime has resulted in slow progress of CDM project registration by the DNA. Another reason for the limited CDM project registration is the extensive national approval procedure, which according to Ehlers and Wiekert (2006) is ‘rather weak’ and evidently suffering from capacity problems.

2.7.5 *CDM project opportunities within South Africa*

Maosheng and Haites (2006) suggest that China represents 25% - 45% of the global CDM potential, while Africa's potential ranges from 4% - 14%. Although less than China, the African carbon market still has a lot of potential. Similarly Jung (2006) found that the most promising CDM host countries are located in Latin America and Asia, the general attractiveness of African host countries is relatively low with the exception of South Africa (being more industrialised).

The 'CDM investment climate index' was developed to measure the investment climate for CDM projects, with potential scores ranging between 100 points (highest) and 0 points (lowest). Using this metric, South Africa was ranked at number 1 in Africa, with a score of 76.4 and a 'good climate' for CDM (Ehlers and Wiekert 2006). The local advantages were listed as favourable macroeconomic parameters (stable growth, good consumer climate), mature economy, and an advanced service and financial sector. This finding was further confirmed by Jung (2006) who classified South Africa's CDM potential as a likely star along with China, India, Brazil, Argentina and Mexico.

Although literary evidence suggests there is a good opportunity for CDM within South Africa, common perception may be the opposite (pers com. Campbell-Colquhoun)[1], thus this factor is retained as a possible limitation to CDM investment, in order to ascertain local opinion.

2.7.6 *Executive Board*

Globally the CDMs Executive Board's main function is to accept validated projects as CDM projects, issue CERs, and accredit operational entities pending their designation by the Conference of the Parties (COP) (Erik Haites and Yamin 2004). The Executive Board is composed of ten members, each representing a specified group of countries, nominated by their groups, and elected by the COP.

[1] Toby Campbell-Colquhoun, Shell Energy Trader, London UK.

The CDM approval procedure is considered a new level of international bureaucracy, which entails a complicated and time consuming process (Shuang 2004; Little et al. 2007). According to Kulovesi (2007) the administration of the flexible mechanisms, especially the CDM, by the Executive Board, and its assistant bodies (Methodologies Panel) are considered overtly slow and bureaucratic. The private sector favours efficiency, predictability, consistency and transparency. Consequently, the CDM approval process is blamed for South Africa's inability to move fast enough to attract foreign investment, due to its slow process and institutional bureaucracy (Karani 2002). Additionally private sector confusion surrounds the demonstration of 'additionality' for each CDM project and the lack of transparency and consistency in project categorisation.

2.7.7 *Transaction costs*

Transaction costs are borne by the host project which, according to Woerdman (2000), can be high thereby decreasing CDM supply potential and gains to non-Annex B countries. Renewable energy projects tend to be capital expensive, but have lower energy generation potential. Current scale economies dictate that projects like wind farms and biomass generation are 3 – 5% the size of traditional 1200MW coal-fired plants (Bergmann, Hanley and Wright 2006).

Table 3 shows the possible transaction costs involved in reducing GHG emissions through the CDM. In addition, to cover the upfront administration expenses of CDM registration and approval 2% of CERs are retained by the Executive Board.

Table 3: Transaction costs

Transaction cost	Description components
1. Project based (CDM): Pre-implementation	
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 that also documents assignment and scheduling of benefits over the project time period. It also includes public consultation with key stakeholders
Baseline determination costs	Development of a baseline (consultancy)
Approval costs	Costs of authorisation from host country
Validation costs	Review and revision of project design document by operational entity
Review costs	Costs of reviewing a validation document
Registration costs	Registration by the UNFCCC Executive Board/JI Supervisory Committee
2. Project based (CDM): Implementation	
Monitoring costs	Costs to collect data
Verification costs	Cost to hire an operational entity and to report to the UNFCCC Executive Board/Supervisory Committee
Certification costs	Issuance of certified emission reductions (CERs for CDM) and emission reduction units (ERUs for JI) by the UNFCCC Executive Board/Supervisory Committee
Enforcement costs	Includes costs of administrative and legal measures incurred in the event of departure from the agreed transaction
3. Trading	
Transfer costs	Brokerage costs
Registration costs	Costs to hold an account in national registry

(source: Dudek and Weiner 1996)

For small CDM projects the transaction costs can be a real threat to their viability, because transaction costs for small projects can be a significant part of the overall project costs (Parikh and Parikh 2004; Shrestha 2004; Shukla et al. 2004). Transaction costs per tonne of CO_2 equivalent varies widely with project size, ranging from €0.1 per tonne of CO_2 (large hydro projects) to €1,000 per tonne of CO_2 (micro projects – solar photovoltaic's) acting as a barrier to many good CDM projects (Shukla et al. 2004). According to Szymanski (2002) the World Bank estimates that validation, monitoring and verification could easily cost US$ 250,000 per project. Additionally, a lack of clearly defined approval procedures lead to poor transparency, resulting in increased transaction costs (Shuang 2004). However, the minimum size of an economically viable project may decline over

time as more approved baseline and monitoring methodologies become available within South Africa (E Haites 2004).

Income from the sale of CERs is usually only a portion of the overall project budget, meaning that project owners also need other sources of funding to make the project viable. The uncertainty and low price of CERs make it mandatory to have low transaction costs to present a business case for CDM (Shukla et al. 2004). Consequently, development costs, in combination with transaction costs, lead to depressed returns on investment (ROI) and ultimately unviable projects.

2.7.8 *CER price*

The carbon market is the most visible result of the regulatory efforts to mitigate climate change. Regulation constraining GHG emissions has resulted in an emerging market that was valued at US$ 64 billion in 2007 (Capoor and Ambrosi 2008).

As the CDM is a market based mechanism, it requires financially viable projects at the prevailing CER price (currently approximately €11 per tonne CO_2e) (*European Climate Exchange* 2009). However, such market based frameworks require information, fair pricing, and trade volumes to effectively sustain the market (Parikh and Parikh 2004). Additional cash flow from CDM credits can boost the internal rate of return, but the value added from the low price of CERs is insufficient to cover the incremental costs of implementing many CDM projects (Zhang 2006).

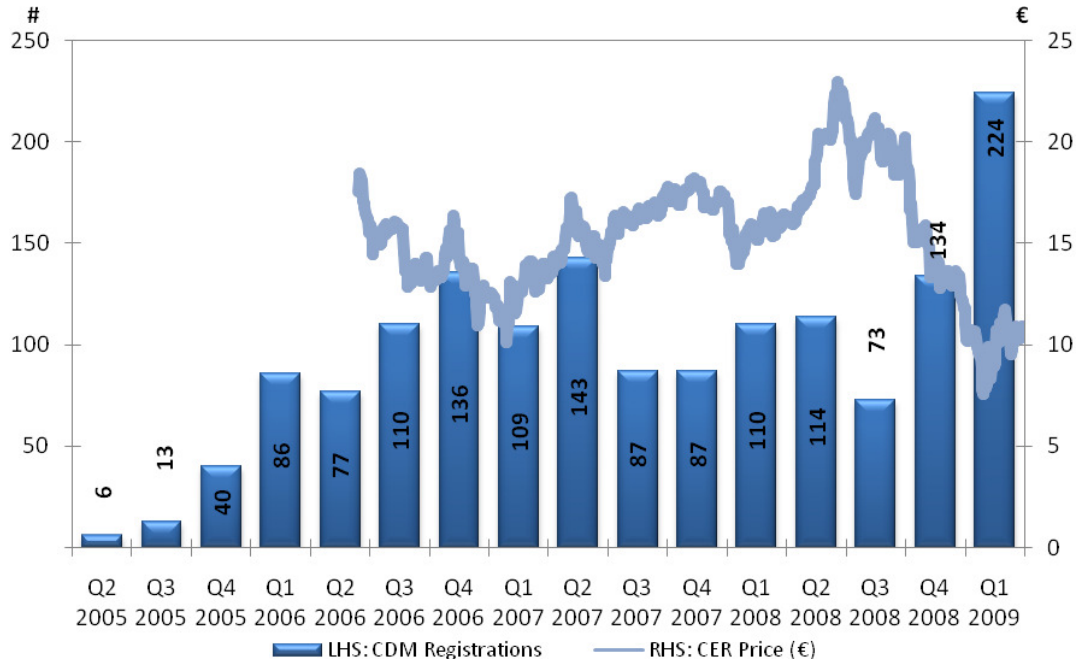
In non-Annex B countries the fiscal gain is the amount of money realised from the sale of CER at the global carbon price less the supply costs. Consequently, the Annex B carbon trading price can be used as the reference price for the CDM carbon price. Schmidt (2009) states that the expense of CDM project implementation, specifically capital expenditure, is prohibitive and the cap-and-trade could have some value, but it is likely to be limited if carbon prices stay low and volatile. Shukla et al.(2004) agrees that there is pessimism arising out of lower CER prices, which may remain low due to the absence of the biggest

potential buyer the United States and a consequential oversupply of CER. The demand for carbon is required by Annex B countries to meet emissions reduction targets, however the supply can be made by both Annex B and non-Annex B countries (Painuly 2001). Demand for carbon is therefore fixed as required by the Protocol. Should additional non-Annex B countries adopt reduction targets the demand for carbon will increase pushing up the carbon price.

According to Shrestha (2004) developing countries are often faced with a shortage of capital for financing energy and power projects that CDM could help alleviate. An analysis of the CDM potential of major technology options in Sri Lanka, Thailand and Vietnam at various CER prices, by Shrestha (2004), demonstrates that fuel-switching (i.e. coal to gas or oil) is more cost-efficient and the preferred option at low CER prices. Conversely, most renewable energy (biomass, solar, wind etc.) power projects were not cost effective even at significantly higher CER prices. These projects often generate relatively few credits with a high investment cost, therefore generating low returns. Additionally, price risk, CER market risk, and the future price of CERs are borne by the project developer in the developing country often making investment in such projects less appealing (Parikh and Parikh 2004).

The variability of the CER price is shown in Figure 8. It is evident that the price has fluctuated dramatically since the markets inception in 2007, and that this is likely to affect investment in the CDM. The number of project registrations is also variable, but due to the lag period in project registration (and the respective countries approval process) a direct correlation is difficult to draw. The variability and low CER price is attributed by Dagoumas, Papagiannis and Dokopoulos (2006) and Viguier (2004) to the lack of participation of the USA thereby influencing the viability of the Protocol.

Figure 8: CER price and CDM project registrations



(source adapted from: European Climate Exchange 2009; CDM Project Database 2009)

2.7.9 *Tax on cash streams*

The Kyoto Protocol rules for CDM projects were not designed with tax efficiency in mind (MacLachlan 2007). Consequently, countries that voluntary impose onerous taxes on such projects may lose CDM investments to other large developing countries. According to Szymanski (2002), initially, a few countries had discussed the possibility of a CER tax, however foreign corporations warned that this would likely hurt the financial viability of CDM projects. South Africa is one of the few countries that imposed an income tax on cash streams generated by the sale of CERS, widely viewed as a possible source of revenue to meet government revenue shortfalls.

Currently, in South Africa there are no laws or special dispensations for CDM projects (Ehlers and Wiekert 2006). However, according to Tucker and Mandlana (2009), in future, to encourage South African companies to take advantage of the Clean Development Mechanism, the Treasury proposes that income derived from the sale of Primary CERs be tax exempt or subject to capital gains tax instead of

normal income tax. Secondary CERs would be classified as trading stock and taxed accordingly. However, as there is no specific timeframe for implementation of this tax reform it cannot be considered within the scope of this research.

2.7.10 *Kyoto Protocol post 2012*

The Kyoto Protocol expires at the end of 2012, and at present there is no certainty concerning the nature of a future framework. Emission reductions post-2012 has limited market value at the present time because commitments beyond 2012 have yet to be negotiated. CDM projects are eligible to earn CERs for 10 to 21 years, so most projects expect to generate CERs for a number of years after 2012. Since reductions beyond 2012 have limited value, the project costs must be recovered from emissions reductions prior to 31 December 2012.

Uncertainties concerning the continuity of the flexible mechanisms and the carbon markets beyond 2012 are limiting investment within CDM (E Haites 2004; Shukla et al. 2004; Kulovesi 2007). At a recent conference in Bali of global nations, clear signals were provided that there would be support for CDMs after 2012 (Howell 2008). However, currently purchasers can only agree on an option to purchase after 2012, affecting the viability of CDM projects with a long lifespan.

The private sector has been calling for a clear and prompt signal on the post 2012 regulatory framework (Kulovesi 2007). An extension over a longer timeframe may incite investments with a longer payback. However, a post 2012 review may lead to fundamental changes in treaty architecture, including emissions targets for at least some of the largest and richest developing nations (Kulovesi 2007). Allocation of gains to developing countries from CDM could be further enhanced when the CDM stimulates emissions trading. With no national cap on emissions South Africa, like other developing countries, are only suppliers and have no demand for carbon. If a cap on emissions is accepted by South Africa, it has the potential to open up the emissions trading system. According to Painuly (2001) benefits to Annex B countries from an emissions trading scheme is highest when non-Annex B countries are also included in the trading system. However, in order

to achieve these gains non-Annex B countries need to actively participate in the design and implementation aspect of CDM.

2.8. Conclusion of Literature Review

The introduction of the Clean Development Mechanism as a new environmental tool to combat climate change has been one of the most important outcomes of the Kyoto Protocol. It has been shown to have enormous potential to generate financial returns through the investment in GHG reducing technologies. Six GHGs are able to be reduced through investment in the CDM including; Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorcarbon (HFC), Perflourocarbon (PFC), and Sulphurhexafluoride (SF_6). Each GHG is reduced by specific CDM projects, each structured financially, technologically and economically to meet specific needs. However, South African business has encountered many barriers resulting in a limited investment in such projects. From the literature review, the following key factors are thought to inhibit investment in the CDM in South Africa:

1. National Policy and Legislation;
2. Awareness within industry;
3. Project identification and validation;
4. Approval process of the Designated National Authority (DNA);
5. CDM project opportunities within South Africa;
6. Executive Board;
7. Transactions costs;
8. CER price;
9. Tax on cash streams; and
10. Kyoto Protocol post 2012.

Each of these factors is considered to act as a barrier to CDM investment within South Africa, but some are thought to be more relevant than others.

Research Question: Which of the key factors are the most important barriers to investment in the Clean Development Mechanism in South Africa?

CHAPTER 3: RESEARCH METHODOLOGY

This section will address the research question put forward in Section 2, through a qualitative research methodology. It includes a descriptive research design, sample and population, and how data was collected. The techniques used to analyse the data are described, in addition to statements on how validity and reliability have been maintained.

3.1. Qualitative research

This study explores the potential CDM project categories, within South Africa (SA), and establishes the main factors adversely influencing investment. The proposed research paradigm for the study is qualitative in nature. According to Creswell (2003) a qualitative approach is useful when a topic needs to be better understood because little research has been undertaken on it. Additionally, qualitative studies tend to work better with small sample sizes, in greater detail, in order to generate insights (Willig 2008).

Qualitative research was suggested because:

- Limited research has been carried out on CDM factors within SA and the intent is therefore to describe and explore;
- The idea is to seek to establish the factors resulting in limited investment in CDM in SA from the view of experts; and
- The sample size is small, as there are relatively few CDM experts with direct SA experience.

Leedy's (1993) 'descriptive survey method' is suggested to be adapted to include semi-structured interviews with subject experts (Fontana and Frey 2005) consisting of written questionnaires and one-on-one interviews.

Qualitative research allows for research into perspectives and interpretations of participants (Henning 2004; Willig 2008). However, the information is not always

objective and alternative interpretation of the data is always possible, in essence the results are not always reproducible (Willig 2008). Qualitative research allowed the exploration of factors influencing investment in the CDM, and a semi-structured interview with open ended questions facilitated greater insight into the factors and the CDM project categories.

3.2. Research Design

The implementation of CDM projects was only made possible after the Kyoto Protocols ratification in 2005. Consequently, there is approximately three years of data available on the topic, with limited research undertaken specific to South Africa. A comprehensive literature review was conducted to identify potential project types and the keys factors thought to act as barriers to investment in CDM projects within South Africa (and internationally). These factors were consolidated from previous studies undertaken on CDM in South Africa shortly after the ratification of the Protocol by Davis (2008), Luiz and Muller (2008), Little et al.(2007) and Kim (2003). Consequently, this research seeks not to identify the factors, as done in the aforementioned studies, but rather to determine the relative importance of each factor, drawing on the practical experience of experts involved in CDMs over the past three years. The key factors identified were:

1. National Policy and Legislation;
2. Awareness within industry;
3. Project identification and validation;
4. Approval process of the Designated National Authority (DNA);
5. CDM project opportunities within South Africa;
6. Executive Board;
7. Transactions costs;
8. CER price;

9. Tax on cash streams; and

10. Kyoto Protocol post 2012.

A semi-structured interview process was employed, consisting of written questionnaires and one-on-one interviews that incorporated both structured as well as open-ended questions to capture relevant data. This approach gave greater flexibility, ensuring that the characteristics and importance of the factors were fully explored, whilst gaining greater insights into why certain factors were considered more important.

3.3. Population and sample

3.3.1 *Population*

The research aims to establish the project categories most suited for the CDM in South Africa, and the main factors that influence investment in such projects. Semi-structured interviews were held with a selection of individuals with in-depth knowledge and experience of the CDM. 'Non-probability Purposive Sampling' (Leedy 1993) was undertaken where individuals and organisations with experience in CDM project implementation were chosen. The population was made up of organisations or individuals that have:

- registered CDM projects in SA;
- attempted to register CDM projects in SA;
- been involved in the decision making process .e.g. DNA; and
- become experts in CDM project identification, registration or implementation e.g. consultants.

3.3.2 *Sample and sampling method*

The sample was chosen to ensure a spectrum of respondents addressing the above components. The identification of 'CDM experts' was undertaken using snowball sampling (Welman and Kruger 1999). Emphasis was placed on respondents with practical CDM experience, such that potential project categories could be identified and key factors determined.

The sample size aimed for, and achieved, was 20 respondents. Larger sample sizes are generally considered to be better, particularly with quantitative analyses requiring more data points to establish statistically relevant conclusion. As the research is qualitative this point remains important, but focus is placed on ensuring quality information from a smaller number of individuals with specific experience of CDM. The sample consisted of organisations that have registered CDMs, organisations that have attempted to register CDMs, implementation experts, CDM consultants and government bodies responsible for CDM decision making. The respondents were considered to have ample knowledge on the subject matter from a range of positions ensuring a balance to the research findings.

3.4. The research instrument

A semi-structured interview survey method consisting of both written questionnaires and interviews was undertaken. This ensured the collection of specific, focused answers addressing the key area of interest as identified in the literature review through structured questions. Open-ended questions in conjunction with the interview ensured a greater understanding of the reasons behind the responses through descriptive information from respondents.

Structured data was collected through the use of a multi-point questionnaire based on the key CDM investment factors identified in the previous sections. The multi-point questionnaire covered two main areas:

1. CDM project categories – GHGs most able to be targeted for reduction through the CDM in South Africa, and CDM project categories most suited for the South African economy.

2. Importance of barriers affecting investment in CDM – Gaining an understanding of the degree of importance of each of the CDM factors, by asking respondents to rate each factor on a five point verbal scale (where 1 represents the lowest level of importance, and 5 the highest), also allowing for the inclusion of additional factors considered relevant to respondents.

Open-ended questions were asked during the course of the interviews, used to gain greater insights into trends or responses that might be particular to a specific respondent. Additionally, where possible, solutions to these barriers were addressed through the open-ended questions.

3.5. Procedure for data collection

The respondents were initially contacted to inform them of the study, and its purpose, to secure their agreement to participate. The procedure for data collection was as follows:

1. Contact respondents telephonically and secure their agreement to participate in principle.

2. Send questionnaire and cover letter via e-mail (unless requested otherwise by respondents). The cover letter explained the context of the study, the time lines (with a deadline for response) and contact details.

3. Follow-up call undertaken to ensure receipt of the questionnaire and to address any concerns upfront. During this call, through mutual agreement, a time was booked for the interview (in person).

4. Undertake interview, and run through questionnaire.

5. Consolidate feedback and follow-up with respondents to ensure correct interpretation of questionnaire and interview.

6. Send note of thanks to respondents for participation within survey.

3.6. Data analysis and interpretation

The completed questionnaires with feedback from the respondents following the interviews were analysed using the most appropriate method to reduce, structure and interpret the data. The data from the interviews were analysed using content analysis to extract the main ideas and opinions of the experts (Welman and Kruger 1999; Henning 2004). Data was captured in a MS Excel spreadsheet which was used to capture and categorise all data within common themes.

The GHGs were ranked from 1 (most likely to be reduced by CDM projects) to 6 (least likely to be reduced by CDM projects) and the reasons for these choices explained. A practical approach to analysing rank ordered response data was undertaken (Stacey 2006). The intrinsic advantage of rank ordering survey items, in questionnaires, is it is intuitive for respondents and is independent of any particular response scale. Stacey's (2006) analysis disregards the fact that rank ordered data are only ordinal in nature, while the parametric techniques are based on the assumption of at least interval level data. His technique was used to estimate the population mean and standard deviation, being pragmatic for small samples and allowing comparison (Stacey 2006).

The CDM project categories were analysed using the frequency count of the responses for each of the questions posed to respondents, which allows for inferences to be made on the relative frequency of overall response.

The importance of barriers affecting investment in CDM, which uses a five-point verbal scale to determine the relative importance of the factors, requires more involved statistical analysis to facilitate interpretation. The survey data is of an ordinal nature and cannot be assume to be linearly correlated through an interval level. In order to achieve a good balance between accuracy and precision Stacey (2005) developed a distribution fitting approach. This allows the conversion of such data into a more representative form, yielding greater accuracy and validity

than alternative methods. Consequently Stacey's (2005) method of distribution fitting was employed allowing for the factors to be interpreted as:

- Critically important
- Important
- Unimportant

Factors are thus able to be ranked against one another and the t-test applied in order to determine the significance. A confidence interval of 99% was used as the consequence of wrongly rejecting the null hypothesis was considered serious (Underhill and Bradfield 1994).

Open-ended questions and responses were then summarised and grouped and common trends identified helping to draw qualitative conclusions, providing further insight into the respective factors.

Luiz and Charalambous (2009) similarly undertook Stacey's (2005) distribution fitting analysis to determine the importance of factors affecting financial institutions expansion into Sub-Saharan Africa. They established the following criteria, which have been adapted for this research:

- If the mean for a CDM factor response is appreciably greater than zero ($\mu > 0$ as determined by the hypothesis test) then that factor is statistically significantly more important than the overall average importance of all the factors and can hence be interpreted as being *critically important* relative to other factors.
- If the mean for an investment factor response is very close to zero ($\mu \sim 0$ as determined by the hypothesis test) then that factor is statistically no more and no less important than the overall average importance of all the factors and can hence simply be interpreted as being *important* (the average) relative to other factors.

- If the mean for an investment factor response is appreciably less than zero ($\mu < 0$ as determined by the hypothesis test) then that factor is statistically significantly less important than the overall average importance of all the factors and can hence be interpreted as being *unimportant* relative to other factors.

3.7. Limitations of the study

The limitations of the study include:

- The study is limited by small sample population (due to limited CDM expertise in SA).
- The result maybe subjective as it is based on the perceptions of respondents. Individuals having had success with CDM projects may view factors differently to those individuals having had poor experience of CDM projects.
- The results of the study are specific to a South African context and might not apply to other non-Annex B countries.
- The study focuses on historic perceptions of CDM within South Africa (up to the time of writing), and legislation or policies current under consideration cannot be considered within the scope of the research (albeit that they might address some of the barriers).

3.8. Validity and reliability

3.8.1 *External validity*

External validity is the ability to extrapolate from the study to a larger population (Kalof, Dan and Dietz 2008). The literature review added to the validity of the research and helped in the formulation of the CDM investment factors. The external validity of these CDM investment factors was further confirmed through

independent assessment by two of the 'expert respondents'. These experts were asked to comment on the list providing additions and deletions that they felt were appropriate. This ensured that all factors were appropriate to a wider audience.

The list of 'expert respondents' are widely considered to be authorities in the field of CDM projects. Additionally, the list of 'expert respondents' were verified by two known CDM experts, for their comment to ensure that all persons have an acceptable level of experience.

3.8.2 *Internal validity*

Internal validity ensures that the study draws the appropriate conclusions from the data at hand (Kalof et al. 2008). The survey was pilot tested with three respondents to ensure that the questions were clear and that there were no other problems with the survey. The internal validity of the research was confirmed by the respondents involved in the research through verifying with them that the conclusions drawn from the questionnaire and interview matched the intended responses. The researcher's interpretation of questionnaires and interviews was verified with five respondents to ensure consistency of response and to minimise researcher bias (Henning 2004).

All respondents were considered experts in the CDM in South Africa being persons involved in corporate implementation of CDM, decision making authorities, implementation experts or CDM consultants.

3.8.3 *Reliability*

Reliability is concerned with ensuring consistency, and describe similar findings revealed on repeated occasions (Kalof et al. 2008). The data received maybe biased as it is based on the subjectivity of the respondents. Where possible all respondents were asked to be as objective as possible, but the validity of this is difficult to confirm. The sample size being chosen was as large as feasibility possible to ensure the reliability of the study and minimise any bias. It should be emphasised that the field of CDM 'experts' is limited and opinion may change with

further experience. In addition, some factors considered in this study were also under review by government and consequently, in the future, some factors may be redressed.

CHAPTER 4: PRESENTATION AND DISCUSSION OF RESULTS

4.1 Introduction

This section presents the summary results obtained from the questionnaire responses and interviews conducted, followed by a discussion. The results and discussion are presented in a similar order to how the questionnaire and interviews were structured; starting with a rank order of the GHGs, then an analysis of the CDM project categories and finally a discussion of the results obtained on the importance of each of the ten CDM barriers, in the order in which they were initially presented. The ten factors are then ranked based on the statistical analysis of the responses. This allows inferences to be drawn as to which are the most important barriers to investment in CDM projects within South Africa.

4.2 Responses Obtained

As mentioned previously, in Chapter 3, this research was undertaken to illicit responses from a sample of 20 'CDM experts' each with any of the following CDM experience:

- Successful CDM project implementation
- Unsuccessful CDM project implementation
- CDM Industry experts (consultants, legal advisors)
- Regulatory CDM bodies

All participants were interviewed and their comments recorded in order to substantiate their respective selections. These comments have been used to validate and expand upon the results obtained.

4.3 CDM Project Types

Firstly, the reduction potential of the six GHGs that are registered under the CDM are presented and discussed. Specifically, which of these gases are likely to account for the majority of the CDM projects within South Africa and the reasons. These gases are rank ordered from highest to lowest potential.

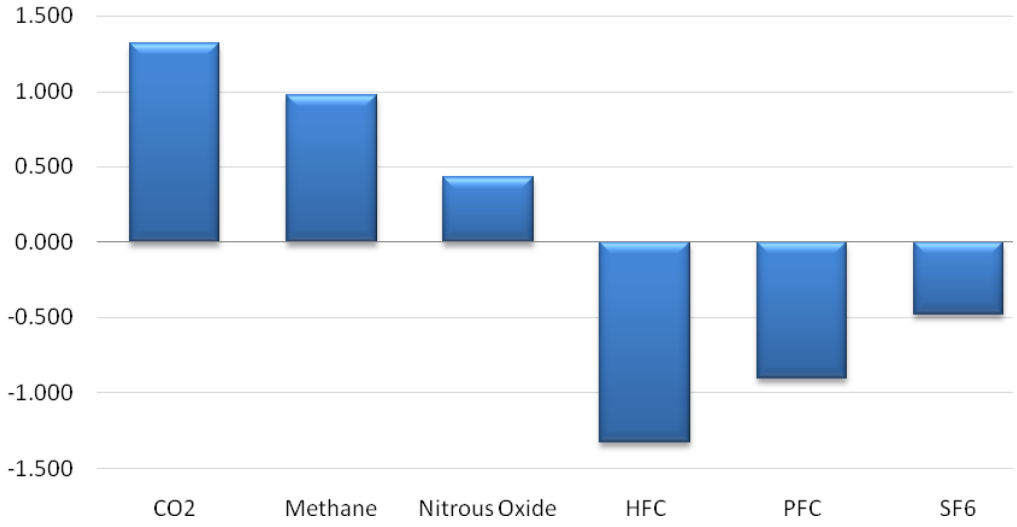
Secondly, the potential CDM project categories that have the greatest potential for investment within South Africa are considered. This incorporates the range of CDM project categories, indicating which projects are suited for the South African economy and which of these have the greatest potential for investment.

4.3.1 *CDM and Greenhouse Gas emissions*

Respondents were asked to rank the six GHGs, as to their potential to be reduced by CDM project investment i.e. which gas could account for the most CDM projects. Each gas is ranked from 1 (greatest potential) to 6 (lowest potential) and the mean, as described in Section 3, used to determine which has the best potential for reduction.

The chart of the means is shown in Figure 9, where zero is the average and those gases above the average have the greatest potential for CDM reduction and those below the least potential.

Figure 9: GHG's with greatest reduction potential



As is evident from the above figure, the GHGs that have the greatest CDM potential are CO_2, methane and nitrous oxide. Of these CO_2 was consistently ranked as number one. This is largely due to power generation based on coal fired power stations, and Sasol's conversion of coal to liquid. It was stated that for every kw/h that South Africa produces approximately 1.2kg of CO_2 is emitted into the air. According to the 'experts' displacing current coal fired power stations with long term renewable energy generation is an imperative, along with energy related opportunities, including energy efficiency.

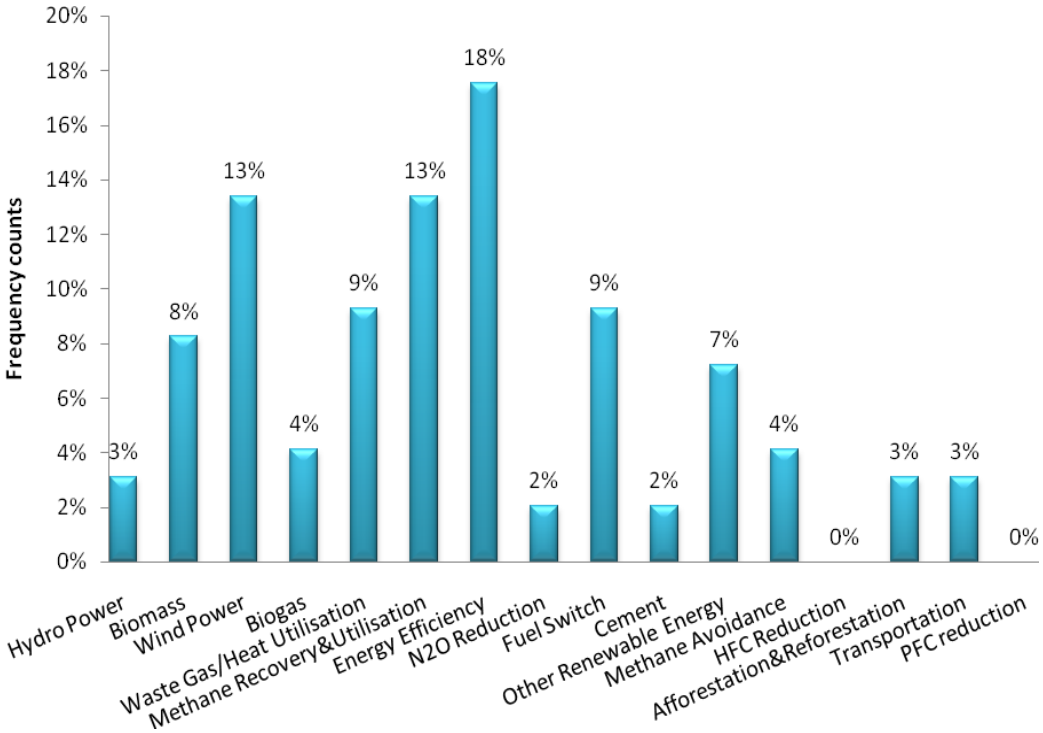
Nitrous Oxide and Methane projects are easier to identify, implement and each units is worth more CERs (higher global warming potential), but they lack the volumes that CO_2 present. South African coal beds, unlike Australia, are not methane intense. So the majority of methane project opportunities exist within municipal landfill and a limited number from agriculture and meat production. The majority of current CDM projects in South Africa are Nitrous Oxide, which have set a precedent through two approved methodologies which can be drawn upon, thereby expediting the registration of such projects. However, the majority of these projects have been implemented and the proverbial 'low hanging fruits' picked with limited additional potential.

The remaining three gases HFC, PFC and SF_6 have very little potential for CDM projects within South Africa. HFC is considered as having the least potential and public criticism of this gas has been growing stronger. The new production of HFC is no longer included in the CDM, due to the conflicting outcome of incentives to overproduce the refrigerant in order to sell the carbons credits produced by capture of its HFC-23 waste. Until a final decision is made there are strong disincentives for producers of refrigerants to install emission reduction technology. It was felt that beyond 2012, a new sectoral arrangement for HFC is likely to be in place. The remaining two gases are produced in low volumes in the relatively modernised South Africa. In general it was felt that South Africa does not have industries that support PFC and SF_6 gas production and emissions, therefore there is no opportunity to reduce said gases.

4.3.2 *CDM Project types*

Respondents were asked to select the CDM project categories that have the greatest potential for investment within the South African economy. The frequency of selection is shown in Figure 10.

Figure 10: Frequency count of CDM project types



Based on these results it appears that energy efficiency is the most probable CDM project, which would reiterate the previous results demonstrative of a high carbon economy and the need for improved energy management through CO_2 reduction. The CDM potential for such projects is considered excellent, being one of the cheapest options. At present energy efficiency projects are under-represented relative to their estimated potential. Energy efficiency within commercial buildings during daily operations has specific potential, as currently lots of inefficiencies occur within the system. Similar opportunities exist in mining where globally 7% of the world's energy is used to liberate minerals to which South Africa is a major contributor. This suggests the existence of factors, such as cheap energy costs, high administrative costs or complicated registration processes for the absence of such projects. Increasing electricity prices and tax rebates could prove catalysts to significantly increase investment in this sector. Demand side management entails actions that influence the quantity or patterns of use of energy consumed by end users, such as actions targeting reduction of peak demand during periods when

energy-supply systems are constrained. Peak demand management does not necessarily decrease total energy consumption but, could be expected to reduce the need for investments in networks and/or power plants. The low penetration of energy demand side management-related projects (even following the recent blackouts) is explained by the high upfront costs of such programmes as well as the barriers of public education and acceptance. These factors are anticipated to be addressed, in future, as part of the Programmatic CDM or Programme of Activities (PoA) which will result in greater focus on energy efficiency. PoA's can weave together various dispersed, smaller CDM activities while promising initiatives target demand side energy efficiency (energy efficiency lighting or appliances).

A PoA is a voluntary coordinated action by a private or public entity which coordinates and implements any policy/measure or stated goal (i.e. incentive schemes and voluntary programmes), which leads to anthropogenic GHG emission reductions or net anthropogenic GHG removals that are additional to any that would occur in the absence of the PoA. PoA's can be registered as a single clean development mechanism project activity provided that approved baseline and monitoring methodologies are used that, inter alia, define the appropriate boundary, avoid double counting and account for leakage, and ensure that the emission reductions or net anthropogenic removals by sinks are real, measurable and verifiable.

Increasing the proportion of power derived from renewable energy sources is considered by the respondents to be an increasingly important part of South Africa's strategy. Wind power and other renewable energy sources (particularly solar) were considered strong CDM project candidates. This is largely due to the minimal or no resource depletion of such technologies, as compared to coal based energy. Renewable energy offers a partial solution to the problem of reducing GHG whilst meeting future energy needs. Wind power is a tried and proven technology and South Africa has variable potential, most promising along the West Coast, for approximately 1 000 MW. The country has some micro hydro power potential, for approximately 50 MW. Solar (especially concentrated solar)

and tidal have very large potential in the future, but currently the technology is being tested and is in its infancy.

Currently projects that involve non-CO_2 gases such as methane and nitrous oxide (N_2O) are over-represented within South Africa. The higher global warming potential values of non-CO_2 projects tend to improve the project economics. N_2O projects entered the pipeline early offering large volume reductions along with low performance risk, limited requirement for investment and short lead times, all attractive characteristics for project developers. However, there are limited large projects remaining and as such N_2O projects don't have significant potential within the future.

Methane recovery and avoidance have the ability to be added onto a current project especially landfill sites, and animal waste, both considered easy wins. For example, methane from waste in the agricultural sector gets dumped, when it could be used to generate energy. Hence the respondents consider such CDM projects to have good potential. Emissions from waste currently account for a large proportion of South Africa CDM projects. However, significant other opportunities exist within this project category and inhibiting factors are considered to include lack of awareness and capacity of municipalities and the absence of appropriate regulatory frameworks. A systematic approach to solid waste management through programmatic CDMs activities could be one way to help create an incentive for better waste management practices. Coal mine methane was cited as an attractive asset class. These assets are able to deliver more predictable volumes of methane reduction, but require more investigation.

Waste gas and heat utilisation projects could be identified through industrial co-generation options. It was felt that there is more opportunity in the industrial system which could be harnessed as the price signals change. However, this will require new technology which might be unlocked by increasing electricity prices. Similarly fuel switch projects, such as coal to gas opportunities abound within industry, but the supply of alternatives either Liquid Natural Gas (LNG) or other sources (coal to sugar, paper and pulp) needs to be secured.

Biomass projects have good potential in waste co-generation plants. These are difficult to monitor and implement, although potential exists for domestic cooking/hearting. There is possible potential for larger scale electricity generation or co-generation.

The remaining project types are considered to have less potential in South Africa. Transportation would have many options if CDM rules accomodated it, currently it's considered too complicated to demonstrate additionality, and transport systems are not integrated enough and thus promote reliance on the private car. New cement plants are relatively energy efficient, but there are limited opportunities to improve old plants. Afforestation and reforestation projects are gaining international support, especially under REDD (Reducing Emissions from Deforestation and Degradation) and may represent limited opportunity in South Africa. Other African countries have led the way in finding innovative ways to sequester carbon through afforestation and reforestation activities that also deliver strong local community, environmental and economic benefits. However, unlike the tropics, forestation projects in South Africa are limited.

More recent buyers in the carbon market appear to prefer investment in lower-cost GHG reductions rather than more capital intensive energy technology options with long lead times. Emphasis on the development of markets for least-cost mitigation has meant that the CDM project portfolio has a large share of brownfield projects, with limited investment in new technology. To be economically viable CDM projects should reduce emissions by at least 100 000 tCO_2e per year. Projects large enough to be economically viable will therefore account for the majority of future CDM projects including large renewable energy generation. Costs are still considered prohibitive, as coal remains too cheap, although electricity prices are rising. Since the investment costs of renewable projects are quantifiable the performance depends on market prices of electricity, fuels and (potential) emission allowances. This is one of the reasons the National Energy Regulator of South African introduced the Renewable Energy Feed-In Tariff (REFIT). REFIT a mechanism to promote the deployment of renewable energy that places an

obligation on specific entities to purchase the output from qualifying renewable energy generators at pre-determined prices, as shown in Table 4.

Table 4: REFIT tariff schedule

	Unit	Wind	Small Hydro	Landfill Gas methane	Concentrated solar plant
Levelised cost of electricity production	R/kWH	1.247	0.940	0.896	2.092

This tariff and higher energy prices, in combination with a solution to the barriers listed below would ensure a more active participation in the CDM project market.

4.4 Barriers to investment

The ten factors that have been identified as probable barriers to investment in the CDM are presented and discussed, with suggestions on how to address such factors where relevant. The intended result of the section is to determine which factors are unimportant, important or critically important to investment. The summary ultimately ranks these factors in order of importance. In addition to these ten factors, any additional factors identified by respondents are discussed.

4.5.1 *Factor 1: National Policy and Legislation*

At present energy efficiency and climate change legislation in South Africa does not specify any legal limit to GHG emissions. However, in terms of policy revisions, it is purported that GHG emissions, in South Africa, will have to stabilise between 2020 – 2025, and begin to fall in absolute terms from 2030 – 2035. This factor looks at current national policies, legislation and strategies to reduce climate change, encourage energy efficiency and facilitate investment in the CDM.

Mean (μ)	0.2307
t-Value (99% confidence interval) ($-2.861 < t_{19} < 2.861$)	2.62
Importance	Not significantly different from the average (0)
Interpretation	**Important**
Barrier Rank 1 (least important) to 10 (most important)	5/10

From the mean calculated, this factor is interpreted as a barrier and is ranked fifth out of the 10 barriers considered. It is not significantly different from the average. The t-value determined is within the critical range demonstrating an *important* factor to investment in the CDM.

The literature review suggests that developing climate change strategies, and policies, help to identify and develop opportunities for new markets and products that may result from a carbon-constrained economy. Climate policy has historically encouraged particular industries to reduce emissions, putting them ahead of competing industries. Accordingly, climate policy particularly encourages energy related industries to reduce emissions, which gives them an advantage through stimulating their interest in emissions trading and the CDM.

It was agreed by the respondents that policy and legislation are important aspects that should support the CDM. Some felt that the limited success of any energy efficiency CDM project in South Africa was a factor of the limited lip service style commitment to reducing GHG at the national level. There is a need for 'sticks and carrots' the Kyoto Protocol and government working in tandem to encourage investment in CDM and a reduction in GHGs.

Although there is increasing emphasis, most felt the plan, workshops and policies have not been translated into working executable projects. The South African National Energy Efficiency Agency is still in limbo without sustainable financial support. The mission of the DME's Energy Efficiency Directorate is to develop measures to promote energy saving, reduce the negative impact of energy use on the environment, reduce energy costs to the economy, contribute towards sustainable development, and to achieve a national energy policy. Many feel the

lack of delivery lies in the interface between Eskom and project owners. A change in policy is thus required in order for CDM to reach full potential, which may include carbon taxes, and cap and trade. Clear signals are needed through government facilitation of programmes (making administration easy) and regulatory frameworks that are clearly seen as incentives such as those developed by China.

4.5.2 *Factor 2: Awareness within industry*

This factor considers the potential lack of awareness amongst decision makers in industry. The CDM project process involves multi-interest groups, with varying knowledge and understanding of the institutional, financial, technical and legislative aspects of the mechanism. This factor includes lack of awareness of the CDM as a missed opportunity within industry, by financial institutions and government.

Mean (μ)	0.4097
t-Value (99% confidence interval) ($-2.861 < t_{19} < 2.861$)	3.97
Importance	Significantly above the average (0)
Interpretation	**Critically important**
Barrier Rank 1 (least important) to 10 (most important)	8/10

From the mean calculated this factor is interpreted as *a* definite barrier and is ranked 8 out of the 10 barriers considered. The t-value determined is well above the critical limit indicating a *critically important* factor to investment in the CDM.

The general perception within South African industry is that CDM is not a major consideration of government and the lack of success stories is demonstrative of a general lack of awareness within industry. A lot of industry players do not really know what it is about in enough detail for them to identify projects and understand possibilities.

Most respondents felt that historically South African industry has been slow to create awareness of CDM. Initially confused by the energy security vs. climate

change issues, the CDM has also lacked support due to the poor number of public success stories. There is a definite need to demonstrate that CDM is more than something to combat climate change, but actually has fiscal returns to incentivise business opportunities.

Awareness, and intellectual capital, is currently held at the wrong management levels within organisations and amongst a select few consultants. There is a lack of capacity within institutions to identify and assess potential projects and for financial institutions to find comfort in the proposed new technology and CDM process. This is further exacerbated by the majority of the investment opportunities not being considered core to business. Translation of a basic awareness into a business decision is what is lacking, especially among senior decision makers who are not ready to commit the level of resources to 'peripheral activities'. These capacity and institutional issues are significant barriers to a more widespread use of the CDM. Eskom, either through intent or ignorance, has not made life easier for those who have potential energy related projects to feed back into grid, which stifles opportunity and reduces awareness through lack of perceived opportunity.

Given the numerous potential CDM opportunities it seems that a lack of awareness is a key contributing factor to poor investment in the CDM. Lessons are ultimately learnt through national success stories, which are few in number, and have not yet resulted in a critical mass.

4.5.3 *Factor 3: Project identification and validation*

This CDM process, especially compilation of the project design document, involving application of the approved baseline methodology is complicated for prospective project developers. This factor considers South African businesses lack of internal expertise needed to develop CDM projects, particularly initial project identification and the complicated validation of an approved methodology.

Mean (μ)	0.5132
t-Value (99% confidence interval) ($-2.861 < t_{19} < 2.861$)	7.62
Importance	Significantly above the average (0)
Interpretation	**Critically important**
Barrier Rank 1 (least important) to 10 (most important)	9/10

From the mean calculated this factor is interpreted as *a* definite barrier and is ranked 9 out of the 10 barriers considered. The t-value determined is well above the critical limit indicating a *critically important* factor to investment in the CDM.

Complications surrounding the CDM project identification and validation process have been found in the literature review to adversely affect the potential benefits of CDM. The low level of CDM registration globally is often attributed to the complexities involved in this process. Investors have consistently voiced concerns about lengthy and complex approval process, particularly in demonstrating additionality.

The respondents agree that a lack of project identification is largely to blame for the poor CDM project pipeline. However, all believe that this is more of a global issue and should not be South African specific. China, Brazil and India are faced with this same barrier and it has not held them back, so this should not be seen as a realistic “excuse” for inactivity. The skills shortage in South Africa is partially to blame, as the shortage of engineers has resulted in the few remaining, employed on “traditional engineering” projects rather than exploring new ideas like CDM methodologies. Consultants are available, but industry needs to employ them in order to identify opportunities, at a cost risk of no success.

Companies start to explore CDM opportunities and then pull out. They perceive the CDM process to be complicated, and protracted, and therefore shying away from such projects. Methodologies do not exist for every potential idea as yet and the development of a new methodology is not a simple task requiring consistent consultant intervention. Validation is very onerous, and can be a little bureaucratic

and time consuming. All respondents agree that the lack of real understanding about the additionallity requirement leads to frustration and often abandonment. Particularly for smaller projects where complications lead to increased costs.

A number of the respondents believe that better guidance improving awareness for project identification could help. This could be through drawing on successful projects internationally, and identifying similar projects, where the same methodologies could be applied in South Africa. A list of experts should be drafted, and their areas of expertise stated, such that they can be called upon to explore CDM opportunities within a given industry. Globally, changes are needed at the Executive Board to expedite the validation process and ensure that projects are not stalled within the system, which could result in increased costs and the ultimate failure of the project.

4.5.4 *Factor 4: Approval process of the Designated National Authority (DNA)*

Each country has a designated authority for approving proposed CDM projects, within South Africa the DNA is the Department of Minerals and Energy (DME). This factor considers the slow progress of CDM project approval by the DME as a result of the extensive national approval procedure, weak systems and capacity problems.

Mean (μ)	-0.6352
t-Value (99% confidence interval) ($-2.861 < t_{19} < 2.861$)	-3.19
Importance	Significantly below the average (0)
Interpretation	**Unimportant**
Barrier Rank 1 (least important) to 10 (most important)	2/10

From the mean, shown above, this factor is interpreted as not a barrier and is ranked the second least important of the 10 barriers considered. The t-value determined, is below the critical value demonstrating an *unimportant factor* to investment in the CDM.

The literature review predicted that excessive government intervention may delay approval, thereby raising transaction costs, consequently limiting market activities under the CDM. Government intervention was perceived to be most significant in developing countries, due to the existence of institutional and regulatory barriers, which may either increase the CDM project cost or make the projects practically infeasible.

It was agreed among the respondents that there is very limited indication that the DNA is a real barrier in the CDM process. Initially, at the inception of the Kyoto protocol, the DNA was considered slow and aloof, but relationships have subsequently improved. The DNA is considered, competent and adequately resourced, and ensures they adhere to the relevant timeframes.

It was highlighted that although the DNA is not a barrier, they have never really been tested due to the limited volumes of CDM projects. Although no criticism of the DNA's impact on the approval process was provided, it was emphasised that they do play a passive role and have not driven or been a catalyst. Other countries, like China, have active intervention and awareness campaigns driven by the DNA such that they enhance CDM project identification and then ultimately ensure an expedient approval process.

4.5.5 *Factor 5: CDM project opportunities within South Africa*

This factor considers the 'CDM investment climate' as a measure of the investment potential for CDM projects i.e. what potential exists for GHG reductions through investment in CDM projects. It suggests that if insufficient opportunities exist for CDM projects in South Africa either through low national GHG emissions, industry maturity or limited economic growth, then this will translate into limited investment.

Mean (μ)	-1.8527
t-Value (99% confidence interval) ($-2.861 < t_{19} < 2.861$)	-6.45
Importance	Significantly below the average (0)
Interpretation	**Unimportant**
Barrier Rank 1 (least important) to 10 (most important)	1/10

From the mean calculated this factor is interpreted as not a barrier and is ranked the least important of the 10 barriers considered. The t-value determined is below the critical value demonstrating an *unimportant factor* to investment in the CDM.

According to the literature South Africa would appear to be one of the most likely garners of a large share of global CDM projects. The South African economy is the largest on the continent, and is heavily focused on metals, minerals and mining with a wide industrial base that should offer plenty of choice to prospective project developers. In addition, South Africa's financial sector is by far the most sophisticated in Africa.

The majority of the respondents agreed that there is significant opportunity for CDM projects in South Africa and all qualified their selection through statements focusing on the carbon intensive nature of the South African economy. Most still believe there is potential for numerous projects, although some of the 'low hanging fruit' may have been taken. South Africa is viewed as endowed with a good, but limited wind regime and excellent solar power potential that would provide significant CDM opportunities under the Renewable Energy Feed-In Tariff (REFIT) and increasing energy prices. Most experts felt that opportunities exist which are not being maximised because of the complicated process and lack of real guidance and facilitation. Many of the potential CDM project participants were viewed as having a normative rather than a business approach which does not aid CDM project identification and facilitation.

A possible driver that has limited CDM opportunities has been the low electricity prices limiting the potential sustainability of proposed projects. The cheap electricity environment has discouraged investment in CDM projects as the return

on investments are not seen as worth the effort. The current escalating energy prices are likely to address this issue, which should see some of the potential renewable energy projects realised.

Given the high level of South Africa's carbon emissions, and the relatively developed economy, with a modern financial system, CDM project opportunities are deemed numerous and widespread. It seems apathy, and profitability, may be the inhibiting factors culminating from a distinct lack of education and drive, which could be addressed through raising awareness and individual/corporate risk taking.

4.5.6 *Factor 6: Executive Board*

The CDMs Executive Board main function is to accept validated projects as CDM projects, issue Certified Emission Reductions (CERs), and accredit operational entities. This factor considers the procedure as a new level of international bureaucracy, which entails a complicated and time consuming process. Additionally, business confusion surrounds the demonstration of 'additionality' for each CDM project and the lack of transparency and consistency in project categorisation.

Mean (μ)	0.1748
t-Value (99% confidence interval) $(-2.861 < t_{19} < 2.861)$	1.36
Importance	Not significantly different from the average (0)
Interpretation	**Important**
Barrier Rank 1 (least important) to 10 (most important)	4/10

From the mean calculated, this factor is interpreted as a barrier and is ranked four out of the 10 barriers considered. It is not significantly different from the average. The t-value determined is within the critical range demonstrating an *important* factor to investment in the CDM.

According to literature the administration of the flexible mechanisms, especially the CDM, by the Executive Board, and its assistant bodies (Methodologies Panel) are considered overtly slow and bureaucratic. The private sector favours efficiency, predictability, consistency and transparency. Consequently, the CDM approval process is often blamed for South Africa's inability to move fast enough to attract foreign investment.

The respondents agreed that the Executive Board can be attributed to very long delays and frustration around the mechanism. The most common criticism levelled is around additionality, a number of projects have been approved which would have happened anyway and thus begs the question about demonstrating additionality. As the board is not close to any particular project it is seen as bureaucratic (slow turnaround in reviews), without any invested interest in any projects success.

Inconsistencies, around decision making, were also reported as an issue. A particular project was delayed by more than 2 years because of confusion arising, from the Executive Board, and them changing their views during the process. The subsequent delay, and related transaction costs, could act as an indicator to the market to avoid the mechanism. This may be related to the competence of the project developers or those assisting them but, may also be that the Executive Board is overcautious. Transparency of the Executive Board around the decisions they take would provide some clarity. Although the Executive Board is a factor, most respondents felt that this has not detracted those that are serious about pursuing CDM projects. The Board is common to all countries, and cannot be seen a uniquely South African issue.

The Board is in the process of trying to streamline issues and further guidance on the CDM is expected. If the current guidelines are followed the process is reported to work, and gets better with experience. The introduction of additional guidelines, timeframes and transparency would ensure that this factor becomes more enabling and less of a deterrent.

4.5.7 *Factor 7: Transaction costs*

Transaction costs are borne by the host project which can be high, thereby decreasing CDM supply potential and gains to non-Annex B countries. Transaction costs per tonne of CO_2 equivalent varies widely with project size, and this factor considers the high transaction costs associated with the establishment of CDM projects.

Mean (μ)	0.3264
t-Value (99% confidence interval) ($-2.861 < t_{19} < 2.861$)	3.62
Importance	Significantly above the average (0)
Interpretation	**Critically Important**
Barrier Rank 1 (least important) to 10 (most important)	6/10

From the mean calculated this factor is interpreted as a definite barrier and is ranked 6 out of the 10 barriers considered. The t-value determined is above the critical limit indicating a *critically important* factor to investment in the CDM.

The literature demonstrates that for small CDM projects the transaction costs can be a real threat to their viability, because transaction costs for small projects can be a significant part of the overall project costs. Income from the sale of CERs is usually only a portion of the overall project revenue stream, meaning that project owners also need other sources of funding to make the project viable. It is reported that the minimum size of an economically viable project may decline over time as more approved baseline and monitoring methodologies become available.

This factor was considered very important and the result of delays leading to frustration with the current mechanism. Few companies have in-house experts so it is frequently quite expensive consulting time which is being expended on projects. Costs involved in developing the methodology include a lot of consulting hours, and added onto these the cost of validation and on-going audits. High costs can be a deterrent to smaller players, particularly PoA style projects. Larger scale projects are more able to absorb the costs. However, there is a question as

to whether these costs can be passed on. Investing in renewable energy might well result, at least in the short and medium term, in an increase in energy prices should there be a transferral of costs. However, this does not make these projects competitive.

The respondents call for a change in the rules and the validation process. Reducing transaction costs has been a stated objective of the CDM since its inception. This has however been difficult to achieve. The move towards programmatic CDM is a positive development, which has the potential to scale up transformative initiatives, while reducing transaction costs. It is also suggested that through a PoA, procedure small scale projects, could become exempt of registration costs thereby making them more viable.

4.5.8 *Factor 8: CER price*

In non-Annex B countries the fiscal gain is the amount of money realised from the sale of CERs at the global carbon price less the supply costs. This factor determines the impact the CER price has on the establishment of CDM projects within South Africa.

Mean (μ)	0.3505
t-Value (99% confidence interval) ($-2.861 < t_{19} < 2.861$)	5.57
Importance	Significantly above the average (0)
Interpretation	**Critically Important**
Barrier Rank 1 (least important) to 10 (most important)	7/10

From the mean calculated this factor is interpreted as *a* definite barrier and is ranked 7 out of the 10 barriers considered. The t-value determined is above the critical limit indicating a *critically important* factor to investment in the CDM.

As the CDM is a market based mechanism, it requires financially viable projects at the prevailing CER price. However, as shown in the literature, such market based frameworks require information, fair pricing, and trade volumes to effectively

sustain the market. A number of CDM projects generate relatively few credits with high investment costs, therefore generating low returns. Additionally, price risk, CER market risk, and the future price of CERs are borne by the project developer often making investment in such projects less appealing

South African CER credits are very sellable, but respondents agree the low and volatile CER price is a definite barrier. This is further compounded by limited understanding of the differences between primary and secondary markets. If the CER price were more consistent, and certain, it would encourage project development. The variability of the market and the uncertainty post 2012 has resulted in the majority of the South African banks not recognising CERs as a probable project cash stream. Consequently, debt needs to be guaranteed by other cash flows making projects more complicated to fund.

Currently the CER price is low due to market uncertainty regarding the lack of clarity of the Protocol post 2012, in tandem with the global economic recession. It is anticipated that following the meeting in Copenhagen in December 2009, and if a decision is made to extend the Protocol, there will be gains in the global CER price. This low price is also attributed to more supply than demand, especially through Chinese easy wins of HFC 23 projects. Particularly criticism is levelled at HFC 23 projects through which refrigerants are often overproduced in order to sell the credits produced by the capture and destruction of its HFC 23 waste stream. The volume of such credits has the effect of dampening the CER price. There is a definite need to revise the rules, for poor projects such as HFC 23 are diluting the value of CERs for beneficial projects.

The absence of the USA, which is a major emission producing country, limits the emission credits buyers and this leads to a reduction in the marginal abatement cost in the trading mechanism. It is envisaged that should the USA become an active member of the Kyoto Protocol (within a post 2012 agreement) the demand for carbon credit would increase resulting in higher and more consistent CER prices.

4.5.9 *Factor 9: Tax on cash streams*

The cash streams resulting from the sale of CERs are subject to tax within South Africa. In future, the Treasury proposes that income derived from the sale of Primary CERs be tax exempt or subject to capital gains tax instead of normal income tax. This factor considers the historical position of tax on cash streams from CER sales and the impact this may have had on CDM project profitability and therefore successes.

Mean (μ)	-0.5025
t-Value (99% confidence interval) ($-2.861 < t_{19} < 2.861$)	-4.72
Importance	Significantly below the average (0)
Interpretation	**Unimportant**
Barrier Rank 1 (least important) to 10 (most important)	3/10

From the mean calculated this factor is interpreted as not a barrier and is ranked the third least important of the 10 barriers considered. The t-value determined is below the critical value demonstrating an *unimportant* factor to investment in the CDM.

The literature states that countries that voluntary impose onerous taxes on CDM projects may lose these investments to other large developing countries. South Africa is one of the few Annex-B countries that voluntarily imposes an income tax on cash streams generated from the sale of CERS, widely viewed as an additional source of revenue to meet government shortfalls.

All respondents agree that this is unlikely to be of particular importance to the CDM as other factors far outweigh this concern. It is more classified as a disincentive, as given the transaction costs and other frustrations, the benefit was then being minimised by increasing taxation. Other countries have far more onerous taxation policies and yet they have delivered projects. However, there is some uncertainty about what tax actually applies to the CDM in South Africa, particularly amongst the smaller corporations. Large companies, with more

complex accounting systems, generally incorporate tax predictions within their business model as it's ultimately classified as revenue.

This factor was largely resolved by the 2009 budget, and resulting tax incentives, where revenues from the sale of carbon credits will be exempt from income tax. This is expected to come into effect in January 2010 and is seen as a positive move from government to encourage investment within renewable energy and the CDM within South Africa.

4.5.10 *Factor 10: Kyoto Protocol post 2012*

The Kyoto Protocol runs out at the end of 2012, and at present there is no certainty concerning the nature of the future framework. This factor considers the uncertainties concerning the continuity of the flexible mechanisms and the carbon markets beyond 2012 as a factor limiting investment within the CDM.

Mean (μ)	0.9852
t-Value (99% confidence interval) $(-2.861 < t_{19} < 2.861)$	6.21
Importance	Significantly above the average (0)
Interpretation	**Critically Important**
Barrier Rank 1 (least important) to 10 (most important)	10/10

The mean calculated for this factor is interpreted as *a* definite barrier and is ranked the most significant of the barriers considered. The t-value determined is significantly above the critical limit indicating a *critically important* factor to investment in the CDM.

The Kyoto Protocol currently expires at the end of 2012. Therefore, according to the literature, emission reductions post-2012 has limited market value at the present time because commitments beyond 2012 have yet to be negotiated. CDM projects are eligible to earn CERs for 10 to 21 years, so most projects expect to generate CERs for a number of years after 2012. Since reductions beyond 2012

have limited value, the project costs must be recovered from emissions reductions prior to 31 December 2012.

All respondents agreed that this is a critically important barrier to investment within the CDM. The lengthy process seems to be at odds with the insecurity post 2012, it appears evident that a project would hardly be approved before the current Protocol comes to an end. This has been compounded in South Africa by the lagged start due to the relatively poor awareness around CDM. South African government, and business, have been slow to react to the opportunity putting prospective investors under pressure regarding the now condensed timeframes. Current uncertainties to what the climate regime will be post 2012 (particularly whether some countries will have legally binding emission 'caps') means investors in CDM projects do not have a clear signal on the need for credits or their value post 2012. This has resulted in a focus on short term emission reduction projects. Thus the number of economically viable CDM projects will decline rapidly over the next few years unless domestic and international measures are given to an economic structure post 2012.

However, the current Protocol seems to work, and is likely to exist after 2012, although certain amendments will be required. Reputable buyers are thus willing to enter into contracts with firm pricing up to 2017, however financial institutions are not likely to include such cash flows as repayment for loans and therefore investment is limited.

It was felt necessary by respondents to create ongoing incentives for worldwide cooperation in the climate change issue. Developed countries fear the dangers to their economic growth of limiting their emissions, developing countries argue that great inequality in current and past emissions should not restrict their development potential. Different potential climate regimes could build on developments under the CDM in different ways. If a CDM-type mechanism were to have a role in the future, its role could be made more significant by making changes to the structure, scope and working of the CDM. Non-participation by large potential 'credit-buying' countries will reduce the demand for and price of credits irrespective of how any future climate commitments are set up.

It appears evident that a post 2012 policy architecture that would increase participation of developing countries in the international effort to curb GHG emissions is required. The idea would be to link international emissions trading market with a domestic contribution to GHG emissions reduction. This would progressively enlarge the Kyoto coalition, with large developing countries accepting a soft binding target. The climate change regime would then be extended to other regions and progressively strengthened.

4.5 Summary of the results

The main GHG that is likely to be reduced by investment in the CDM within South Africa is CO_2 and then methane. Reduction of these gases is most likely to occur through investment in energy efficiency, renewable energy (such as wind, biomass and solar power) along with methane recovery and utilisation predominantly from landfill gases and animal waste.

The main aims of this research were to establish, and rank, the key factors that are perceived to be barriers to investment in CDM projects. In each case the rank as well as the mean calculated as part of the distribution fitting analysis is shown and from this the level of importance interpreted. The summary of the results are show below in Table 5.

Table 5: Importance of the factors as barriers to CDM projects

Rank	Factor	Mean (μ)	t-value	Interpretation
1	Kyoto Protocol post 2012	0.9852	6.21	Critically Important
2	Project identification and validation	0.5132	7.62	Critically Important
3	Awareness within industry	0.4097	3.97	Critically Important
4	CER Price	0.3505	5.57	Critically Important
5	Transaction Costs	0.3264	3.62	Critically Important
6	National Policy & Legislation	0.2307	2.62	Important

Rank	Factor	Mean (μ)	t-value	Interpretation
7	Executive Board	0.1748	1.36	Important
8	Tax on cash streams	-0.5025	-4.72	Unimportant
9	Approval process of DNA	-0.6353	-3.19	Unimportant
10	CDM project opportunities within SA	-1.8527	-6.44	Unimportant

Essentially this means that respondents that partook in this research viewed:

- Kyoto Protocol post 2012
- Project identification and validation
- Awareness within industry
- CER price
- Transaction costs

as the critically important factors acting as barriers to investment in CDM projects within South Africa.

While the following factors were also seen as important barriers, but not necessarily critical when making investment decisions:

- National Policy and Legislation
- Executive Board

The following factors were unimportant and were generally viewed as factors that don't act as barriers to investment in CDM projects in South Africa:

- Tax on cash streams
- Approval process of DNA
- CDM project opportunities within South Africa

4.5.1 *Additional factors for consideration*

Through the interview process, and open ended questions posed, respondents were asked if they felt there were any additional factors that could be acting as barriers to the investment in the CDM in South Africa. These are summarised below:

The CDM process requires any industrial CDM project developer to interface with government at a number of crucial points in the process. A number of respondents, who had recently completed CDM projects, felt that the Environmental Impact Assessment (EIA) process was a 'stumbling block'. Each EIA is a lengthy process, and the relevant South Africa departments are unable to meet the prescribed timeframes in issuing a Record of Decision. Consequently the CDM registration process, which is reliant on an approved EIA, is held up leading to additional costs and at time abandonment of the project. It was suggested that CDM projects should be included within an expedited EIA approval process to avoid any undue delays.

In line with the delayed environmental approvals by Government, there was also concern raised around the passive position Government plays in the process. Government often needs to be lobbied to ensure support on the CDM, when they should be leading on it. Additionally, the position of the South African Government post 2012 is not transparent. Industry players in South Africa are aware of the European Unions view post 2012, but not that of our own government, making it difficult to plan and commit resources.

The long term view of the CDM is in conflict with the short term view of business. Corporate executives looks at cash flows in order to evaluate projects for funding, but the CDM has long term positive cash flows, with proportionally high upfront capital costs, therefore making it a difficult investment for small companies. The time taken to demonstrate positive returns is also resulting in limited access to local finance. Companies are finding it difficult to find local funding and are looking overseas as a source of funding, often at a premium, where the carbon market is more mature and where shareholders demand sustainable investment.

This being said many opportunities do seem to exist in South Africa for those with the patience and tenacity to see a good potential CDM project through to delivered completion.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This final chapter encapsulates the results of the research into the conclusion of the study. Where possible, and drawing upon the responses of the experts, recommendations have been made on how best to mitigate the barriers to investment, which would result in increased investment in the CDM within South Africa. Research around the CDM is still within its infancy, and this chapter concludes by suggesting additional research that might be undertaken in the future to shed further light on a rapidly evolving mechanism.

5.2 Conclusions of the study

Developing countries are well place to reap both fiscal and technological benefits from investment in the CDM. However, South Africa has lagged behind the majority of the other developing nations when investing in such projects. South Africa has great potential to reduce CO_2 and methane, but has been slow to implement such reductions. Reduction of these gases is most likely to occur through investment in CDM projects such as energy efficiency, renewable energy (such as wind, biomass and solar power) along with methane recovery and utilisation predominantly from landfill gases and animal waste.

This study has shown that there are now fewer barriers than at the inception of the Kyoto Protocol, however they bear greater significance. The barriers to CDM projects in South Africa have been identified and ranked in Table 6.

Table 6: Rank of barriers to CDM projects within South Africa

Rank	Factor	Interpretation
1	Kyoto Protocol post 2012	Critically Important
2	Project identification and validation	Critically Important
3	Awareness within industry	Critically Important
4	CER Price	Critically Important
5	Transaction Costs	Critically Important
6	National Policy and Legislation	Important
7	Executive Board	Important
8	Tax on cash streams	Unimportant
9	Approval process of DNA	Unimportant
10	CDM project opportunities within SA	Unimportant

It is therefore evident that the critical barriers are iterative in nature and focus around:

- Continuation of the mechanism into the future (Kyoto Post 2012)
- Cost (Kyoto Post 2012, CER price, transaction costs)
- Awareness leading to project identification (awareness within industry, project identification and validation)
- Arduous process (project identification and validation, transaction costs)

There has been a general lack of awareness by both the South African government and the business community around the CDM, a clear institutional structure is required and an implementation strategy extending beyond 2012.

5.3 Recommendations

The study has determined which GHGs are most likely to be reduced through investment within the CDM in South Africa, as well as which CDM project types are best suited for the South African economy. Drawing upon this knowledge it is suggested that government provide provisional CDM guidelines to facilitate the smooth implementation of key CDM project types. There should be an awareness raising campaign by the National Business Institute (NBI), to its members, alongside that of their Carbon Disclosure Project. Commercial banks should be encouraged to realise the opportunity that exists for a competitive advantage going into a carbon constrained economy. Vertical integration of CDM project origination, facilitation and carbon trading will ensure profitable returns for banks while streamlining the process for prospective clients. Export credit agencies should be encouraged to develop innovative risk management products geared towards CDM investors and explore ways they can support such investments.

The respondents have ranked the key factors currently perceived to contribute to poor investment in CDM in South Africa, and identified those that are critically important. It is vital that capacity building assistance, the establishment of streamlined and transparent CDM procedures and sound governance pave the way for project investment. Private investors are confused around the requirements for sustainable development (SD). South Africa should make it clear to outside investors what is meant by the SD objective of the CDM in South Africa's national conditions. This should be supplemented by dissemination of the CDM knowledge to local authorities and project developers sectorally, getting them involved in the process of CDM rules and procedure. Engaging development assistance/international finance to structure projects profitably. These institutions can help attract and manage the CDM process, especially projects with strong sustainable development benefits.

In order to encourage CDM project development government needs to use 'sticks' as well as 'carrots', such as charging fees or imposing carbon taxes to endorse and encourage any project under the CDM. The use of such 'sticks' will ensure that the cheaper energy options are not the only projects that are implemented. The South African energy market needs to be opened to reduce the dependence on Eskom and coal fired power stations. This approach needs to fit in with the national agenda around climate change, encouraging investment in renewable energy and carbon reduction techniques.

The ability to shorten project lead times is limited. Project developers have an economic incentive to get projects into operation as quickly as possible. A more detailed examination of the requirements of the Executive Board could lead to a more effective approach, and reduce delays. Growth in the CDM globally is likely to strengthen the capacity of the Executive Board to, hopefully, ensure that lead times do not increase due to larger volumes of projects.

Currently, the position post of Kyoto 2012 is considered crucial and the following are suggested for inclusion:

- Developed countries need to be pushed to set strong binding emissions reductions (including the US),
- Funds and technology cooperation must be established to support the implementation of low-carbon economies in the developing world,
- Developing countries should commit to reduce emissions (initially at a voluntary level), with the relevant fiscal incentives if targets are reached.

5.4 Suggestions for further research

The opportunities for research into CDM are vast, especially leading up to 2012, and then post 2012. The following suggestions are made for further research:

- To explore the corporate inertia specifically around industry response to climate change and South African industry's conservative reaction to new non-traditional opportunities,
- The potential for renewable energy alternatives in South African industry. This should include the impact the REFIT is having on business acceptance,
- Energy efficiency opportunities in South Africa compared to those in developed countries – the chance for knowledge exchange,
- A similar study of the factors influencing industrial CDM processes within China, India and Brazil and how beneficial processes and systems can be transferred to South Africa,
- The links between existing barriers and how single outcomes might result in solutions to a number of barriers,
- Scenario planning for South Africa from the possible replacement mechanisms to the Kyoto Protocol post 2012,
- Case studies of successful implementation projects within South Africa, assessing the outcomes through a cost benefit analysis.

REFERENCES

Bergmann, A., Hanley, N. and Wright, R. (2006) Valuing the attributes of renewable energy investments, *Energy Policy,* 34, p. 1004 - 1014.

Boden, T. (2007) *Carbon Dioxide Information Analysis Centre,* last accessed 1 May, 2009, from http://cdiac.ornl.gov/aboutcdiac.html.

Capoor, K. and Ambrosi, P. (2008) *State and Trends of the Carbon Markets 2008*, World Bank.

Carstanjen, H. (2004) *The First Ten Years*, UNFCCC, Bonn France.

CDM in Charts Ver 7 (2009, 1 April 2009), last accessed 14 April, 2009, from www.iges.or.jp.

CDM Project Database (2009, 1 April 2009), last accessed 14 April, 2009, from www.iges.or.jp.

Clean Development Mechanisms Can they work?, (2007) *OECD Observer*(264/265), p. 11-12.

Cosbey, A., Parry, J., Browne, J., Babu, Y. D., Bhandari, P., Drexhage, J. and Murphy, D. (2005) *Realizing the Development Dividend: Making the CDM Work for Developing Countries*, International Institute for Sustainable Development.

Country Comparison: GDP (2009), last accessed 18 October, 2009, from www.cia.gov/library/publications/the-world-factbook.

Creswell, J. (2003) *Research Design: Qualitative, Quantitative and Mixed Method Approaches,* 2nd ed., Sage Publications, London.

Dagoumas, A. S., Papagiannis, G. K. and Dokopoulos, P. S. (2006) An economic assessment of the Kyoto Protocol application, *Energy Policy,* 34, p. 26 - 39.

Davis, S. (2008) Carbon Credits one of the world's largest traded commodities, *The Wits Business School Journal,* Oct - Dec, p. 50 -52.

DEAT (2005, 17 November 2007) *State of the Environment Report: Greenhouse Gas Emissions,* last accessed 2 May, 2009, from http://soer.deat.gov.za/themes.aspx?m=172.

DEAT (2006) *South Africa Environmental Outlook: A report on the state of the environment*, Department of Environmental Affairs and Tourism, Johannesburg.

Dudek, D. and Weiner, J. (1996) *Joint Implementation, transaction costs and climate change*, Organisation for Economic Co-operation and Development, Paris.

Ehlers, C. and Wiekert, M. (2006) *CDM-Market Brief South Africa*, German Office for Foreign Trade, Cologne.

Ellis, J., Winkler, H., Corfee-Morlot, J. and Gagnon-Lebrun, F. (2007) CDM: Taking stock and looking forward, *Energy Policy,* 35, p. 15 - 28.

European Climate Exchange (2009, 4 May 2009)*,* last accessed 4 May, 2009, from http://www.ecx.eu/.

Fontana, A. and Frey, J. H. (2005) 'Chapter 27: The interview - From neutral stance to political involvement', In Denzin, N. K. and Lincoln, Y. S. (eds.), *The Sage Handbook of Qualitative Research* Sage, London,

Gantsho, M. and Karani, P. (2007) Entrepreneurship and innovation in development finance institutions for promoting the clean development mechanism in Africa, *Development Southern Africa,* 24(2), p. 335 - 344.

Greene, W. (2006) *Carbon Finance for Africa - An Investor Guide*, Africapractice, London.

Haites, E. (2004) *Estimating the Market Potential for the Clean Development Mechanism: Reviews of Models and Lessons Learned*, World Bank.

Haites, E. and Yamin, F. (2004) Overview of the Kyoto Mechanisms, *International Review for Environmental Strategies,* 5, p. 199-215.

Henning, E. (2004) *Finding Your Way in Qualitative Research*, Van Schaik, Pretoria.

Howell, A. (2008) A new and uncertain market, *International Financial Law Review,* 27(3), p. 58-59.

Jung, M. (2006) Host country attractiveness for CDM non-sink projects, *Energy Policy,* 34, p. 2173 - 2184.

Kalof, L., Dan, A. and Dietz, T. (2008) *Essentials of Social Research*, McGraw Hill, Maidenhead.

Karani, P. (2002) *Introduction to emerging carbon offset markets: prospects and challenges for development in Africa*, College Publishers, Nairobi, Kenya.

Kenney, B. (2008) *The What, Why Carbon Foot,* last accessed 10 March 2009, from www.industryweek.com.

Kim, J. (2003) *Sustainable Development and the CDM: A South African Case Study*, Tyndall Centre for Climate Change Research.

Kulovesi, K. (2007) The Private Sector and the Implementation of the Kyoto Protocol: Experiences, Challenges and Prospects, *Review of European Community & International Environmental Law,* 16, p. 145-157.

Kyoto Protocol to the United Nations Framework Convention on Climate Change (2005, 14 April 2009), last accessed 15 April, 2009, from http://unfccc.int/kyoto_protocol/items/2830.php.

Leedy, P. (1993) *Practical Research: planning and design,* 5th ed., MacMillan, New York.

Little, G., Maxwell, T. and Sutherland, M. (2007) Accelerating the implementation of the clean development mechanism in South Africa, *South African Journal of Economic and Management Sciences,* 10(4), p. 395 - 411.

Luiz, J. and Muller, E. (2008) Greenhouse Gas Emission Reduction Under the Kyoto Protocol: The South African Example, *International Business & Economics Research Journal,* 7(1), p. 75 - 92.

Luiz, J. M. and Charalambous, H. (2009) Factors influencing foreign direct investment of South African financial services firms in Sub-Saharan Africa, *International Business Review,* 18, p. 305 - 317.

MacLachlan, J. (2007) Taxing times for climate change, *International Tax Review,* 18(3), p. 26-28.

Maosheng, D. and Haites, E. (2006) Implementing the Clean Development Mechanism in China, *International Review for Environmental Strategies,* 6, p. 153-167.

Moerman, F., Weller, J. and Zheng, Z. (2008a) The Administration and Approval of CDM Projects in China, *China Business Review,* 35(5), p. 45-45.

Moerman, F., Weller, J. and Zheng, Z. (2008b) Green Investment: Opportunity Knocks, *China Business Review,* 35(5), p. 42-45.

Muller, E. and Luiz, J. (2008) Opportunities under the Kyoto Protocol, *The Wits Business School Journal,* Oct - Dec, p. 62 - 63.

Naidoo, B. (2009) Carbon Graveyards: South Africa pushes ahead with carbon dioxide storage atlas project, but scepticism persists, *Engineering News,* (29)1, p. 16 - 17.

Painuly, J. P. (2001) The Kyoto Protocol, Emissions Trading and the CDM: An Analysis from Developing Countries Perspective, *Energy Journal,* 22, pp. 147.

Parikh, J. and Parikh, K. (2004) The Kyoto Protocol: An Indian Perspective, *International Review for Environmental Strategies,* 5, p. 127-144.

Pinkse, J. (2007) Corporate intentions to participate in emission trading, *Business Strategy & the Environment (John Wiley & Sons, Inc),* 16, p. 12-25.

Repetto, R. (2001) The Clean Development Mechanism: Institutional breakthrough or institutional nightmare?, *Policy Sciences,* 34(3/4), p. 303-327.

Roy, J., Das, S., Sathaye, J. and Price, L. (2002) Estimating baselines for CDM: case of eastern regional power grid in India, *Environmental Economics & Policy Studies,* 5(2), pp. 121.

Schmidt, C. W. (2009) Carbon Offsets, *Environmental Health Perspectives,* 117(2), p. A62-A68.

Schneider, M. (2008a) All about positioning: Keeping a close eye on how firms are coping in a world that's become more carbon constrained, *The Financial Mail,* 17 Oct, pp. 15.

Schneider, M. (2008b) Clean Development Mechanism: Green Money up for grabs, *The Financial Mail,* 17 Oct, pp. 10.

Shrestha, R. M. (2004) Technological Implications of the Clean Development Mechanism for the Power Sector in Three Asian Countries, *International Review for Environmental Strategies,* 5, p. 273-288.

Shuang, Z. (2004) Mitigating Climate Change through the CDM--The Case of China, *International Review for Environmental Strategies,* 5, p. 289-299.

Shukla, P. R., Sivaraman, B. and Yajnik, A. (2004) The Clean Development Mechanism and India: Firm Responses, Baselines, and Development Dynamics, *International Review for Environmental Strategies,* 5, p. 257-272.

Smrcka, K. (2009) Strategies for more sustainability - the German recipe, *Engineering News,* 29 (1), pp. 61.

Stacey, A. (2005) The reliability and validity of the item means and standard deviation of ordinal level response, *Management Dynamics,* 14(3), p. 187 - 210.

Stacey, A. (2006) Estimating the means and standard deviations of rank ordered survey items, *Management Dynamics,* 15(3), p. 26 -35.

Swanepoel, E. (2008, 2 September 2008) *SA lagging behind in emission finance,* last accessed 17 April, 2009, from http://www.engineeringnews.co.za/sa-lagging-behind-in-emission-finance.

Szymanski, T. (2002) The Clean Development Mechanism in China, *China Business Review,* 29(6), pp. 26.

Tucker, C. and Mandlana, W. (2009, 9 March 2009) *New Laws Being Prepared to Respond to the Challenge of Climate Change,* last accessed 7 April, 2009, from http://www.internationallawoffice.com/Newsletters/Detail.apsx.

Underhill, L. and Bradfield, D. (1994) *IntroSTAT 5.0*, Juta & Co Ltd, Cape Town.

UNEP and WMO (eds.) (1996) *The science of climate change, contribution 1 to the second assessment of the intergovernmental panel on climate change*, Cambridge Univeristy Press.

Viguier, L. L. (2004) A proposal to increase developing country participation in international climate policy, *Environmental Science and Policy,* 7, p. 195 - 204.

Wara, M. (2007) Is the global carbon market working?, *Nature,* 445(7128), p. 595-596.

Warra, M. (2007) *South Africa still struggles to attract CDM investment*, Point Carbon.

Welman, J. C. and Kruger, S. J. (1999) *Research Methodology for the Business and Administrative Sciences*, Thomson Publishing, Johannesburg.

Willig, C. (2008) *Introducing Qualitative Research in Psycology: Adventures in Theory and Method,* 2nd ed., McGraw Hill, Maidenhead.

Woerdman, E. (2000) Implementing the Kyoto Protocol: Why JI and CDM show more promised than international emissions trading, *Energy Policy,* 28, p. 29 - 38.

Zhang, Z. (2006) Towards an effective implementation of clean development mechanism projects in China, *Energy Policy,* 34, p. 3691 - 3701.

APPENDIX A

Appendix A – Annex B Countries

Country	Target (1990** - 2008/2012)
EU-15*, Bulgaria, Czech Republic, Estonia, Latvia, Liechtensteain, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland	-8%
US***	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0%
Norway	1%
Australia	8%
Iceland	10%

* The 15 States who were EU members in 1990 will redistribute their targets among themselves, taking advantage of a scheme under the Protocol known as a "bubble", whereby countries have different individual targets, but which combined make an overall target for that group of countries. The EU has already reached agreement on how its targets will be redistributed.

** Some EITs have a baseline other than 1990.

*** The US has indicated its intention not to ratify the Kyoto Protocol.

APPENDIX B

Appendix B – Respondents contributing to the Research

Karin Ireton – Director of Group Sustainability Standard Bank

Karin has spent many years as the head of sustainable development: markets and economics for Anglo American. She has played an ongoing role in developing corporate understanding and practice as well as the formulation of national and international policy around climate change.

Andrew Gilder – Director Imbewu

Imbewu are environmental-legal specialists focusing on environmental and climate change laws, paying particular attention to developing international and South African climate change legal and CDM regimes. Andrew has been involved in a number of CDM projects and has undertaken research into the practical implementation of climate change mitigation projects in terms of the CDM, including environmental legal, contractual and strategic advice.

Eugene Muller - Production Manager Omnia Fertilizer

Omnia Fertilizer registered a N_2O decomposition project under the CDM in December 2006. At the projects inception, Eugene was the production manager for the nitric acid plant and remained involved from the point of view of getting the project registered and implemented on site. In addition, Eugene has undertaken research into the CDM through his thesis at Wits Business School.

Chauke Lindiwe Olga – Director Department of Minerals and Energy (DME)

Chauke has the key role of CDM project promotion and capacity building within the DME. She has the primary responsibility of encouraging CDM projects and is the key person acting within the Designated National Authority for CDM in South Africa.

Mark Taunton – Director Red Cap

Mark has worked extensively in the CDM arena, particularly focusing on energy efficiency and is now looking at Programme of Activities. He, through his consulting services, is involved in all aspects of CDM from project identification through to development of a methodology.

Loshni Naidoo – Senior Manager Ernst & Young

Loshni works within the climate change and sustainability services for E&Y, whom have a mandate as the DOE within South Africa. She works on a project by project basis, verifying GHG reductions as part of CDM projects, and due to the service offered by E&Y is critical to CDM project implementation within South Africa.

Sizwe Kuzwyo – Business Developer CAMCO

CAMCO is a leading climate change and sustainable development company. As business developer, Sizwe, is responsible for CDM project origination and advisory services around investment for prospective clients.

Johan Myburgh – Process Development Manager Sappi

Sappi have, over the years, explored numerous CDM opportunities within South Africa. Johan has the primary responsibility within the business to identify such opportunities

and to facilitate their implementation. To date no CDM projects have been registered, but a number of projects are in the pipeline and under review.

Lindsey Straughn – Owner Green Engineering

Lindsey was the landfill manager of the Durban landfill-gas project which was registered as a CDM in April 2007. He was actively involved in the CDM project and has subsequently established Green Engineering which looks at “green’ opportunities including CDM from an engineering perspective.

Sithembiso Khunerie – Project Engineer Rosslyn Brewery (SAB)

South African Breweries implemented a fuel switch to natural gas at their Rosslyn Brewery, which was registered as a CDM project in June 2007. Sithembiso was the project engineer responsible for the switch and was actively involved in the project design documents and registration process.

Stefan Raubenheimer - Managing Director SouthSouthNorth

The SouthSouthNorth Group, is a leading organisation working in the not-for-profit sector on climate change and development issues. He is also a Director of Energy Transformations which is a consultancy developing CDM projects for private sector clients. Stefan was a key member in the development of the CDM Gold Standard. In addition he is a registered facilitator, mediator and arbitrator, and is involved in numerous third party process interventions, including policy development work for the South African Government.

Peter Coombes – Head Anglo American Technical Services

Peter was previously an environmental consultant within the mining industry and now heads Anglos Technical Services department. This division looks at climate change solutions, and interventions, within the groups various mining operations having

extensive experience of the CDM. The group are exploring a number of CDM opportunities within South Africa, but have as yet not registered any projects.

Johan van den Berg – CEO African Climate Solutions

Johan is a CDM and legal compliance expert CDM within South Africa. Adv van den Berg practised at the Cape Bar as an advocate from 1993-2002, specialising in Environmental law and Environmental Dispute Resolution. During 2000 he made the decision to move fulltime into climate change work. In 2001/2002 he completed a certificate course in the Mathematical Modelling of Financial Derivates at the University of South Africa and in April 2002 left the bar to become head of the Energy desk at Commodity Trading House in Stellenbosch. In November 2002 he was retained by UNEP's Collaborating Centre on Energy and the environment to write "Legal Background Paper on the CDM in Developing Countries". Johan has also done work for the World Bank. He founded CDM Africa in mid-2003 as a specialised advisor to CDM project developers. Johan is an Associate Fellow of the Society of Advanced Legal Studies in London, legal advisor to the Darling National Demonstration Windfarm and the African Wind Energy Association, an internationally accredited mediator, a registered trader of the South African Futures Exchange and has lectured at four South African Universities on CDM and energy.

Robbie Louw – Director Promethium

Robbie is a Chemical Engineer with an Honours degree in Economics. He is currently busy with a Masters degree in Environmental Economics. His areas of expertise include CDM project development, the UNFCCC and IPCC regulatory environment, carbon footprint accounting as well as general chemical, mining and metallurgical process expertise. Robbie has been active in the CDM space from the very start of CDM-related activities in the country and is one of the leading CDM practitioners in the country today. He is responsible for the technical and engineering functions within Promethium.

Debra Roberts – Ethekwinin Municipality Deputy Head: Environmental Management

Debra was involved in the Durban City Council landfill gas project, which was registered as a CDM project. Her key responsibilities include strategic environmental management to ensure that all plans, programmes, strategies and projects emanating from the department align with the municipal Integrated Development Plan (IDP) and national policy.

Michael Goldblatt – Director Parma Development Group

Michael Goldblatt is an economist specialising in environmental and natural resource economics. He has worked in the field of environmental management policy and strategy since 1996 with a focus on the areas of climate change and GHG reduction, water and solid waste service delivery, water resources management, and the application of economics to environmental management and protection. Michael has been involved in consultancy and transaction advisory services around the CDM.

Marco Lotz – Technical Manager CDM Climate Solutions

Marco works on CDM project identification and research. He has a particular interest in CDM project management and is reading towards a PhD in this topic. He has a focus on South African CDM project support and regularly presents at conferences to raise awareness around the subject.

Grant Little – Senior Project Originator Masdar (Abu Dhabi Future Energy Company)

Grant has extensive experience in South Africa and Internationally, in CDM origination and implementation, including sourcing, screening and PDD drafting. He has been involved in the energy industry for a number of years and has published a paper on the CDM within South Africa.

Esmé Gombault – Group Operations Director EnviroServ

EnviroServ Waste Management (Pty) Ltd focuses on providing innovative and sustainable waste management solutions. Esmé, previously General Manager of the treatment and disposal division of EnvrioServ was actively involved in the Chloorkop landfill gas recovery project which was registered as a CDM in July 2007. This project included Japan Carbon Finance Ltd and is a methane recovery and utilisation project.

David Nicol – Director Red Cap Consulting

David Nicol was previously employed by the Sustainability Institute and headed up the Energy Efficiency Initiative located within the Cape Town Partnership. He now works as a consultant on CDM for the World Bank, focusing around renewable energy and energy efficiency as well as drafting project design documents for South African companies.