The Role of Market-Based Incentives in Promoting Low Carbon Development in Developing Countries

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Abstract

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The economic advancement that society has experienced in the past two centuries is largely based on a carbon intensive development model. This is now causing a vexing problem because the exploitation of fossil fuels is a leading cause of global climate change. As developing countries advance energy-intensive developmental agendas, a more sustainable approach is necessary to facilitate growth without the accompanying negative environmental externalities inherent to the business as usual approach. The purpose of this thesis is to explore the relationship between market-based incentives (MBIs) for reducing greenhouse gas emissions and the underlying host country context. The main research question is: How does host country context affect MBIs in developing countries? The theoretical framework is drawn from the literature on market based environmental policy, and links to the literature on governance in areas of limited statehood.

The thesis links five distinct empirical papers to present a cohesive body of research. The experience of the internationally mandated Clean Development Mechanism (CDM) is explored via qualitative comparison between China and South Africa, and between Zambia and South Africa. A quantitative analysis of utilisation and underlying host country indicators is also presented to further understand the antecedents of CDM uptake at the national level. Furthermore, South Africa's nationally mandated promotion of renewable energy is explored. This includes a comparison with Germany to highlight how key considerations of renewable energy promotion vary between a developed and developing country.

The research finds MBIs in developing countries, both internationally and nationally mandated, to be highly dependent on the overall host country context. The key aspects identified include 1) host country prioritisation of low carbon development; 2) supporting structures and policies that generate awareness, build capabilities and encourage private sector participation; and 3) access to finance, with a specific focus on cost of capital. The findings support the market-based environmental policy literature that suggests an effective regulatory framework by the state is a necessary condition for MBIs in developing countries. However it also shows that the regulatory framework alone is not a sufficient condition for successful implementation of MBIs in the developing world. Consequently, the overall host country context determines private sector interest in and the success of MBIs in developing countries.

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List of Papers

Journal papers

1) Fay, J., Kapfudzaruwa, F., Na, L., & Matheson, S. (2012). A Comparative Policy Analysis of the Clean Development Mechanism in South Africa and China. *Climate and Development*, 4(1), 40–53. doi: 10.1080/17565529.2011.628182

2) Fay, J., (2013). Market-Based Incentives in South Africa and Zambia: A Comparative Analysis of the Clean Development Mechanism. Accepted for publication in *Development Southern Africa*.

3) Fay, J., & Kumar, U., Market-Based Incentives in Developing Countries: Geographical Dispersion, Antecedents and Implications of the Clean Development Mechanism. Submitted to *Climate and Development*.

4) Fay, J., & Kumar, U. (2013). An Index-Based Model for Determining the Investment Benchmark of Renewable Energy Projects in South Africa. Accepted for publication in *South African Journal of Economics*.

Book Chapter

5) Fay, J. (2013). Renewable Energy Incentives across Varying Levels of Statehood. In Hamann, R. & Börzel, T. (eds), *Business Contributions to Climate Change Governance in Areas of Limited Statehood*. New York: Palgrave Macmillan.

The author of this thesis is either the sole author or the first author and main contributor to each of the above papers. The author of this thesis did the bulk of the work on the co-authored papers, including the initiation, conception, execution and write up for each of the articles. Paper 1 was written in collaboration with Farai Kapfudzaruwa, Lin Na and Shirley Matheson, who mainly contributed to the data collection and provided useful input and comments to the paper. Papers 3 and 4 were written in collaboration with Assistant Professor Umesh Kumar of State University of New York – Canton who provided useful input and comments on the quantitative rigour of the papers. The author of this thesis solely wrote papers 2 and 5.

Related publications not included in thesis

Lewis, D., Bell, S., Fay, J., Bothi, K., Gatere, L., Kabila, M., Travis, A., et al. (2011). Biodiversity Conservation and Poverty Traps Special Feature: On biodiversity conservation and poverty traps. *Proceedings of the National Academy of Science*, 108(34), 13907-13912. doi:10.1073/pnas.1011538108

Moldvay, J., Fay, J., & Hamann, R. (2013). Assessing opportunities and constraints related to different models for supplying wind turbines to the South African wind energy industry. Accepted for publication in *Development Southern Africa*.

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List of abbreviations

All Bond Index – ALBI

BASIC – Brazil, South Africa, India and China

CaC – Command and Control

CAPM – Capital Asset Pricing Model

CDM – Clean Development Mechanism

CDM EB – Clean Development Mechanism Executive Board

CER – Certified Emission Reduction

CDI – Climate Driver Index

CO_2 – Carbon Dioxide

CO_2e – Carbon Dioxide Equivalent

CO_2E – Fossil Fuel Based Emission

CO_2I – Carbon Dioxide Intensity

CPI – Consumer Price Index

DNA – Designated National Authority

DOE – Designated Operating Entity

EDB – Ease of Doing Business

EPI – Environmental Performance Index

ERPA – Emissions Reduction Purchase Agreement

EU ETS – European Union Emissions Trading Scheme

ETF – Exchange-Traded Fund

FDI – Foreign Direct Investment

FTSE – Financial Times Stock Exchange

GHG – Greenhouse Gases

GFCF – Gross Fixed Capital Formation

GOVI – Government Bond Index

GW – Gigawatt

GEF – Grid Emissions Factors

GDP – Gross Domestic Product

HDI – Human Development Index

HFC – Hydrofluorocarbon

IPP – Independent Power Producers

IRR – Internal Rate of Return

JSE – Johannesburg Stock Exchange

kWh – kiloWatt hour

LDC – Least Developed Country

LoA – Letter of Approval

MBI – Market Based Incentives

MW – Megawatt

NCB – National CDM Board

NDRC – National Development and Reform Commission

NLGCC – National Leading Group on Climate Change

N_2O – Nitrous Oxide

OECD – Organisation for Economic Co-operation and Development

OTHI – Other Bond Index

PFC – Perfluorocarbon

PII – Political Instability Index

PPM – Parts Per Million

PPP – Public-Private Partnership

PIN – Project Idea Note

REFiT – Renewable Energy Feed In Tariff

REIPPP – Renewable Energy Independent Power Producers Procurement

RoE – Return on Equity

SO_2 – Sulphur Dioxide

SACDMIA – South Africa Clean Development Mechanism Industry Association

SARI – South African Renewables Initiative

SSA – sub-Saharan Africa

tCO_2e – Tonnes of Carbon Dioxide Equivalent

UNEP – United Nations Environmental Programme

UNFCCC – United Nations Framework Convention on Climate Change

WGI – World Governance Indicators

YTM – Yield to Maturity

1.0 Introduction

1.1 Context and Motivation

The rising concentration of greenhouse gases (GHG) in our atmosphere and resulting changes in the global climate are a controversial but increasingly recognised global challenge (Stern, 2007). Climate change poses a serious threat to economic advancement in developing countries, particularly sub-Saharan Africa (SSA). Limiting the long-term average temperature increase to two degrees Celsius, commonly correlated with carbon dioxide (CO_2) parts per million (ppm) of 450, has been established as the consensus mitigation target to maintain a stable climate (IEA, 2008, 2011; Pachauri & Reisinger, 2007). Unfortunately, achieving this threshold is becoming more and more unlikely as we are collectively locking into an emissions scenario that is estimated to go well beyond the target 450 scenario. The World Energy Outlook 2011 ominously predicts the following:

> "Four-fifths of the total energy-related CO_2 emissions permissible by 2035 in the 450 scenario are already 'locked-in' by our existing stock (power plants, buildings, factories, etc.). If stringent new action is not forthcoming by 2017, the energy-related infrastructure in place will generate all the CO_2 emissions allowed in the 450 scenario up to 2035, leaving no room for additional power plants, factories, and other infrastructure unless they are zero-carbon, which would be extremely costly" (IEA, 2011, p. 2).

The resource intensive development model used since the industrial revolution is increasingly recognised as ecologically unsustainable and acknowledged as a key driver of environmental degradation (Kowalski et al., 2011; McDonough & Braungart, 2002). The

implication is that in order to meet the needs of the world's increasing population without exceeding the earth's environmental boundaries, a more sustainable development alternative is necessary, especially for developing countries seeking rapid economic advancement (Rockström et al., 2009). De Boer and van Bergen (2012) summarise this conundrum as follows, "If we are already living beyond our means but at the same time 3 billion people need to rise out of poverty, then the central challenge of our age must be to decouple human progress from resource use and environmental deterioration" (p. 4).

"Virtually all aspects of economic activity – individual consumption, business investment, and government spending – affect GHG emissions and, hence, the global climate" (Aldy & Stavins, 2012a, p. 45). This makes climate change an unprecedented challenge because "incentives for sacrificing the future for the present are often overwhelming" (Daily & Ehrlich, 1992, p. 761). This creates a "time inconsistency problem between short-term survival strategies and longer-term environmental concerns" (Lufumpa, 2005, p. 366). The unfortunate outcome is summarised by Hart (1997), "in meeting our needs, we are destroying the ability of future generations to meet theirs" (p. 67).

Locking in an emissions trajectory that could destabilise the climate is especially disconcerting for countries with the least ability to cope with the adverse effects of climate change because they will be the most negatively impacted (Parry, 2009; Pettit, 2004; Someshwar, 2008). This is referred to as 'climate injustice' (Comim, 2008) and is worrisome for SSA, because it is the world's least developed region, with insufficient capacity to cope with the anticipated environmental shocks (UNDP, 2011). Veit (2010) notes "Africa, with its widespread rural poverty, relatively high dependence on rain fed agriculture and chronic energy crises, has of all regions the lowest capacity to adapt to a changing climate" (p. 121).

Decision makers in developing countries, and particularly in SSA, acknowledge the long term risks of climate change but do not consider it a top priority when compared to economic advancement and poverty alleviation (Ellis, Winkler, Corfee-Morlot, & Gagnon-Lebrun, 2007). The Kyoto Protocol, the legally binding international agreement to reduce GHG emissions, provides the rationale why developing countries are not perceived as responsible for taking immediate action to reduce their emissions (UNFCCC, 1997). The Kyoto Protocol is based on the principle that nations will address climate change, "on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead" (United Nations, 1992, Article 3, paragraph 1). This provides an explicit recognition that developing countries have little responsibility for the historic accumulation of GHG, and therefore developed country shall take the lead in reducing GHG emissions (Aldy & Stavins, 2012b).

Even though developing countries are not considered responsible for addressing climate change, reducing their GHG emission levels is increasingly important because developing countries are where future growth will occur. The grouping of developed countries referred to as the Organisation for Economic Co-operation and Development (OECD) are no longer the growth drivers of GHG emissions as "non-OECD countries account for 90 per cent of population growth, 70 per cent of the increase in economic output and 90 per cent of the energy demand growth over the period from 2010-2035" (IEA, 2011, p. 1). This trend highlights the urgent need for developing countries to begin reducing their emissions if we are to avoid locking-in a scenario above the 450-ppm threshold. The anticipated emissions growth in developing countries is one of the reasons why the focus of this thesis is on developing countries, while the notion of

climate injustice and its implications is the motivation for why SSA is selected as the primary study area of this thesis.

A major challenge to taking action on climate change is that the negative externality costs associated with GHG emissions are currently not counted. The result is that low carbon alternatives are often perceived as prohibitively expensive in comparison to fossil fuel based options that are a leading cause of GHG emissions (Schneider & Goulder, 1997; Wigley, Richels, & Edmonds, 1996). To overcome this challenge, low carbon alternatives require innovative policies and mechanisms to ensure the cost-benefit analysis applied by decision makers includes not only financial costs, but also the long-term social and environmental externalities associated with each option (Parry, Palutikof, Van der Linden, & Hanson, 2007). Incentive mechanisms must also be capable of attracting significant private sector participation, as public funding alone is not sufficient to meet the challenge posed by climate change (Unruh & Carrillo-Hermosilla, 2006).

The two main environmental policy intervention options to reduce GHG emissions are command and control (CaC) regulation and market-based incentives (MBIs)[1]. CaC regulations limit the quantity of allowable emissions by setting environmental standards (performance or technology) for each individual source of pollution (Hahn, 1989). Performance standards mandate the amount of emissions allowable per unit of economic activity and technology standards require a particular emission reducing process or industrial equipment be used (Jaffe & Stavins, 1995). MBIs are "regulations that encourage appropriate environmental behaviour through price signals rather than explicit instructions" (Stavins & Whitehead, 1997, p. 105).

[1] There are numerous terms used for what I refer to as market-based incentives, including market-based instruments, market-based mechanisms, incentive-based programs, market-based policy, economic-incentive based policy and economic incentives. For consistency, I use market-based incentive or market mechanism throughout this thesis.

Options include environmental taxes, marketable permits and subsidies. Environmental taxes are designed to "collect from those deemed responsible for pollution" (Fullerton, 2001, p. 230) to pay for any necessary mitigation, and serve as a mitigating factor by increasing the cost to pollute. The marketable permit approach (also referred to as cap and trade) allocates a finite number of tradable emission permits to firms that allow a specified amount of pollution. Firms that minimise their total emissions below their permitted level are eligible to trade their unused permits to other firms that were unable to sufficiently reduce their emissions. In theory, the marketable permit approach is believed to minimise the overall cost of achieving a specified level of emissions if "firms minimise their total production costs, and the market for permits is competitive" (Hahn, 1989, p. 96). Subsidies, with regard to MBIs, aim to incentivise low carbon development activities without stifling economic growth but require a financial subsidy (Parry & Williams, 1998).

Considering that developing countries are not deemed responsible for reducing GHG emissions, measures that tax or place an absolute limit on their emissions are often deemed inappropriate for developing countries (Babiker, Reilly, & Jacoby, 2000). The rationale is that limiting or taxing GHG emissions may hold back economic growth because low carbon alternatives are more expensive and less proven than traditional carbon intensive development approaches (Bruggink, 2012). As a result, MBIs (specifically subsidies) can be argued as the most acceptable option for developing countries to reduce GHG emissions because they do not stifle income generation and economic development opportunities (Savedoff, 2011).

MBIs are considered by many to be an effective means to deliver environmental aims in a cost-effective manner (Hahn & Stavins, 1991; Pagiola, Bishop, & Landell-Mills, 2002; Sandor, Bettelheim, & Swingland, 2002). There is a substantial body of literature concerning market-

based environmental policy from a developed economy perspective (Bechberger & Reiche, 2004; Butler & Neuhoff, 2008; Haas et al., 2011; Haas et al., 2004; Szarka, 2006). The literature often makes the broad generalisation that the developing world lacks the regulatory capabilities necessary to effectively administer a market mechanism (Aldy & Stavins, 2012a; Aldy, Ley, & Parry, 2008). For example, Hahn and Stavins (1991) state,

> "Appropriate mechanisms will vary depending on relevant government agency's resources and capabilities. Much of the work on markets and emission taxes assumes that there is a reasonably sophisticated environmental control agency that can administer incentive-based programs. This may be a reasonable assumption for many industrialized nations, but is probably the exception, rather than the rule, in developing countries. The design of incentive-based instruments that require less administrative expertise and fewer resources to implement could facilitate more and better applications" (p. 14).

In addition, Sawin (2006) points out that, "specific national characteristics, particularly within developing countries, can play an important role in determining barriers from one country to the next" (p.73). Specific barriers facing developing countries are predicted to include poor infrastructure, long travel distances, low technical capabilities and low literacy rates (Martinot et al., 2002). Additional concerns assumed to increase perceived investment risk in developing countries are political, regulatory and market stability (Sawin, 2006). However, the literature is lacking specific analysis of the underlying drivers of MBIs within developing countries (Aldy & Stavins, 2012b).

The need for a strong regulatory framework for MBIs to work, as highlighted in the academic literature, is an overarching theme explored throughout this thesis by linking to the

emerging literature on governance in areas of limited statehood (Börzel & Risse, 2010; Risse & Lehmkuhl, 2006; Risse, 2010). According to Lehmkuhl and Risse (2006), areas of limited statehood can occur within nation-states if they have limited ability to effectively implement and enforce policy. In these situations, alternative non-state actors can play a role in filling the void left by the state (Börzel, Héritier, Kranz, & Thauer, 2010). With regard to MBIs, the state must play a role, to varying degrees, in establishing the policy and regulation of an incentive mechanism but relies on the non-state actor to implement the activities that reduce GHG emissions. This is called "governance with government" within the literature relating to governance in areas of limited statehood and is the explicit link to market-based environmental policy (Börzel & Risse, 2010).

Two main MBIs applicable to developing countries are explored, the internationally mandated Clean Development Mechanism (CDM) and nationally mandated renewable energy promotion. These are selected because they are the only GHG reducing MBIs that are currently being implemented specifically within SSA (Arens et al., 2011; Nganga, 2012). The CDM is a project-based offset mechanism of the Kyoto Protocol that allows eligible developing countries to host projects that generate and sell emission offsets to developed countries (UNFCCC, 1997). The CDM was established with the dual objective of helping developing countries achieve sustainable development while lowering their 'business as usual' emissions. In order to do so, the CDM provides a subsidy in exchange for verifiable carbon credits that represent reductions in emissions that would have not otherwise occurred. The intent of the CDM is that the international climate regime, led by developed countries attempting to meet their legally binding emission reduction targets under the Kyoto Protocol, will fund and regulate the CDM projects, placing little financial or regulatory burden on the host country government. In theory, all

rational firms will take advantage of any "profitable opportunities for innovation" including an abatement subsidy such as the CDM (Porter & Linde, 1995, p. 99). In reality, this has not happened as the CDM has resulted in inequitable utilisation across eligible developing countries, and utilisation is especially low in SSA (Arens et al., 2011; Boyd et al., 2009; Byigero, Clancy, and Skutsch, 2010; Jung, 2006). This gives rise to a compelling question of why is such a theoretically attractive MBI that is internationally mandated, regulated and funded so unevenly distributed across the developing world. A full analysis of the CDM is presented in this thesis (see papers 1, 2 and 3).

Similarly, incentives for renewable energy promotion are being implemented at the national level, in both developed and developing countries. Governments within SSA, plagued by chronic energy shortages, have begun exploring ways to increase renewable energy supply within their overall energy mix (Nganga et al., 2012, Pegels, 2010). Renewable energy promotion differs from the CDM in that the host developing country pays the required subsidy (as opposed to developed countries).

Renewable energy is typically promoted using either a demand driven or price driven strategy (Haas et al., 2004). Within the demand driven strategy, the state sets a target of renewable energy supply to be achieved within the overall energy supply, typically through quotas on electricity suppliers through a system of tradable green certificates (Menanteau, Finon, & Lamy, 2003). This is less applicable to developing countries because the structure of the power industry is predominantly characterised by monopolistic government run utilities, as is the case in most of SSA including South Africa (Eberhard & Gratwick, 2011).

Due to the limited applicability of demand driven strategies in SSA, price driven strategies are the focus of renewable energy promotion in this thesis. Price driven strategies are

characterised by the state setting a price that is intended to reduce uncertainty and attract investment. The best-known mechanism is the renewable energy feed in tariff (REFiT), whereby a premium tariff price (either fixed or competitively bid) is established through long-term power purchase contracts (Huang and Wu, 2011). A fixed price REFiT has been effectively used to exceed renewable energy targets in a number of developed countries, most notably Germany (Janet and Martinot, 2011). After initially considering a REFiT for South Africa, a competitive bidding process was implemented whereby prices are determined through a staged competitive bidding process called the Renewable Energy Independent Power Producers Procurement programme (REIPPP). Renewable energy promotion in South Africa is compared to the German experience in this thesis (see papers 4 and 5).

Aldy and Stavins (2012b) recently called for research to focus on innovative ways to incentivise emission reductions in developing countries. This indicates a clear gap in the literature on market-based environmental policy resulting from a relative absence of research on 1) what constitutes an effective host country environment for MBIs in developing countries, and; 2) the role of the state in ensuring success of MBIs in developing countries. The gap identified in the literature is the motivation for why this thesis explores MBIs in developing countries, with a particular focus on the host country context.

1.2 Objective and Research Questions

The overarching objective of this thesis is to contribute to a better understanding of MBIs in developing countries. I aim to make a theoretical contribution to the literature regarding market-based environmental policy by clarifying which aspects of the host country context are particularly important to the effectiveness and efficiency of MBIs in developing countries. It is my hope that this thesis will contribute to a better understanding of how MBIs in developing

countries can facilitate alternative approaches capable of meeting today's needs without destabilising our climate.

In line with the objective of this thesis, the following are the research questions that the empirical papers of this thesis collectively investigate and answer.

Main Research Question:

How does host country context affect MBIs in developing countries?

Subordinate questions:

- How has the CDM performed to date and why? What are the key considerations influencing CDM utilisation or non-utilisation across developing countries? What are the key host country macro indicators influencing the utilisation of the CDM?
- What are the key considerations for renewable energy promotion in developing countries versus developed countries? How do financial considerations affect the success of MBIs? Using electricity as a key example, how does statehood impact the cost differential between electricity supplied by renewable energy sources and the existing tariff structure?

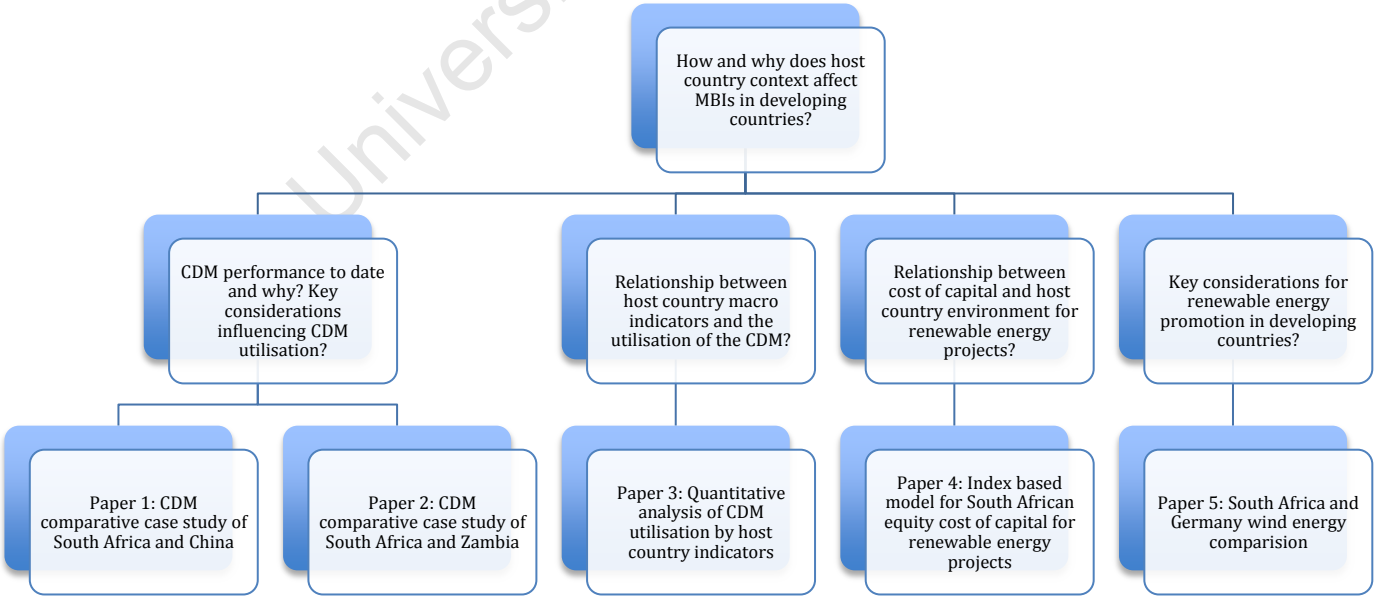
1.3 Summary of Papers

This is a single-themed cohesive PhD thesis that includes publications comprised of five inter-linked papers that individually and collectively speak to the main research question. The main research question motivates and links each of the empirical papers into a cohesive body of research. Each empirical paper directly investigates one or more subordinate research questions, collectively responding to the main research question.

I conceptualised, planned and implemented the five empirical papers as part of this PhD thesis with my supervisor's guidance. Paper 1 is a comparative case study between the CDM

experience of South Africa and China (co-authors Farai Kapfudzaruwa, Lin Na and Shirley Matheson). Paper 2 provides a comparative case study of the CDM in South Africa and Zambia. Paper 3 is a quantitative analysis of regional dispersion and country antecedents for utilisation of the CDM (co-author Umesh Kumar). This paper adopted deductive hypothesis testing based on arguments inducted from papers 1 and 2. Paper 4 proposes an index-based model to estimate the cost of capital for renewable energy projects in South Africa. Paper 5 expands on the work of paper 4 with a comparative case study of the South African and German experience incentivising renewable energy, focusing on how the host country context (with particular emphasis on level of statehood) affects cost of capital, and the corresponding impact on the viability of MBIs. Figure 1.1 illustrates how the overarching research question and sub-questions give rise to the research question(s) focused on in each of the papers.

Figure 1.1: Research Questions Link to Empirical Papers



Collectively, the papers provide a single-themed, cohesive thesis linked by the main research question that makes a theoretical contribution to understanding the role of MBIs in developing countries. The following is a concise summary of the each of the papers and their key arguments, which in turn gives rise to the overarching, collective arguments of the thesis. The full empirical papers are included in Section 3.

1.3.1 Paper 1

A Comparative Policy Analysis of the CDM in South Africa and China

The first paper is a qualitative comparative case study of CDM experiences in South Africa and China. The paper addresses the subordinate research question regarding CDM performance to date, exploring key considerations and underlying drivers that influence CDM utilisation.

China and South Africa were selected as the case study countries because both are considered emerging economies but have vastly different experiences engaging the CDM. South Africa and China's economies are heavily reliant upon fossil fuel based development approaches so theoretically both provide significant opportunities to leverage the CDM to reduce emissions through renewable energy or efficiency gains. However, experience to date indicates that South Africa only accounts for 0.9 per cent of the worldwide registered annual certified emission reductions (CERs), whereas China has dominated the market, generating 54 per cent of the annual worldwide CERs (Fenhann, 2011). This demonstrates that CDM alone cannot drive the transformation toward a low carbon pathway. The analysis in this paper reveals that a strong industrial and energy policy of the host country government plays a crucial role in the engagement with the CDM. The paper also finds that active engagement by key government and private sector stakeholders, as well as the presence of a friendly business environment positively impacts the utilisation of the CDM.

This comparison provides insight into how China has set national and regional policy that is supported by the CDM. Such policy measures are complementary to the CDM and increase its utility as an MBI. Until recently, South Africa has not provided similar policy support to encourage CDM usage, which has resulted in low participation. The paper points out the need for complementary policies and integrated support to overcome hesitancy to engage with new and unproven MBIs such as the CDM.

1.3.2 Paper 2

MBIs in South Africa and Zambia: A Comparative Analysis of the CDM

The second paper is also a qualitative comparative analysis of the CDM with the geographic focus on Southern Africa. The paper explores why, in theory, such an attractive incentive opportunity has been so under-utilised in Africa. The paper compares the experience of the CDM in South Africa and Zambia. These two Southern African countries were selected because of their varying levels of statehood, South Africa being an emerging, middle-income economy, while Zambia is classified as a least developed country (LDC).

General challenges affecting the CDM were identified in the literature to be awareness, capacity, eligibility and access to finance (Arens & Kreibich, 2011; Bowen & Fankhauser, 2011; Karani & Gantsho, 2007). The paper then compares how these overarching issues specifically impact the CDM experience in South Africa and Zambia. The paper finds that complexities relating to awareness, capacity, eligibility and finance have different implications at the national and local level. The paper engages the subordinate research questions by identifying precisely how common challenges to CDM affect countries at differing levels of statehood.

1.3.3 Paper 3

MBIs in Developing Countries: Geographical Dispersion, Antecedents and Implications of the CDM

The third paper continues to explore the CDM by performing a quantitative analysis of how the CDM has performed to date throughout the developing world. The paper uses descriptive statistics to assess the state of CDM dispersion and continues with regression analysis to identify the factors influencing the utilisation of the CDM. The analysis uses the CDM projects per capita as the dependent variable instead of absolute CDM projects. This accounts for the differences in scale across the eligible developing countries by levelising the countries by their population, making a country comparison relevant. Levelising by population, as opposed to an economic indicator, is deemed appropriate with regard to climate change because the "location of emissions of greenhouse gases has no effect on the global distribution of damages" (Stavins, 1997, p. 7).

The independent variables and the rationale for their use are summarised in Table 1.1. Each indicator is described in detail and cited in paper 3. The indicators were selected based on the findings of papers 1 and 2, as well as drawn from the academic literature. An inherent challenge in this research is to identify appropriate and valid macro indicators that are not highly correlated. To address this, the analysis applied a plus or minus 0.700 correlation threshold in order to avoid any distorting multicollinearity issues (Farrar and Glauber, 1967).

Table 1.1: Independent Variable Summary based on Paper 3

Variables	Rationale	Citation
Foreign Direct Investment per capita, Gross Domestic Product per capita, Gross Fixed Capital Formation per capita (World Bank Statistics)	CDM projects are privately funded and attracted by countries with complementary financial resources.	*Paper 2;* Jung, 2006; Byigero et al., 2010; Dinar et al., 2008; Dolsak and Bowerman, 2007; Lütken, 2008; Niederberger, A., & Saner, R. (2005).

Fossil fuel based emissions per capita and Carbon Dioxide Intensity (Carbon Dioxide Information Analysis Center)	CDM gives monetary value to emission reductions, correspondingly the market searches for the highest volumes at the lowest cost.	*Paper 1*; Ellis et al., 2007; Wang and Firestone, 2009; Flues, 2010
Ease of Doing Business Ranking (World Bank / IFC)	Business and economic environment is an important factor in determining the host country level of risk for CDM projects.	*Paper 1 & Paper 2*; Oleschak & Springer, 2007; Baffoe-Bonnie & Khayum, 2003
World Governance Indicators (World Bank) and Political Instability Index (Economist Intelligence Unit)	Governance affects CDM procedures such as evaluation criteria and approvals. Political risk decreases investment and increases cost of capital, negatively affecting CDM implementation.	*Paper 1 & Paper 2*; Ellis et al., 2007; Newell, 2008; Nhamo, 2006; Jung, 2006; Oleschak and Springer, 2007
Environmental Performance Index (Yale Center of Environmental Law and Policy) & Climate Driver Index (Center for Global Development)	High levels of environmental and climate risk may create a greater awareness to proactively address the cause.	*Paper 1*; Nussbaumer, 2009
Human Development Index (United Nations Development Programme)	A country overall level of development signals its ability to prioritise discretionary action such as engaging with the CDM.	*Paper 1 & Paper 2*; Boyd et al., 2009; McGowan, 2008

This paper reaffirms that despite the stated intent of the CDM to have equitable dispersion, it has not been utilised across all eligible, developing countries in an equitable manner, either from an absolute or levelised perspective. The multi-variant regression analysis finds the human development index (HDI) to be the most statistically significant determinant of CDM uptake, as well as environmental performance index (EPI) and world governance indicators (WGI) to be significantly related to CDM project implementation. The findings of the paper suggest that without having achieved a minimum threshold of development, even the most economically advantageous incentive will not be fully maximised. This suggests that the one-

size-fits all approach of the CDM is problematic if equity across all participating countries is desirable.

Paper 3 contributes to the overall thesis by providing empirical evidence of how the CDM has performed to date by identifying significant relationships between host-country indicators and levelised CDM utilisation.

1.3.4 Paper 4

An Index-Based Model for Determining the Investment Benchmark of Renewable Energy Projects in South Africa

The fourth paper shifts the focus from the internationally mandated CDM to nationally mandated renewable energy promotion. The paper proposes an index-based model for determining the internal rate of return[2] (IRR) required by equity investors for renewable energy projects, and applies this to the South African context.

Financial markets act as a benchmark for the optimal level of asset allocation and returns based on risk inherent in the economies. Investors require an optimal return on their investment given finite resources. In relatively new sectors like grid-connected renewable energy, many investors face difficulty in assessing proper return, making them more averse to financing such projects. South Africa has significant potential for renewable energy projects (Banks & Schäffler, 2006), but an arbitrary choice of the required rate of return for project evaluations can negatively affect funding decisions.

The index-based model presented in this paper proposes that risks inherent to South Africa result in an equity IRR requirement of 22.96 per cent. The significance is that level of

[2] Internal rate of return is the metric used to measure and compare the profitability of potential investments

statehood and associated risks have a significant impact on the financing required to attract private sector participants.

This paper relates to the overall thesis by identifying and providing a model to assess the financing requirements that significantly impact the ability of MBIs to promote renewable energy in South Africa, which can be applied to other developing countries.

1.3.5 Paper 5

Renewable Energy Incentives across Varying Levels of Statehood

The fifth paper builds on paper 4 to explore the key considerations affecting MBIs for renewable energy promotion in developing countries. The paper explores how level of statehood impacts the cost of capital for renewable energy projects, which in turn influences the required tariff and price differential between electricity from renewable sources as compared to existing fossil fuel dominated electricity supply.

A comparative analysis of hypothetical wind energy projects in South Africa and Germany is presented to highlight how varying host country context affects the cost of renewable energy. The two countries were selected because they are at different stages of implementing price driven MBIs to promote renewable energy. South Africa is an emerging economy with a nascent wind energy sector, while Germany is a developed country with an advanced wind energy industry.

MBIs need to provide investors with a return commensurate to the risk associated with the activity and its host environment. In most cases MBIs are required to bridge the cost differential between traditional fuel sources and renewable sources, and provide assurance that private sector, independent power producers (IPPs) will receive a financial return that corresponds with the host country risk. The financial support to the renewable energy tariff price

varies by country and is a result of the differential between the current tariff price (typically fossil fuel based power generation) and renewable energy costs. A key challenge identified in the paper is to determine a price per kilowatt-hour that is the lowest possible cost but is still attractive to private sector led renewable energy development.

The comparison of hypothetical wind farms demonstrates a significant difference in cost of capital between Germany and South Africa. Using the index-based model proposed in paper 4 as of January 2012, Germany's equity IRR is estimated as 7.30 per cent and South Africa's is estimated as 20.77 per cent[3]. Using financial modelling and publically available data for all key inputs, a required tariff rate is estimated to be €9.7c in South Africa and €6.3c in Germany. This represents a 54 per cent difference for the cost of wind-based electricity driven mainly by cost of capital implications that are in large part based on host country context.

This paper contributes to the overall thesis by exploring the key financial considerations for renewable energy incentives in developed countries versus developing countries. It builds upon the proposed model in paper 4 to extrapolate a required electricity tariff rate with the ability to attract IPPs. The research provides a better understanding of how to maximise effectiveness and efficiency by setting a tariff that will minimise the cost of renewable energy but still entices IPPs to develop the renewable energy projects. Paper 5 contributes to answering the main research question by explaining how host country environment impacts financial considerations and how that in turn affects the overall cost of renewable energy.

1.4 Theoretical Contribution

This thesis constructs new knowledge through the identification and suggestion of "plausible connections and relationships that have not yet been glimpsed" (Van Maanen, Sørensen, &

[3] The small difference in the estimated IRR is a result of the index model being applied at different points in time.

Mitchell, 2007). I aim to make a theoretical contribution by filling the gap I have identified in the market-based environmental policy literature resulting from a relative absence of research in developing countries on what constitutes an effective host country environment for MBIs and the role of the state in ensuring success of MBIs. Corley and Gioia (2011) define theoretical contribution as "a significant theoretical advancement in our understanding of a phenomenon" (p. 12). In line with this definition I query the use of market-based environmental policy, specifically focusing on the function (effective as a means to an end as opposed to ineffective) and generalisation (general as opposed to local phenomenon) of MBIs within the context of the developing world (Davis, 1971).

Policy makers and scholars have suggested that MBIs are an effective and efficient approach to reducing GHG emissions (Hahn & Stavins, 1991; Held, Ragwitz, & Haas, 2006; Sandor et al., 2002; Schmalensee & Stavins, 2012). However it is also assumed that the developing world lacks the necessary regulatory structures and enforcement capability to effectively administer an MBI (Aldy & Stavins, 2012a; Aldy, Ley, & Parry, 2008; Blackman & Harrington, 1989). I show that this assumption is too general and does not always hold true because MBIs are highly dependent on the specific host country context. Papers 1 and 2 argue that engagement with the CDM is linked to the host country priorities and requires alignment with local capabilities and capacity. Papers 4 and 5 make clear the relationship between the host country and cost of capital, which in turn affects efficiency and effectiveness of incentives for renewable energy promotion. Collectively these papers highlight that the success or failure of MBIs is closely aligned to the specific host country context.

The empirical papers individually and collectively argue that MBIs cannot be implemented in a general manner. Papers 1, 2 and 3 show that even when a strong international

regulatory structure is put in place to administer an MBI, as with the UNFCCC regulating the CDM, results are varied and inequitable. This highlights that customised MBIs are required for different country contexts. Paper 3 highlights that CDM uptake significantly relates to the overall level of development attained by the host country, while paper 5 shows how cost of capital within the host country significantly impacts the effectiveness and efficiency of promoting renewable energy.

Collectively the papers show that a key factor influencing MBIs is the host countries' level of statehood. This explains why the efficiency and effectiveness of MBIs is reliant on the overall host country context, and how the local framework either supports or hinders private sector involvement.

1.5 Paradigm & Methodology

The post-positivist ideological position is the underlying basic belief system that my research most closely adheres to (Cook & Campbell, 1979). This suggests that attaining knowledge about reality is always subject to falsification. As a result, it is necessary for findings to be "subjected to the widest possible critical examination to facilitate apprehending reality as closely as possible (but never perfectly)" (Guba & Lincoln, 1994, p. 110). My worldview is also influenced by pragmatism, recognising that meaning is derived from the experiences that create the knowledge (Johnson & Onwuegbuzie, 2004). This thesis attempts to be persuasive and interesting by allowing the reader, as stated by Siggelkow (2007), "to see the world, and not just the literature, in a new way" (p. 21). The research is not confined to either qualitative or quantitative methods, allowing for the objective and research questions to determine the most appropriate method for each aspect of the study.

The thesis as a whole uses both qualitative and quantitative methods. Johnson and Onwuegbuzie (2004) define the mixed methods approach as "the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study" (p. 17). Yin (1981) asserts "the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone" (p. 62). Furthermore, Johnson and Onwuegbuzie (2004) highlight the advantages of a mixed method approach with the following comments:

> "It is an expansive and creative form of research, not a limiting form of research. It is inclusive, pluralistic, and complementary, and it suggests that researchers take an eclectic approach to method selection and the thinking about and conduct of research. What is most fundamental is the research question—research methods should follow research questions in a way that offers the best chance to obtain useful answers." (pp. 17-18).

The mixed method approach was deemed useful for this study because it does not limit the methods for fully understanding how and why the host country context affects MBIs. This is in line with Denzin's (2010) mixed- and emergent-methods discourse, which highlights "the critical researcher, the bricoleur, the jack of all trades, produces a bricolage based on the use of many different interpretive practices and methodological tools" (p. 423).

This thesis is ultimately a social science inquiry, whereby the case study method is used collectively across the five papers to expand the knowledge about how MBIs are emerging in SSA through a process of describing, understanding, and explaining. In addition, financial modelling techniques that extend beyond social science methods are applied (papers 3, 4 and 5) as part of the 'bricolage' approach. An embedded case study approach is used. Tietje and Scholz

(2001) expand on the embedded case approach and its focus on a single multi-dimensional case with the following:

> "In an embedded case study, the starting and ending points are the comprehension of the case as a whole in its real-world context. However in the course of the analysis, the case will be faceted either by different perspectives of inquiry or by several subunits" (p. 2).

The culmination is primarily an inductive, explanatory study of MBIs and their practical implementation, though paper 3 also uses deductive reasoning to test factors identified in papers 1 and 2 and derived from the literature. The overarching embedded case study design focuses on two types of MBIs: 1) the CDM – an international mandated MBI; and 2) the promotion of grid-connected renewable energy – a nationally mandated MBI. In order to purposefully build the theory, these two analytical case studies were drawn from a non-random theoretical sample (Eisenhardt, 1989). They were selected because they are MBIs currently being implemented on a large scale in SSA, with one mandated at the international level and the other at the national level. These two primary case studies serve as distinct analytic units that support the overall findings, and generalise my main conclusions (Yin, 1994).

The theory I am attempting to build is "situated in and developed by recognizing patterns of relationships among constructs within and across cases and their underlying logical arguments" (Eisenhardt & Graebner, 2007, p. 25). According to Gibbert, Ruigrok and Wicki (2008), "case studies are considered most appropriate as tools in the critical, early phases of a new management theory, when key variables and their relationships are being explored" (p. 1465). Considering the emerging stage of MBI development in developing countries, the case study approach is deemed appropriate for this research.

The thesis arguments are structured within five empirical papers, each engaging the main research question from a different but complementary viewpoint. Figure 1.2 outlines the broad methodologies adopted within each of the five papers.

Figure 1.2: Thesis Methodologies – Collective and Individual Papers

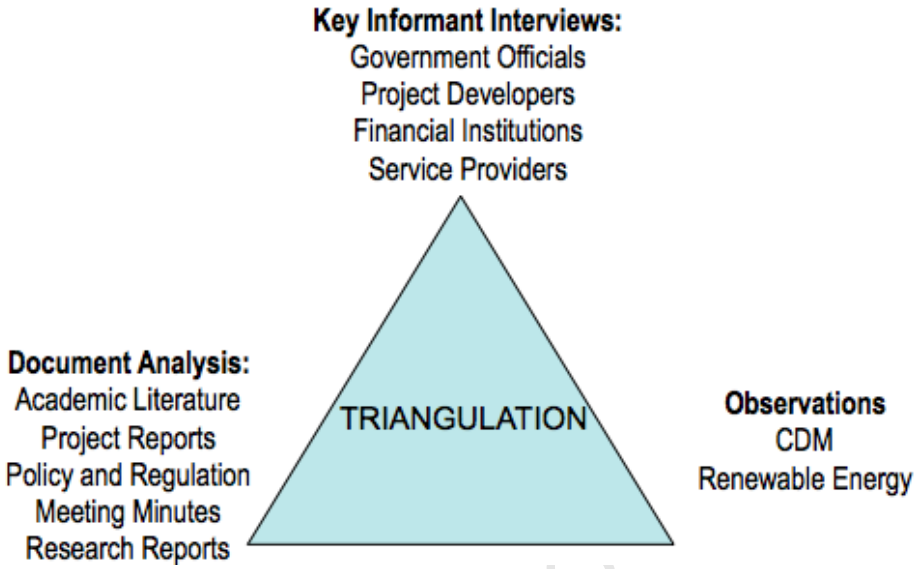
Papers 1 and 2 both use a comparative cross country case study approach to specifically address the research sub-questions pertaining to CDM performance and key considerations influencing utilisation. As discussed in Section 1.4, South Africa is first compared to CDM leader China in paper 1, then to LDC Zambia in order to inductively explore the CDM. Paper 3 utilises a quantitative methodology to show the emerging relationship between levelised CDM utilisation and the underlying host country macro indicators. This engages specifically with the sub-question asking what country macro indicators influence the utilisation of the CDM. Viewed as a collective sub-unit, papers 1, 2, and 3 provide a depiction of how the CDM has been applied and the challenges it has faced.

Papers 4 and 5 combine to explain how renewable energy promotion is developing in South Africa, and specifically how financing considerations inherent to the host country significantly impact renewable energy promotion. Paper 4 requires a quantitative method to determine the cost of equity financing in South Africa specific to renewable energy. The proposed index model to determine cost of equity capital is necessary to perform the comparative case study of paper 5 between South Africa and Germany, a developed country acknowledged as a world leader in renewable energy promotion. Paper 5 specifically engages the subordinate research questions to explore the key considerations for renewable energy promotion in developed countries versus developing countries, using cost differential between electricity supplied by renewable energy sources and the existing tariff structure as the key example. The mixed method approach inherent to papers 4 and 5 results in an analysis of how the underlying host country environment significantly impacts the cost and effectiveness of renewable energy promotion.

Specific data collection methods are explained within each of the five empirical papers. First of all, an extensive literature and document review was conducted as a means of exploring and understanding the current discussions around the CDM and renewable energy promotion, both globally and specifically to SSA. The use of multiple data sources was employed to triangulate key points and enhanced the validation process by ensuring that weaknesses inherent in one approach were counterbalanced via strengths in another (Denzin, 1989; Jick, 1979). To mitigate the bias that is associated with interviews, the research used numerous and highly knowledgeable informants who viewed and understood MBIs from multiple different perspectives (see Table 1.2 Interview List). Descriptive statistics and field observations were

used to validate data from interviews and relevant literature. Figure 1.3 illustrates the triangulation process embedded within this data collection approach.

Figure 1.3: Data Collection Triangulation



The qualitative data sources used throughout the thesis include the following:

1. All relevant documents were reviewed, including policy documents, feasibility reports, environmental impact assessments (specific to renewable energy projects in South Africa), CDM project design documents including all South African renewable energy projects and available financial models via the United Nations Framework Convention on Climate Change (UNFCCC) website, reports, meeting notes and position papers, with specific focus placed on CDM projects (located in SSA and China) and renewable energy projects (located in South Africa and Germany). Statistics were also used from the UNFCCC website (papers 1, 2), United Nations Environmental Programme (UNEP) Risøe CDM project pipeline (papers 1, 2, 3) relevant indices (fully detailed in papers 3 and 5) and Bloomberg Market

Data (paper 4). Documents and archival data were located from publically available databases and sourced from interviewees. All documents have been cited and referenced in the empirical papers.

2. Key informant interviews (papers 1, 2, 5). Interviews with respondents with considerable knowledge of the CDM or renewable energy promotion were targeted to gain further insight into the perspective of elite stakeholders for papers 1, 2 and 5 (Welch, Marschanpiekkari, Penttinen, & Tahvanainen, 2002). To identify interviewees, a list of key CDM stakeholders was compiled from CDM association lists, project documents, CDM analysis reports and climate related conference proceedings. Furthermore, asking each contacted interviewee for additional referrals for information rich key informants proved effective (Mason, 2002; Welch et al., 2002). Semi-structured interviews were conducted with open-ended questions to give the interviewee the latitude to fully articulate their responses (Aberbach and Rockman, 2002). The interviews focused on a set of targeted questions developed from the literature and document review and allowed for elaboration by the interviewee to facilitate discussions on a wide range of issues pertinent to the research (Bernard, 2005; Bryman, 1992). To gain numerous perspectives, interviews were conducted with government officials, academic researchers and private sector representatives, including investors, service providers, CDM project developers and IPPs. A list of all interviews, including place and dates, are included in Table 1.2.
3. Observation and analysis of the CDM and renewable energy activities is another source of data incorporated in all five papers. Informal discussions and experiences with CDM and renewable energy projects in South Africa and Zambia provided insights into practical MBI examples and how they were emerging. Specifically the research benefited from access to

two wind energy projects under development in the Eastern Cape of South Africa (both also having applied for CDM), as well as access to the first registered CDM project in Zambia.

Table 1.2: List of Interviews

Paper	Interviewee	Perspective	Date	Place
1 & 2	Albrecht Van Ruffen, Manager, N-Serve Carbon Consulting	CDM Consultant	28.10.2009	Telephonic - Netherlands
1 & 2	Anton-Lewis Oliver, Manager, NU Planet	CDM Consultant	02.11.2009	Telephonic – South Africa
1 & 2	Ed Gluckman, Managing Director, Global Carbon Exchange	CDM Consultant	16.11.2009	Telephonic – South Africa
1 & 2	Henk Sa, Manager, Ecosecurities	CDM Consultant	16.11.2009	Telephonic – South Africa
1 & 2	Steve Thorne, Director, South South North	CDM Consultant,	27.11.2009	Cape Town, SA
1 & 2	Lindiwe Chauke, Director, South African Designated National Authority	Government Official	28.11.2009	Telephonic – South Africa
1 & 2	Mandy Rambakos, Sustainability Director, ESKOM	Parastatal - Utility Official	28.11.2009	Telephonic – South Africa
1 & 2	Terry Carter, Exclusive Access Trading	Project Owner	29.11.2009	Telephonic – South Africa
1 & 2	Konrad Reuss, Manager, Standard and Poor's	CDM Service Provider	29.11.2009	Telephonic – London, England
1 & 2	Marie Parramon, Consultant, Imbewu Sustainability	CDM Consultant	30.11.2009	Telephonic – South Africa
1 & 2	Randall Spalding-Fecher, Consultant, ECON	CDM Consultant, Researcher	30.11.2009	Cape Town, SA
1 & 2	Piete Rayneke, MTO Forestry	Project Owner	30.11.2009	Telephonic
1 & 2	Vincent Donato, Consultant, DNS Consultants	CDM Consultant	31.11.2009	Telephonic – South Africa
2	Julius Daka, Environmental Council of Zambia (ECZ)	Government Official	15.06.2010	Lusaka, Zambia
2	Wilfred Serenje, Chief Executive, Rural Electrification Authority,	Government Official	15.06.2010	Lusaka, Zambia

	Zambia			
2	Dr. Mclay Kanyangarara, Climate Change Advisor, COMESA	Multi-lateral organisation official	16.06.2010	Lusaka, Zambia
2	Assan Ng'ombe, Progamme Analyst – Environment, UNDP	Multi-lateral organisation official	16.06.2010	Lusaka, Zambia
2	Nkusuwila Silomba, Development Officer, Ministry of Energy and Water Development, Zambia	Government Official	16.06.2010	Lusaka, Zambia
2	Ian Mackintosh, Technical Director, Zambian Breweries Group – Carbon Project	Project Owner	17.06.2010	Lusaka, Zambia
2	Ephraim Mwepya Shitima, Zambian Designated National Authority	Government Official	17.06.2010	Lusaka, Zambia
2	Professor Francis Yamba, Managing Director, Centre for Energy Environment and Engineering	Researcher	18.06.2010	Lusaka, Zambia
2	Dr. Julius Kaoma, Manager, Universal Mining and Chemical Industries Limited	Project Owner	19.06.2010	Lusaka, Zambia
2	Frederick Mulenga, Senior Forestry Officer, Forestry Department – Zambia	Government Official	19.06.2010	Lusaka, Zambia
2	Klaus Trifellner, Project Manager, Climate Management	Project Owner	20.06.2010	Lusaka, Zambia
2	Peter Aagaard, Director, Conservation Farming Unit	Project Owner	22.06.2010	Lusaka, Zambia
2	Lemmy Namayanga, National CDM Capacity Building Expert, Climate Change Facilitation Unit	Government Official	03.08.2010	Lusaka, Zambia
2	Charles Hayward, Dunavant Cotton,	Project Owner	04.08.2010	Lusaka, Zambia

	Operations Director			
1 & 2	Kai Windhorst, Unique Forestry, Forestry and Carbon Consultant	CDM Consultant	04.08.2010	Lusaka, Zambia
2	Gracious Hamatala, Dunavant Cotton, Yield Programme Manager	Project Owner	05.08.2010	Lusaka, Zambia
1 & 2	Neeta Hooda, Programme Officer, The BioCarbon Fund, World Bank	CDM Investor	05.08.2010	Lusaka, Zambia
2	Rob Munro, Manager, PROFIT Project	NGO	05.08.2010	Lusaka, Zambia
1 & 2	Timm Tennigkeit, Director, Unique Forestry	CDM Consultant	19.08.2010	Telephonic, Freiburg, Germany
1 & 2	Ellysar Baroudy, Director, The BioCarbon Fund, World Bank	CDM Investor	24.08.2010	Telephonic – Washington DC
1	Michael Van der Meer, Portfolio Manager, EEA Group Ltd	CDM Investor	24.03.2011	Telephonic – Beijing
1 & 2	Anthony Mills, Director, AfriCarbon Ltd	Researcher	28.03.2011	Cape Town
2	Ronato Roldao, Consultant, Ecoprogresso	CDM Consultant	28.03.2011	Telephonic – Beijing
2	Søren Lütken, Researcher, UNEP Risø	CDM Researcher	30.03.2011	Telephonic – Denmark
2	Andrea Di Angelis, Senior Climate Change Advisor, UNDP	Multi-lateral organisation official	31.03.2011	Telephonic – Beijing
2	Anonymous, Developer of China Wind Projects	Project Owner	04.04.2011	Telephonic - Beijing
2	Carlo Ferrara, Head of Carbon Strategy Development China, Enel	CDM investor	06.04.2011	Telephonic – Beijing
2	Madeleine Rawlins, Global Qualifications Director, Camco Carbon Developer	CDM Consultant / Project developer	06.04.2011	Telephonic – Beijing
2	Massimiliano Varrucciu, China Representative, EDF Trading Limited	Project Investor	08.04.2011	Telephonic – Beijing

2	Stephanie Kwan, Manager, Sindicatum Carbon Capital	CDM Consultant / Project developer	9.04.2011	Telephonic – Beijing
5	Klaus Jacob, Free University Berlin	CDM Investor / Project manager	13.10.2011	Berlin, Germany
5	Dr. Martin Frick, Manager, E3G	Policy Analyst	21.10.2011	Berlin, Germany
5	Felix Groba & Johann Diekmann, DIW	Policy Analyst	18.10.2011	Berlin Germany
5	Thomas Präßler, Consultant, McKinsey	Renewable Energy Consultant	01.11.2011	Telephonic – Germany
5	Luke Callcott-Stevens, Developer, Rainmaker Energy	Renewable Energy Developer	04.05.2012	Cape Town
5	Doug Jenman, Developer, Rainmaker Energy	Renewable Energy Developer	10.05.2012	Cape Town
5	Jon Duncan, CSR Research Analyst, Old Mutual Investment Group	Renewable Energy Investor	31.05.2012	Cape Town
5	Dr.Felix Christian Matthes, Researcher, Öko-Institut	Policy Analyst	21.06.2012	Cape Town
5	Greg Paterson-Jones, Chief Executive, Sterling Waterford Securities	Renewable Energy Investor	29.06.2012	Cape Town
5	Michael Schlup, Bunge Emissions	Investor	03.11.2012	Cape Town
5	Norbert Siepelmeyer, Developer, IPD Power	Renewable Energy Developer	11.09.2012	Cape Town

Once initial data was collected for each specific paper, the detailed notes from the interviews and document review were analysed and grouped according to broad concepts. The coding process highlighted emerging themes in the interviews and data, as well as suggested the need for additional data. This primary and secondary data gave rise to the theoretical contribution of this thesis. Lastly, insights gained from direct observations at conferences,

workshops and informal interaction with project developers were useful to triangulate the data. Table 1.3 lists the conferences and workshops that were attended as part of the overall research and data collection.

Table 1.3: Conferences and Workshops

Conference/Workshop	Place	Date
UNFCCC Conference of Parties 15	Copenhagen, Denmark	December 2009
Carbon Expo 2010	Cologne, Germany	May 2010
Global Conference on Environmental Governance and Democracy	New, Haven, Connecticut, USA	September 2010
World Bank GHG Mitigation through Agricultural Management in Developing Countries Workshop	Washington DC, USA	September 2010
Carbon Markets and their Future: A Social Science Perspective Workshop	Hamburg, Germany	November 2010
Southern African Designated National Authority Training Workshop on Issues of Carbon Finance and Climate Change	Livingstone, Zambia	February 2011
Carbon Expo 2011	Barcelona, Spain	May 2011
Association of Environmental Studies and Sciences Annual Conference	Burlington, Vermont, USA	June 2011
FAO Smallholder Mitigation: Whole Farm and Landscape Accounting Workshop	Rome, Italy	October 2011
The Business of Social and Environmental Innovation Conference	Cape Town, South Africa	November 2011
UNFCCC Conference of Parties 17	Durban, South Africa	December 2011
The Business and Governance of Climate Change Workshop	Cape Town, South Africa	April 2012
The International Energy Workshop	Cape Town, South Africa	June 2012
Academy of Management Annual Conference	Boston, Massachusetts, USA	August 2012
Hydropower Africa and Solar Energy Africa Conference	Cape Town, South Africa	September 2012
The Business of Social and Environmental Innovation Conference	Cape Town, South Africa	October 2012

Quantitative methods were also employed to further understand the role of MBIs. The quantitative analysis in paper 3 uses macro country indicators (each explained in detail in table 3.6 of paper 3) to identify statistically significant relationships to CDM project implementation.

Paper 4 uses a capital asset pricing model (CAPM) to propose an index-based model for estimating cost of capital in South Africa (Sharpe, 1964). The CAPM model was selected for its simplicity and strong theoretical foundation, both key reasons for its widespread use in practice (Kaplan and Peterson, 1998). More specifically, it is an effective mechanism to calculate the discount rate required for South African renewable energy projects.

The data used for this are publically available market data, all data is explained in detail in Tables 1-5 of paper 4. Lastly, in order to compare wind energy projects in South Africa to Germany, publically available data regarding costs of wind farms was utilised in order to make an accurate estimation of the cost of wind power in both countries. All data is fully explained and referenced in paper 5.

1.6 Relevance & Rigour

This thesis is relevant per the definition proposed by Straw (1994), "from a research perspective, relevance comes closer to depicting the importance of a finding or idea for the advancement of knowledge" (p. 86). The intent is for the research to advance knowledge by making a theoretical contribution that has practical implications to further low carbon development in the primary study area of SSA, and more broadly throughout the developing world. This thesis is anticipated to be of relevance to policy makers, academics and private sector practitioners engaged in economic and developmental advancement in SSA. Policy makers, both at the international and national level, will find the research of use because it provides a better understanding of the relationship between host country context and MBIs. This is useful for future climate change policy because it helps to show how specific incentive mechanisms need to be in developing countries. Lastly, private sector actors will find this research useful because it identifies and explains the risk inherent to MBIs. The index-based model proposed in paper 4 specifically will

be useful for project developers to better understand appropriate benchmarks for evaluating renewable energy projects in developing countries.

There exists within this thesis, as with nearly all research endeavours, degrees of freedom that render multiple predictions possible (Campbell, 1975). To demonstrate that the research is rigorous, the traditional measures of validity (internal, construct, external) and reliability are discussed (Campbell & Stanley, 1963; Campbell, 1975). In the remainder of this section the question 'What passes as a rigorous case study?' (Gibbert et al., 2008) is used as the framework to discuss how rigour was purposefully built into the research design.

Internal validity questions if "logical reasoning is powerful and compelling enough to defend the research conclusions" (Gibbert et al., 2008, p. 1446). To ensure internal validity within this thesis, a clear overall research framework is established in which the five papers all contribute to addressing the main research question. The embedded case studies formed by the five empirical papers provide a comprehensive analysis of MBIs from both the internationally and nationally mandated perspectives. A logical progression was followed, whereby the previous one informed each subsequent paper, and the emerging theory continually refined as more information became available and incorporated into the overall body or research (Eisenhardt, 1989). For instance, papers 1 and 2 used qualitative, inductive reasoning to highlight host country indicators that influenced CDM utilisation. These variables were cross-referenced with the academic literature and then the suggested relationships explored using quantitative hypothesis testing. Paper 5 was also developed by following a logical progression. It uses the index-model approach proposed in paper 4 to estimate the equity cost of capital, a key variable necessary for estimating the resulting tariff price required to produce wind power.

"Construct validity refers to the extent to which a study investigates what it claims to investigate, that is, to the extent to which a procedure leads to an accurate observation or reality" (Gibbert et al., 2008, p. 1466). To address this, I verified with interviewees that the conclusions reached during the interview were factually correct and in line with the intention of the respondent. This verification process occurred at the end of each interview and draft manuscripts of the papers were sent to respondents who agreed to review. Furthermore, "different data collection strategies and different data sources" were sought to triangulate in order to enhance construct validity (Gibbert et al., 2008, p. 1468). Interview notes were cross-referenced with key reference materials pertaining to the status of the CDM (primarily publically available documentation from UNFCCC) and official documents relating to the evolving REIPPP process in South Africa.

In the case of paper 5, the competitive bidding nature of the REIPPP in South Africa restricts the amount of information project developers and financiers were willing to share. As a result this had to be addressed to ensure what was being measured, specifically within the renewable energy analysis was valid. For example, reliable financial data regarding project finance and funding sources were difficult to obtain for review as it is not typically in the public domain. Steps were taken to overcome this problem by using a hypothetical financial model and verifying critical assumptions to the model via key informant interviews and publically available datasets. For example, CDM project design documents are publically available, all project documents and accompanying financial models for renewable energy in SSA were reviewed to verify my financial model inputs and assumptions. This allowed me to construct a valid and reliable depiction of the practical reality without infringing on sensitive competitive information of any of the informants or their projects.

External validity is the overall ability to generalise the research results. Eisenhardt and Graebner (2007) state that, "central to building theory from case studies is replication logic" (p. 25). Within case study research, this refers to the accuracy of the generalisation as it moves from empirical observations to theory (Yin, 1994). This is particularly important to because it has been acknowledged that comparing across countries with significantly different political, institutional and economic context can have limitations and potentially result in weak generalisations (Yin, 1981; Miles, 1979). To address, the thesis research employs the mixed method approach and provides a detailed analysis of MBIs from numerous points of view to increase external validity. Different frames of analysis include the qualitative comparisons of the same MBI across different countries (paper 1, 2 and 5), quantitatively assessing the utility of the CDM (paper 3) and using existing market data to estimate cost of capital for renewable energy (paper 4). The CDM and promotion of wind energy were selected as subset case studies because they are practical examples providing different viewpoints of MBIs, the former being mandated and funded by developed countries and the later being domestically mandated and funded.

Steps were also put in place to reduce systematic and random error to increase overall reliability of this research. All research, both qualitative and quantitative, was carefully documented to ensure that the analysis could be easily traced and steps replicated. Each paper explains key assumptions and the process that generated the findings. Document analysis is also carefully referenced to ensure all inferences drawn from materials can be traced to the original source. A database of all relevant documents and interview notes, including notebooks on observations, has been maintained throughout the entire research process. All interviewees were offered to review draft manuscripts of the papers.

Furthermore, a draft manuscript of each paper has been presented at a conference or workshop for peer feedback to further validate the findings. Table 1.4 highlights the conference and date that each paper has been presented.

Table 1.4: Paper Presentations

Paper	Conference	Place	Date
Paper 1	Global Conference on Environmental Governance and Democracy	New Haven, Connecticut, USA	September 2010
Paper 2	Carbon Markets and their Future: A Social Science Perspective Workshop	Hamburg, Germany	November 2010
Paper 3	The Business of Social and Environmental Innovation Conference	Cape Town, South Africa	November 2011
Paper 4	International Energy Workshop	Cape Town, South Africa	June 2012
Paper 5	Business and Governance of Climate Change Workshop	Cape Town, South Africa	April 2012

1.7 Assumptions and Limitations

There are a number of key assumptions inherent to this thesis. I assume that the interviewees willingly provide accurate information with only the intention to contribute to the theoretical and practical knowledge of this research. This assumption is based on both the REIPPP programme in South Africa and the CDM being competitive amongst private sector participants, therefore I assume the interview responses did not include any inaccurate information with the objective of increasing competitive positioning.

From a technical standpoint, within the current state of affairs low carbon development is assumed to have incremental costs (actual or perceived) over and above traditional business as usual approaches. This is important because the incremental cost is a main reason why incentives are necessary to further low carbon development.

Furthermore, there are limitations that influence the validity and reliability of the research. The reliability hinges on accurate and complete information being accessible. Within this thesis, accessing such information is predicated on availability to key informants within national governments, international organisations and the private sector and the interviewees accurately portraying the relevant information. As discussed previously, this was not always the case due to the competitive nature of the REIPPP and steps were put in place to address this limitation. Moreover, the research topic is evolving as the research is taking place. This represents a challenge in terms of being able to replicate the study results, because policy changes will continue to change the underlying setting. To address this, the data collection has been fully documented and triangulated (see figure 1.3) to present an accurate depiction of MBIs in SSA at the point in time of the research.

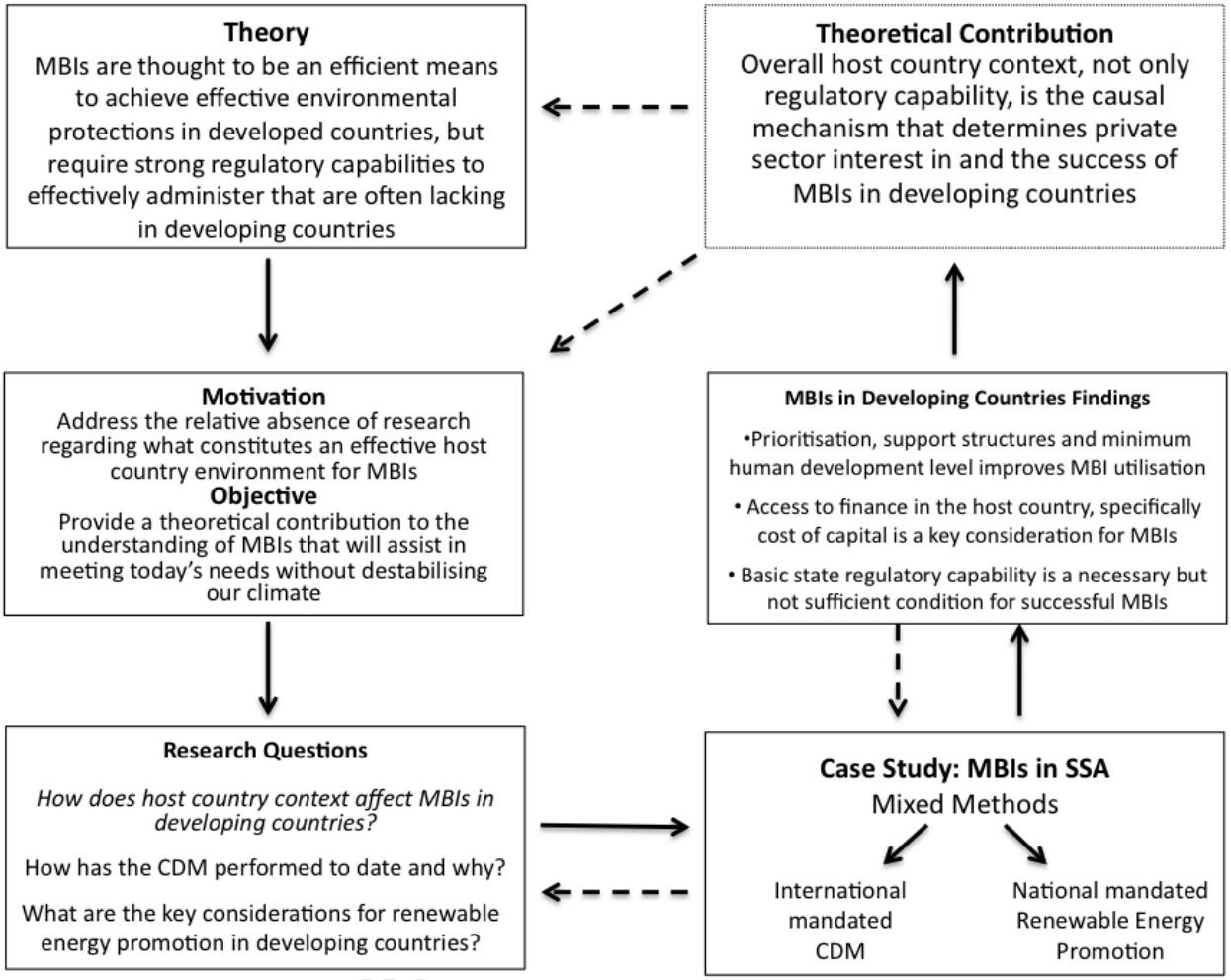
Lastly, I have practical experience working with MBIs in SSA, and in consulting across the climate change and development space. This is a positive background in terms of access and knowledge of the sector, but it is also a limitation in terms of pre-existing impressions. As a result, throughout the research I have been cognizant of the potential for the research to be influenced or biased by my preconceived notions from past and ongoing professional experiences.

1.8 Conceptual Framework

The following outline attempts to describe, understand and explain how this thesis explores the role of MBIs in developing countries. Figure 1.4 is the schematic outline of the thesis that illustrates the iterative nature of the research and how the motivation and objective are informed by the theory. The research questions are an expression of the objective, which is a product of the existing literature and practical implementation of MBIs. The research questions interact with

the case studies in a continual refinement process that evolves as more information becomes available. From this process the findings and synthesis combine to provide a theoretical contribution that helps to better understand the role of MBIs in developing countries.

Figure 1.4: Thesis Schematic Outline



The remaining sections of this thesis are structured in the following manner. Section 2 provides a detailed discussion and critical review of the relevant literature, including market-based environmental policy and governance in areas of limited statehood. The overall intent of the literature review is to describe how the research questions are embedded within this debate and capable to make a theoretical contribution to the conversation. Section 3 presents the full empirical papers. Section 4 is the discussion of the empirical papers. The overall theoretical contribution and the policy implications are discussed. Section 5 provides a concluding summary and discusses opportunities for future research. Section 6 provides a list of all cited references.

1.9 Research Ethics

I confirm that this thesis conforms to the research ethics required by the University of Cape Town's Graduate School of Business and the Commerce Faculty. Consent for participation in this research was clearly explained and obtained from all participants (interviews, observation, sensitive document review). The confidentiality of all sensitive data and information has been fully protected as specified by participants. Per PhD Rule 6.3I of the University of Cape Town Handbook 3 – I confirm this contribution is my original work, and I have acknowledged any and all extracts from the work of others. Lastly, I certify that the thesis is an honest and accurate contribution and I have not purposefully misrepresented any information or opinions.

2.0 Literature Review

The aim of this section is to provide a review of the literature on market-based environmental policy and governance in areas of limited statehood. In accordance with the structure of this thesis, further literature review of the specific MBI mechanisms explored is included in the empirical papers.

2.1 Market-Based Incentives for Environmental Protection

The primary goal of environmental protection is to ensure a safe and liveable environment for all (Parry et al., 2007). To achieve this, pollution needs to be limited to tolerable and sustainable levels without stifling societal development. Broadly, the academic literature contributing to the theory of market-based environmental policy is focused on finding efficient and effective ways to deal with pollution deemed unfavourable to society.

Firstly, in order to fully discuss market-based environmental policy it is necessary to take a step back to review the history of the theory within academic literature. As far back as the late nineteenth century, Sidgwick (1887) wrote "there are some utilities which, from their nature, are practically incapable of being appropriated by those who produce them or would otherwise be willing to purchase them" (p. 406). This is of relevance, even to the contemporary debate regarding global climate change, because Sidgwick continued with an example that keeping up forests has a known benefit to rainfall, in his words "the advantage is one which private enterprise has no tendency to provide; since no one could appropriate and sell improvements in climate" (Sidgwick, 1887, p. 407). From this he outlines an underlying problem that market-based environmental policy is attempting to address with the following statement:

> "private enterprise may sometimes be socially uneconomical because the undertaker is able to appropriate not *less* but *more* than the whole net gain to the community of his enterprise; for he may be able to appropriate the main part of the gain of a change causing both gain and loss, while the concomitant loss falls entirely upon others" (Sidgwick, 1887, p. 408)

Pigou (1920) followed by introducing the concept of 'incidental disservices', defined as situations in which "marginal private net product is greater than marginal social net product"[4] (p. 139). Sidgwick's above inference and Pigou's concept of incidental disservices encompass what is commonly referred to as negative externalities. Jaffe, Newell and Stavins (2004) further define externality as "an economically significant effect of an activity, the consequences of which are borne (at least in part) by a party or parties other than the party who controls the externality-producing activity" (p.37). Externalities are important because without proper regulation they have the potential to become, to varying degrees, market failures that contribute to the deterioration of our natural environment. In what can be seen as coming full circle to Sidgwick's ideas, a century later Stewart (1991) summarises how, in theory, externalities can result in market failures with the following:

> "Private market decision makers also often ignore the social and environmental impacts of their actions. Many markets provide incentives to producers of goods and services to satisfy consumers' desires, but fail to incorporate in the prices of producers' production inputs and commodity outputs the environmental costs that

[4] Marginal social net product is defined by Pigou (1920) as the "total net product of physical things or objective services due to the marginal increment of resources in any given use or place, no matter to whom any part of this product may accrue." The marginal private net product is defined with the example "*i.e.* prior to sale—to the person responsible for investing resources there". (p. 109)

the polluter, as well as other negative effects of resource use, impose on society at large" (pp. 549–550).

Over the years, much of the debate has focused on how to address externalities in an efficient and effective manner. Numerous theories have been put forth for consideration because when it comes to protecting the environment "the decision problem actually faced by policy makers is more complex, involving tradeoffs among multiple objectives and real and frequently binding constraints" (Hahn & Stavins, 1991, p. 2). This makes clear that environmental protection measures must be viewed in relation to all other pressing concerns and priorities facing policy and decision makers. What have emerged are the two main policy options for addressing externalities, CaC instruments and MBIs, with hybrids of the two falling in between. Next a brief summary of CaC instruments is provided, as they are the often-cited alternative to MBIs.

CaC instruments are characterised by "performance standards, such as requirements that firms not emit more than specified amounts of pollutants per unit of economic activity; and technology standards, such as requirements that particular industrial equipment or processes be employed" (Jaffe & Stavins, 1995, p. 45). Theoretically, performance and technology standards are meant to allow polluters flexibility in meeting the prescribed standard, however in reality the onus of demonstrating compliance usually limits the options to mitigate pollution to particular technologies (Stewart, 1991).

CaC measures are often criticised because they are perceived to produce "uniform, inflexible standards that result in high compliance costs, restrict innovation, discourage efficient use of resources, and require detailed central planning of economic activity" (Stewart, 1991, p. 551). Aldy and Stavins (2012) point out that "although uniform technology and performance

standards have been effective in achieving some established environmental goals and standards, they tend to lead to non-cost-effective outcomes in which some firms use unduly expensive means to control pollution" (p. 45). Furthermore, CaC instruments have also been criticised as too authoritarian, lacking the "incentives for firms to go beyond the level of abatement stipulated by the regulation" (Rivers & Jaccard, 2006, p. 224).

CaC was the instrument of choice for environmental regulation until approximately thirty years ago when market-based environmental policy started to gain prominence as a practical alternative to CaC (Hahn, 1989; Huber, Ruitenbeek, & Seroa da Motta, 1998; Jaffe & Stavins, 1995). Within the literature and practice, there was a growing consensus that MBIs (including taxes, marketable permits and subsidies) are more effective and efficient than other policy options (Aldy & Stavins, 2012; Schmalensee & Stavins, 2012; Sandor, Bettelheim, & Swingland, 2002; Stavins, 1997). MBIs fundamentally differ from CaC instruments in that they attempt to "alter price signals to ensure that polluters face direct cost incentives to control emissions" (Stavins, 1997, p. 6). In theory, efficiency and effectiveness are achieved "because these market-based instruments have the effect of inducing decision-making units (typically firms) to choose control levels at which their marginal abatement costs are the same, overall pollution abatement costs will, in theory, be minimized" (Stavins, 1997, p. 6). The end goal of this approach is to maximise the difference between social benefits and social costs, which is intriguing to economists, as well as policy and decision makers attempting to prioritise protecting the environment in relation to all other societal needs and priorities.

Pigou (1920) is often credited with starting the market-based environmental policy discussion by suggesting that pollution could be effectively dealt with by applying corrective taxes or abatement subsidies directly to the pollutant. In theory, such a Pigouvian tax, as

environmental taxes have been coined, should be applied "at a rate equal to the pollutant's marginal environmental damages" (Fullerton, 2001, p. 225). Subsequent neoliberal critics of Pigou's neoclassical argument point to its lack of practical utility and believe the interventions proposed are unnecessary. Critics claim Pigou's analysis relies on the theoretical situation of perfect competition and proposes an optimal allocation of resources which is effectively impossible to calculate in reality (Baumol & Oates, 1971; Baumol, 1972). This is further illustrated by Knight's (1924) critique of Pigou's work as too simplistic because "assumptions diverge in essential respects from the facts of real economic situations" (p. 586). He continues to point out that this field is highly subjective because determining the precise externality amount, producer and appropriate distribution "belongs to ethics as much as to economics" (Knight, 1924, p. 583).

In response to the initial criticism of Pigou, the theoretical discussion has tended to evolve toward practical application in order to engage what Knight (1924) called real economic situations. Of particular interest to this thesis is the contribution by Meade (1952) in the article titled 'External Economies and Diseconomies in a Competitive Situation'. In this influential article Meade distinguishes between various types of externalities and the respective return to individual industry and society. His analysis explores the utility of MBIs across different scenarios. First he explores external economies and institutional constraints arising from unpaid factors of production, using the well known example of the market failing occurring between bee-keeping and apple-growing because the full value of services incidentally provided to one or the other external economy is not accounted for and therefore unpaid (Meade, 1952). Theoretically incentives can address this type of market failure and it does not pose a problem to society as a whole (Meade, 1952). The details and implications of this example have often been

debated, from highlighting that an unpaid factor by one party can be considered an ownership externality (Bator, 1958), to disputing Meade's underlying conjecture that these failings may be rectified through a "political market in the form of corrective taxes, subsidies or other regulatory activities" (Johnson, 1973, p. 50).

Secondly, Meade extends the focus from market players to the precise physical and social impacts of collective market activity with the description that an "atmosphere is a fixed condition of production which remains unchanged for all producers in the industry in question without anyone else doing anything about it" (Meade, 1952, p. 61). To clarify this point, Meade leverages Sidgwick's foreboding forestry example to demonstrate how afforestation is beneficial to rainfall, and therefore contributes to an atmosphere that is equally positive or negative, to all farmers within the specific region. The key distinction from the unpaid factor example is that "the subsidies (or taxes) required to promote (or discourage) the creation of favourable (or unfavourable) atmosphere are net additions to (or subtractions from) society's general fiscal burden" (Meade, 1952, p. 67). Meade makes a powerful point that is analogous to the present day challenge of global climate change, where activities such as fossil fuel based power generation and land-use change are considered a negative burden to Meade's theoretical atmosphere and our actual atmosphere.

Meade's contribution is significant to market-based environmental policy because it distinguishes between differing externality scenarios and persuasively suggests that different approaches to address each situation are necessary. Meade (1952) concludes that "external economies or diseconomies may not fall into either of these precise divisions and may contain features of both of them" (p. 67), which serves as a warning against broad generalisation and the need to understand the context and interactions that produce externalities.

Coase (1960) further contributes to market-based environmental policy by challenging the view that any measure to remove perceived externalities is unequivocally desirable, indirectly highlighting the necessity of efficiency and effectiveness. The Coase theorem, as it is coined, "is considered by many to provide the theoretical underpinning for 'free-market' solutions to environmental problems" (Hahnel & Sheeran, 2009, p. 215). Coase advocates for a free market, property rights approach for solving negative environmental externalities, whereby bargaining between the affected parties can be an efficient solution, assuming transaction costs are negligible. Coase promotes the need for evaluating externalities in its entirety to determine the reciprocal nature of the problem. He implies that this may assist in avoiding the creation of a problem worse than the one being fixed. Coase (1960) concludes with a word of caution that when dealing with externalities "we have to take into account the costs involved in operating the various social arrangements (whether it be the working of a market or of a government department), as well as the costs involved in moving to a new system" (p. 44).

Building on Coase's argument, Kapp (1963) argues that institutional arrangements give rise to the social costs caused by externalities, and therefore can be addressed by institutional reform and economic policy. Next, Dales (1968) proposed transferable 'pollution rights' be issued by government and sold to the highest bidder, thereby putting a market value on pollution to further environmental protection at a lower overall cost than standard CaC instruments. The idea is to put a price on the right to pollute via tradable permits to ensure that "pollution most cheaply avoided would be prevented, and the most expensive to control suffered" (Winch, 1969, p. 323). This is a key contribution because it is seen as the theoretical underpinning for marketable permits or cap and trade.

A persuasive case has also been made for the flexibility of MBIs to catalyse technological innovation. Porter and van der Linde (1995) find that well designed incentives can trigger innovation offsets that can typically cover the cost of compliance. Jaffe, Newell and Stavins (2004) also make the case that MBIs "foster cost-effective technology innovation and diffusion" (p. 35). MBIs, it is explained, can provide a strong incentive for the private sector to adopt better pollution controls if sufficient low-cost technology or processes are available and can be adopted (Jaffe, Newell, & Stavins, 2002).

The preference for MBIs gained further support by the well-documented United States emissions trading mechanism put in place to address sulphur dioxide (SO_2) pollution. The SOx market, as it was called, was so successful that it decreased SO_2 emissions by 43 per cent between 1990 and 2007 at one quarter the original cost estimates (Joskow & Schmalensee, 1998; Lazarowicz, 2009, p. 7). This lent a practical example to the preference for market mechanisms. However, subsequent research has called into doubt the apparent success of emission trading schemes including the SOx market (Lane, 2012; Lohmann et al., 2005). Recent research has further pointed out that much of cost-efficiency of the SOx market was the unanticipated result of unrelated events such as prior railroad deregulation (Schmalansee and Stavins, 2012).

Subsequent to the perceived success of the SOx market, the Kyoto Protocol adapted a market-based approach to reduce GHG emissions via the UNFCCC. GHG emissions pose a particularly vexing problem to address and assign accountability because "climate change is truly a global commons problem. The location of emissions of GHGs has no effect on the global distribution of damages" (Stavins, 1997, p. 7). To address this in an equitable manner, the Kyoto Protocol is based upon a principle of 'common but differentiated responsibilities' where industrialised countries are recognised as historically being the main driver of climate change

and therefore responsible to take the lead in addressing climate change (UNFCCC, 1997). A two-tiered system has been put in place with differing roles and responsibilities for industrialised nations and developing countries. Industrialised countries are legally bound to reduce their carbon emissions as measured in 1990 below an agreed upon amount, known as the countries cap. Countries are incentivised to reduce below their cap by being allowed to sell any emission reductions below their cap, denominated in tonnes of CO_2 equivalent (tCO_2e). Developing countries are not legally bound to reduce their emissions but are nevertheless eligible to create project-based emission offsets to be sold to industrialised countries under the CDM.

The CDM was established as a MBI with the dual objective of helping developing countries achieve sustainable development while lowering their business as usual emissions, and assisting industrialized countries to meet emission reduction commitments. Under the CDM, projects that reduce GHG emissions and contribute to sustainable development, as defined by each participating country, can generate CERs, a tradable permit in the international carbon markets. The CDM can effectively be thought of as a 'Pigouvian' subsidy used to price carbon via a market-based instrument. Overall, CDM has been effective in the creation of emission reduction credits, evidenced by over one billion credits being issued by developing countries by the end of 2012 (UNFCCC, 2012). However, the CDM has also been criticised for being limited in geographic distribution (Boyd et al., 2009; Byigero, Clancy, & Skutsch, 2010), insufficient in achieving environmental aims (Lohmann, 2008), inadequate in achieving its stated sustainable development objective (Pearson, 2007) and fraught with corruption (Bond, 2012; Böhm, 2009). Moreover, research that explores CDM from a political economy perspective points out that, "offsetting produces highly unequal geographies that link permits to pollute and international treaty commitments and regulations to opportunities to obtain cheap, compensatory, carbon-

reduction projects in the South" (Bumpus and Liverman, 2008, 9.147). Newell (2012) emphasises the role of power in creating the geographical inequity by stating, "the politics and organization of carbon markets also need to change to ensure that finance flows to projects, sectors and regions where it is most needed, where alternatives do not exist, and where support will likely enable lower carbon transitions" (p. 138). Papers 1, 2, and 3 provide further review of literature specific to the CDM.

Similar to the internationally mandated CDM, domestic incentives to promote renewable power generation have also gained theoretical and practical prominence. The rationale for renewable energy promotion, especially in developing countries, is based more on the need for economic development, job creation and energy security than emission reductions (Sawin, 2006). A number of strategies have been implemented to promote renewable energy, each requiring significant involvement by the state. To this end, an ongoing debate over which approach is the most competent focuses on price versus demand strategies (Blackman & Harrington, 1999; Haas et al., 2004). Core to the argument is the acknowledgement of the need to, "offer a reasonable risk-return ratio to investors and … minimise the total costs for society" (von Flotow & Friebe, 2011, p. 9).

Price driven strategies are characterised by the state setting a price that is intended to reduce uncertainty and promote renewable energy development. The most commonly used price strategy is the REFiT, whereby "utilities must purchase all renewable power for sale and in return receive a premium" (Huang & Wu, 2011, p. 1). The acceptance of REFiT, primarily in industrialised countries, is evidenced by the fact that by 2012, "65 countries have implemented some form of a REFiT, driving 64 per cent of global wind installations and 87 per cent of global photovoltaic installed capacity" (Nganga et al., 2012, p. 1). On the other side of the debate is the

demand driven strategy. An example is the state imposing a quota system similar to emission trading, whereby electricity suppliers are required to generate a certain amount of renewable energy, or buy tradable permits sometimes called renewable energy credits (Menanteau, et al., 2003). Literature regarding renewable energy promotion is explored in further detail in Section 3 (papers 4 and 5).

Market-based environmental policy has increasingly moved into practice and the literature has also veered toward a practical persuasion with the focus on global climate change. How to address GHG emissions has become the prominent topic within the climate change debate. There has been an increase in academic literature regarding environmental policy from the "sudden interest by mainstream economists in environmental issues brought about by concerns regarding global climate change" (Hahn & Stavins, 1991, p. 4). Evaluating and comparing price (e.g. taxes or subsidies) versus quantity (e.g. standards and caps) instruments is the focal point. Nearly forty years ago Weitzman (1974) asked the following question that has come to dominate the literature, "is it better to fix the total amount by a quantity or price control mode?" (p. 490). His contribution attempts to ascertain which method is superior for "implementing a plan" and recognises "in the presence of uncertainty, price and quantity instruments transmit central control in quite different modes" (Weitzman, 1974, p. 482). A key takeaway from Weitzman's work is that the treatment (policy instrument) significantly depends on the ailment (type of pollutant).

Stavins has been central in shaping the debate while maintaining a rather agnostic stance toward the question posed by Weitzman (Hahn & Stavins, 1991; Stavins, 1998; Stavins, 1997). Aldy and Stavins (2012a) summarise attributes between the primary two options of price or quantity by pointing out that a tax or subsidy might be an efficient way to price emissions

because it provides more certainty regarding costs, however neither provide the same level of environmental effectiveness as the emissions trading approach which constrains total emissions by supplying a limited number of tradable permits. Others have contributed by demonstrating situations where one instrument proves more effective than the other. For example Newell and Pizer (2003) advocate for price instruments to deal with CO_2 build up over time. Parry and Williams (1999) claim, "the superiority of emission taxes and emission permits over other instruments can hinge on whether these policies generate revenues that are used to reduce other distortionary taxes" (p. 347). In another example, Hahn and Stavins provide the stark reminder that "not all systems are feasible in a technical, legal, economic, or political sense" (1991, p. 4). Aldy and Stavins (2012) further point out that economic considerations are not the sole determinate in a course of action with the statement, "political-economy implications of the costs associated with various policy instruments give public officials strong incentive to identify and select policies and instruments with minimal perceived costs" (pp. 54-55). Again, similar to the initial environmental policy literature, the more contemporary research also highlights that there is no one-size-fits all solution to addressing environmental problems.

An acknowledged blind spot in MBI literature is that it has been primarily focused on developed countries that have the capabilities to implement and enforce environmental regulation (Aldy & Stavins, 2012a; Aldy et al., 2008). Hahn and Stavins (1991) recognise the potential limitations inherent to developing countries administering and enforcing MBIs, and suggest "the design of incentive-based instruments that require less administrative expertise and fewer resources to implement could facilitate more and better applications" (p. 14).

The lack of MBI research within the context of developing countries is not a trivial shortcoming because developing countries are the future growth centres, and if a reasonably safe

and liveable climate is to be maintained, then efficient and effective mechanisms for reducing GHG emissions will be needed. Aldy and Stavins (2012b) further support this notion by calling for proposals capable of meaningful emission mitigation in developed and developing countries within their respective capabilities, emphasising the urgency of their call with the statement, "this is a time for innovative proposals for future international climate-policy architecture, not for incremental adjustments to the old pathway" (p. 1044).

The above review of market-based environmental policy has suggested that aligning any MBI to the host country context can improve MBI efficiency and effectiveness. The subsequent sub-section explores governance in areas of limited statehood in relation to the theoretical framework of this thesis.

2.2 Governance in Areas of Limited Statehood

The literature related to governance in areas of limited statehood is useful to the theoretical framework because it explores what happens when the state is not solely capable of providing public good. With specific regard to MBIs in developing countries, the aspect of the literature pertaining to "governance with government" is particularly useful for exploring the respective roles of the state and the private sector for implementing activities that reduce GHG emissions (Börzel & Risse, 2010). This is useful because it provides a framework to explore the state's role in establishing and administering MBIs within the developing world context.

Peters and Pierre (1998) state, "governance, as are all models of public service, is derived from the political culture within which it is embedded. The emergence of governance therefore will appear in different institutional forms in different national contexts" (p. 233). This is relevant because MBIs are implemented through regulatory mandate by international or national

bodies, and significantly influenced by the institutional forms of the country in which they are made available. The remainder of this section provides a summary of the governance in areas of limited statehood literature as it relates to this thesis.

First, limited statehood as used within the governance literature does not refer to a lack of international legal sovereignty, as defined by Krasner (2009) as "practices associated with mutual recognition, usually between territorial entities that have formal juridical independence" (p. 179). What the concept does refer to is a lack, to varying degrees, of domestic sovereignty, as defined again by Krasner (2009) as "the formal organization of political authority within the state and the ability of public authorities to exercise effective control within the borders of their own polity" (pp. 179–180). Risse (2010) explains further with the comment, "areas of limited statehood concern those parts of a country in which central authorities (governments) lack the ability to implement and enforce rules and decisions or in which legitimate monopoly over the means of violence is lacking, at least temporarily" (p. 4). As an example of limited statehood, Börzel et al. (2010) point out that even in South Africa where legal standards and regulation are quite advanced, capacity for implementation and compliance is often lacking. All countries in SSA demonstrate some degree of limited statehood so it proves a useful concept for understanding potential governance configurations affecting MBIs in SSA.

Risse (2010) defines governance as "the various institutionalised modes of social coordination to produce and implement collectively binding rules, or to provide collective goods" (p. 9), and further explains "this changes profoundly under conditions of limited statehood" (p. 10). The result is, within areas of limited statehood, hierarchical governing is often not feasible, resulting in other modes of governance emerging out of necessity (Vogel, 2009). This shift occurs because the ability to produce and enforce rules or provide public goods is often

severely constrained. The lack of enforcement capability also erodes the state's shadow of hierarchy, or ability to threaten governmental intervention to ensure compliance with voluntary agreements, that in theory promote public good (Héritier & Eckert, 2007). "Whether complying or not complying depends on how likely it is that legislators will implement their threat and how they would do so" (Héritier & Lehmkuhl, 2008, p. 2). As a result, developing countries with limited ability to threaten or enforce state action may rely (usually by default) on functional equivalents to fully consolidated statehood if they are to meet the "classical responsibilities of the state, from the creation of economic stability and the guarantee of minimal social security to public health, education, and, today, the maintenance and the creation of a clean environment" (Liese & Beisheim, 2010, p. 10).

What has emerged is "non-hierarchical modes of governance, where non-state actors participate in the formulation and implementation of public policy" (Mayntz, 2003a, p. 1). Examples of this include corporate social responsibility and fair trade standards (Hamann, 2012; Mayer & Gereffi, 2010). The growing trend of non-hierarchical governance is likely here to stay. Mayer and Gereffi (2010) elaborate on this with the following:

> As globalization progresses, particularly as the larger developing country economies mature, it is both likely and desirable that some significant part of the private governance innovations be institutionalized within the national governments of those countries. In the longer run, this would provide more effective, stable, and representative governance for the global economy (p. 20).

However, acceptable conditions for engaging non-state actors to participate in provision of public good are necessary. Börzel and Risse (2010) point out that "functional equivalents to consolidated statehood and its shadow of hierarchy have to provide sufficient incentives for non-

state actors to engage in the provision of collective goods" (p. 126). The result is that non-hierarchical modes of governance can be viewed across an overlapping continuum of governance by, with and without government.

First, governance by government is the epitome of the fully consolidated, hierarchical state, and may include international regimes but retains the focus on state-actors (Hasenclever, Mayer, & Rittberger, 1997; Krasner, 1984). This includes varying degrees of participatory governance, where non-state actors participate in the discussion (publicly or privately) that leads to policy decision-making (Heinelt, 2002), but rulemaking and enforcement still remain the full responsibility of the state actors. Second, "governance with government" depicts a range of public-private partnership (PPP) options (Börzel & Risse, 2007; Liese & Beisheim, 2010). In theory, PPPs develop as the state consults with non-state actors to determine which entities (state actors, non-state actors or a combination) are best suited to manage and mitigate risks associated with provision of public goods. The rationale for PPPs is summarised with the following statement, "involving non-state actors in the provision of collective goods not only allows tapping into their cognitive and financial resources but also helps to ensure effective implementation" (Börzel & Risse, 2010, p. 126). Other types of "governance with government" are voluntary agreements, or societal self-regulation by non-state actors, arising from either expressed delegation from the state or as a response to the state's shadow of hierarchy (Heritier & Rhodes, 2011; Mayer & Gereffi, 2010). Third, governance without government is the polar opposite of hierarchical control, whereby private self-regulation has little or no public involvement (Peters & Pierre, 1998), or in the more extreme "anarchy" case when the state collapses (Menkhaus, 2007). Figure 2.1 from Börzel and Risse (2010) illustrates the multi-level governance continuum.

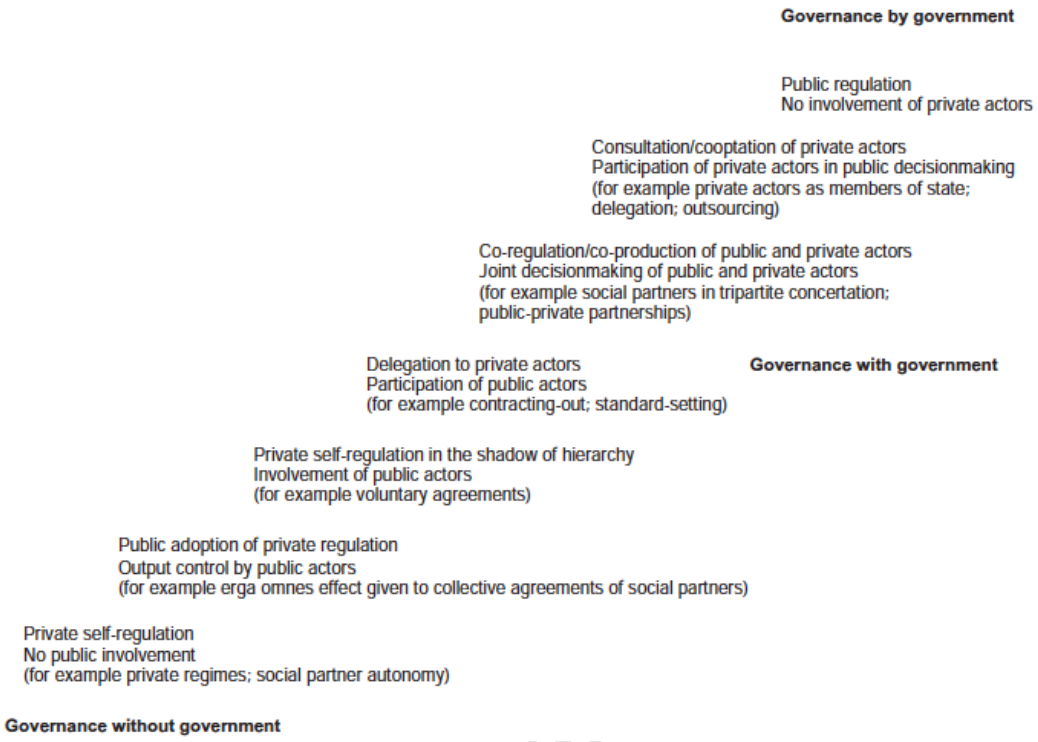


Figure 2.1: Multi-Level Governance Continuum
Source: Börzel, T. A., & Risse, T. (2010). Governance without a state: Can it work? Regulation & Governance, 4, p. 116.

MBIs are implemented within the "governance with government" category (Börzel & Risse, 2010). It is important to highlight that governance of MBIs, with specific reference to areas of limited statehood, operates in a way that "hierarchical control and societal self-regulation are not mutually exclusive. They are different ordering principles which are often combined, and their combination, self-regulation in the shadow of hierarchy, can be more effective than either of the pure governance forms" (Mayntz, 2003b, p. 32). Moreover non-hierarchical modes of coordination, no matter their form, are often embedded in hierarchical structures (Börzel & Risse, 2010).

In areas of limited statehood, "two scope conditions provide incentive structures to ensure that non-state actors engage in effective and sustainable governance in areas of limited statehood: the risk of anarchy and highly institutionalized settings" (Börzel & Risse, 2010, p. 122). Examples of what has induced non-state actor contribution to governance in areas of limited statehood include "the threat of external intervention, the pressures of the international or local community, or efficiency gains and competitive (dis) advantages" (Börzel, 2012, p. 6). With regard to MBIs in developing countries, what has induced business organisations to participate in both the CDM or the South African REIPPP programme is the viability of the business opportunity, either via efficiency gains or competitive advantage.

The state still has an important role to play if non-state actors are going to participate in the delivery of public goods. There is a requirement for at least a minimum level of capabilities by the state actors to coordinate modes of non-hierarchical governance. This is supported by Héritier & Eckert (2007), who state there is a need for "a looming shadow of hierarchy in the form of control by governmental actors or robust incentives for agents in order to sustain the self-regulatory effort and obtain satisfactory results" (p. 114). Börzel (2012) further explains the need for the basic functioning state with the following:

> "A lack of administrative, financial, cognitive and human resources not only weakens the credibility of state actors to unilaterally adopt and impose costly policies (shadow of hierarchy). It also prevents them from acting as reliable partners to non-state actors in the provision of common goods and fosters a fear of agency capture, making state actors reluctant to engage with more resourceful actors" (p. 9).

All MBIs, to varying degrees, require state involvement. Prag, Briner and Hood (2012) found that MBIs "require effective governance within the institutional structure and throughout decision-making processes" (p. 7). Furthermore, Newell and Paterson (2010) highlight that transformation away from the current dependence on carbon based development needs to be driven forward by aligning actors, interests and coalitions. As a result, if MBIs are to be effective particularly in SSA, it can be deduced that the state must possess at least the ability to coordinate and enable non-state actors to manage and implement the provision of public goods. For example the CDM requires the host country to approve the project based on the host country's definition of sustainable development, and the REIPPP programme in South Africa is fully implemented (i.e. establish procurement regulation, manage bidding process, provide additional funding required for the REFiT) by the state. However if the state is not viewed as capable of performing their role in making an MBI successful, the uncertainty and risk may become too high for promising projects to become a reality.

As explained in this section, the 'governance with government' aspect of the literature related to governance in areas of limited statehood is the explicit link to market-based environmental policy (Börzel & Risse, 2010). This is why governance in areas of limited statehood provides a useful theoretical framing that helps explore how host country context affects MBIs, with particular emphasis on the role of the state.

3.0 Empirical Papers

This section includes the full manuscripts of the five empirical papers of this thesis. Each paper contributes to the overall research objective, individually addressing a key area of inquiry indicated in subordinate research questions and collectively contributing to the overall research question of how does statehood impact the efficiency and effectiveness of MBIs.

3.1 Paper 1: A Comparative Policy Analysis of the Clean Development Mechanism in South Africa and China

3.1.1 Introduction

The CDM is a market-based approach under Article 12 of the Kyoto Protocol, designed to provide financial incentives for developing countries to voluntarily contribute to emission reduction efforts and promote sustainable development (UNFCCC, 1997). China and South Africa both ratified the Kyoto Protocol in 2002, and are eligible to implement CDM projects and to trade CER credits through the international compliance and voluntary carbon markets. Due to the nature of the CDM as a market-based approach, it is logical that project development favours low cost opportunities within large 'smokestack' industries (such as engineering, energy production or manufacturing that is heavily dependent on fossil fuels), preferably in host countries with political stability, well functioning domestic institutions and investment security (Jotzo & Axel Michaelowa, 2002a, p. 10; Jung, 2006; Okubo & Axel Michaelowa, 2010b, p. 31).

As of March 1st 2011, 2 867 projects have been registered globally by the CDM Executive Board (EB) at the UNFCCC, with expected CERs representing 798 million tCO_2e per year. Whilst the emergent economies of China and South Africa both have attributes deemed favourable for hosting CDM projects (Jung, 2006, p. 2179; Oleschak & Springer, 2007, p. 478),

in reality the distribution of the projects indicates a significant disparity in CDM uptake between the two countries. As illustrated by Table 3.1, China has supplied a significant number of CDM projects and generated a majority of CER volume, whereas South Africa, the leading CDM host country in Africa, has thus far played a negligible role.

Statistic	*Worldwide*	*China*	*China % of overall CDM*	*South Africa*	*South Africa % of overall CDM*
Issued projects	956	411	43.0%	6	0.6%
Issued kCERs	553,223	302,375	54.7%	1,794	0.3%
Registered projects	2,867	1,241	43.3%	19	0.7%
Registered kCERs	1,985,016	1,129,922	56.9%	16,348	0.8%
Total CDM pipeline projects	5,935	2,418	40.7%	37	0.6%
Total CDM pipeline annual kCERs	798,015	436,514	54.7%	6,088	0.8%
GDP 2009 estimated[1] ($ thousands)	-	4,985,461,201	-	285,365,880	-
CER / GDP ($ thousands)	-	0.09	-	0.02	-
Estimated Population[2]	-	1,331,460,000	-	49,004,031	-
CER / Population	-	0.33	-	0.12	-
CDM Consultants	1,624	271	16.69%	17	1.05%
CDM Consultants / GDP ($ billion)	-	0.05		0.06	
CDM Consultants / Population ($ million)	-	0.20		0.35	
Total Emissions (kilo-tCO_2e)[3]	-	6,533,018	-	433,173	-
CER / kilo-tCO2e Emitted	-	67	-	14	-

Notes:

1. World Bank national accounts data, and OECD National Accounts data files.
2. United Nations Population Division. 2009. World Population Prospects: The 2008 Revision. New York, United Nations, Department of Economic and Social Affairs (advanced Excel tables). Available at http://esa.un.org/unpd/wpp2008/index.htm.

3. Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States.

Table 3.1: CDM project and CER Comparison
Source: UNEP Risoe CDM/JI Pipeline Analysis and Database (01 March 2011)

Even when taking into account the significant size differences between China and South Africa, it remains that South Africa has lagged behind in leveraging the CDM, albeit less extreme than comparing absolute CDM projects or CERs. After comparing CDM uptake for differences in gross domestic product (GDP), population and emissions, China continues to have higher normalised utilisation of CDM than South Africa in terms of estimated CER per $1,000 GDP (0.09 to 0.02), CER per person (0.33 to 0.12) and estimated CERs per kilo tCO_2e emitted (67 to 14).

It is the authors' intent to analyse the development of the CDM market in China and South Africa to better understand how domestic policy affects market-based incentives to mitigation climate change. This article explores the underlying policy drivers of the Chinese and South African experience in order to compare and contrast what has supported or hindered CDM uptake. At the same time, hopefully the lessons learnt from this analysis of CDM in Chinese and South African can be useful for policy makers in other developing countries to facilitate a more effective implementation of the CDM or other market-based incentive mechanisms.

Exploring the CDM experience of China and South Africa is of particular interest because both are considered emerging industrialised economies with high emissions relative to other developing countries. Also, both countries are part of the voluntary BASIC (aka Brazil, South Africa, India and China) country forum that coordinates for international climate change negotiations and cooperates on mitigation and adaptation actions (DEA RSA, 2010). On the other hand, significant differences exist between China and South Africa's population size, economic structure and governance systems, limiting the overall explanatory significance of this

paper to the country context in which they operate. It is not the intent to imply policy and measures of China or South Africa should be implemented elsewhere as each country has unique social, environmental, political and economic determinants.

3.1.2 Methodology

This paper utilised a mixed method approach to allow for a comprehensive analysis of data from different sources (Creswell & Plano Clark, 2007; Tashakkori & Teddlie, 1998). The methodological and investigator triangulation (Denzin, 1989; Jick, 1979; Kimchi, Polivka, & Stevenson, 1991; Thurmond, 2001) employed various methods including an in-depth desk top review, descriptive statistics analysis, structured and semi-structured interviews and field observations. The use of multiple data sources to triangulate key points regarding CDM in South Africa and China enhanced the validation process by ensuring that weaknesses inherent in one approach were counterbalanced via strengths in another (Denzin, 1989; Jick, 1979). For example, to mitigate the bias that is associated with interviews, the research used numerous and highly knowledgeable informants who viewed and understood CDM from different perspectives. In addition, the descriptive statistics and field observations were used to valid and confirm data from interviews and relevant literature.

An extensive literature and document review was conducted as a means of exploring and understanding the current discussions around CDM, both globally and specifically to South Africa and China. Both academic literature and grey materials including policy documents, reports and position papers, were reviewed. Descriptive statistics regarding number and type of CDM projects, and corresponding CERs generated, were obtained from the UNFCCC website and the UNEP Risøe CDM project pipeline as of March 1, 2011 for analysis (Fenhann, Staun, Karavai, & Bertule, 2011).

To further develop a first-hand understanding of the drivers and constraints to CDM uptake in both China and South Africa, structured and semi-structured interviews were conducted with key informants. To identify interviewees, a list of key CDM stakeholders in China and South Africa was compiled from CDM association lists, project documents, CDM analysis reports and conference proceedings. Furthermore, asking each contacted interviewee for additional referrals for information rich key informants proved effective (Mason, 2002; Welch, Marschanpiekkari, Penttinen, & Tahvanainen, 2002). The interviews focused on a set of targeted CDM questions and allowed for elaboration by the interviewee to facilitate discussions on a wide range of issues related to CDM policy (Bernard, 2005; Bryman, 1992).

An initial round of key informant interviews were held in China and South Africa during 2009, followed by a second round of interviews in 2011. For the China research component, interviews were conducted with 24 interviews with European Companies operating in China, five local project developers, two investors, three researchers and two officials representing the Designated National Authority (DNA). For the South African research component, interviews were conducted with two DNA officials, nine project developers, two Designated Operating Entity (DOE) representatives, four research consultants and three representatives of a financial services firm.

Lastly, the researchers have direct experience working in CDM in China and across Africa. The authors have been actively involved with the implementation of the EU-China Facilitation project and the development of the Africa Carbon Credit Exchange, as well as participation in CDM related conferences and workshops. The authors collective work experience has informed this research by ensuring the research is aligned with the evolving realities of the CDM sector.

3.1.3 CDM: General Background

All developed nations, aside from the United States, have ratified the Kyoto Protocol and committed to legally binding measures that set a ceiling or cap on allowable emissions released in the atmosphere (UNFCCC, 1997). The 37 industrialised nations that signed the Kyoto Protocol committed to international and legally binding reductions on average of 5.2 per cent against 1990 levels over the first period commitment period from 2008 – 2012 (Gupta & Bhandari, 1999). These targets are expressed as levels of allowed emissions over the first commitment period. In order to assist countries in meeting their obligations when national reduction measures fall short, three market-based mechanisms are available under the Kyoto Protocol: International Emissions Trading, Joint Implementation and CDM. International Emissions Trading allows countries that have unused allowed emissions to sell their excess capacity to other countries that are over their targets. Joint Implementation allows countries with commitments under the Kyoto Protocol to transfer or develop emission reduction units from an emission-reduction project. This applies to all Annex B countries (developed countries with legally binding emission caps) but has primarily been associated with the former Soviet states that have significantly reduced their emissions over the 1990 baseline as a result of moving away from central planning to market based economies after the breakup of the Soviet Union. Lastly, developing countries that have ratified the Kyoto Protocol do not have binding emission reduction targets but are able to participate via the CDM. The CDM allows the Annex B countries to purchase a limited amount of GHG certified emission reductions from projects in the non-Annex I countries (developing countries without emission caps), providing a flexible alternative for Annex B countries to meet their binding obligations.

The market-based approach of carbon trading, as supported by market theory advocates, is perceived to reduce carbon emissions at the lowest overall cost to business or society, either through efficiencies, trading or offsets (Sandor, Bettelheim, & Swingland, 2002, p. 1608; Stavins, 2002; Yeoh, 2008, p. 190). It has been argued that the design and use of the market-based CDM is more effective at achieving its goal of reducing mitigation costs and less effective in achieving the dual aim of contributing to sustainable development (Ellis et al., 2007; Figueres & Streck, 2009; Fuhr & Lederer, 2009; McGowan, 2008; Nussbaumer, 2009; Olsen, 2007; Pearson, 2007; Resnier, C. Wang, Du, & J. Chen, 2007; Sutter & Parreño, 2007). Issuance of CERs as of 1 March 2011 supports this claim as a clear initial preference is evident for "smokestack" projects with short lead times and low costs, as 72% of issued CERs as of 1 March 2011 are generated by industrial gas projects (Fenhann et al., 2011). However, the overall percentage of CERs expected until 2012 by these industrial gas project types is expected to decrease significantly to 27% (Fenhann et al., 2011). Furthermore, evaluating sustainable development impact is fraught with complications as it is dependent upon the varying definitions of sustainable development, which was deliberately to be defined by the host country and has a tendency to underestimate broader effects of CDM to the host country, such as general climate change awareness (Fuhr & Lederer, 2009).

The operation of CDM requires significant institutional involvement at different levels, which must balance bureaucracy with speed and transparency in the production of credible offsets (Lovell, 2010, p. 361). At the international level, the CDM EB oversees CDM policy making and activities, including project registration and issuances of credits, under the authority and guidance of the UNFCCC Conference of the Parties. The CDM EB relies on accredited DOEs to validate project integrity and adherence to the set out methodology prior to registration,

as well as verify the validity of generated credits prior to issuance of CERs. At the national level, the DNA reviews submitted CDM projects and approves or rejects them based on the integrity of the proposed emission reductions and the locally defined definition of sustainable development. The institutional CDM capacity is important as research has shown host country CDM procedures, specifically policy and an efficient DNA, are a determinant to CDM investment (Jung, 2006, p. 553; Nhamo, 2007).

3.1.4 CDM in China

Overview

China signed the Kyoto Protocol on 29th May 1998 and it was ratified on 30th August 2002. Subsequently, China has become the largest host country for CDM projects and CER supplier to the international carbon market. As illustrated in table 3.1, 2 418 Chinese projects have been developed or are currently in the CDM development pipeline as of 1 March 2011, including 1 241 projects registered. The expected average annual CERs from the Chinese CDM projects is over 436 million tCO_2e, representing nearly 54.7% of the worldwide total annual expected CERs (Fenhann et al., 2011).

Project scope

As illustrated in Figure 3.1, current CDM projects in China cover a wide range of industrial types. Renewable energy projects, including small hydropower, wind power and biomass, represent a dominant share of existing CDM projects, in terms of both project number and the quantity of expected annual CERs. Energy efficiency is the second largest area for CDM project development, coming from various industrial sectors including steel, iron and power industries. Furthermore, a majority of the energy efficiency CDM projects are for their own power generation, using waste heat recovery or waste gas recovery for power generation. Several new

project types have emerged recently, including the solar energy utilisation, PFC, sulfur hexafluoride and transport, which are a result of new methodology development.

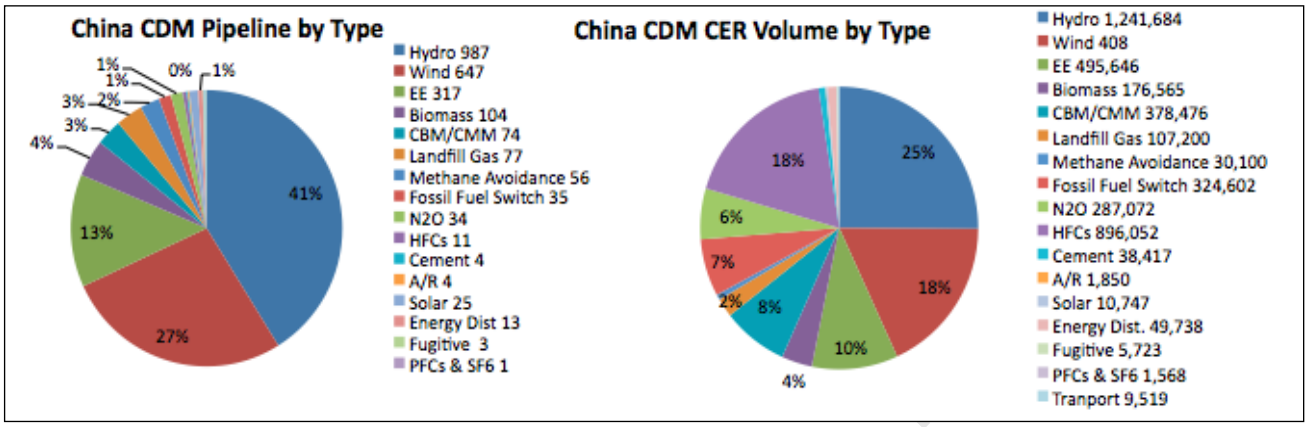


Figure 3.1: Pipeline Projects & Anticipated CERs Generated to 2020 in China
Source: (Fenhann et al., 2011)

Early on in the Chinese CDM experience, hydrofluorocarbon (HFC) and Nitrous Oxide (N_2O) projects were considered as 'low-hanging fruits', due to the large amount of CERs from a single project and the relatively low per unit investment. However, from the beginning of 2009, there are no new HFC projects being developed, with the last HFC project registered in April 2009. The growth of N_2O projects has also slowed, with only four new projects added to the pipeline since October 2009. This is mainly due to the HFC and N_2O project potential in the Chinese market being exhausted. In addition, the marketability of these controversial projects was greatly reduced in January 2011 when the European Commission banned companies from using HFC and N2O credits in the European Emissions Trading Scheme (EU ETS) after 1 May 2013, citing concerns regarding environmental integrity, value-for-money and inequitable geographical distribution of these project types (European Commission, 2011). However, while this ban has generated considerable debate regarding the future supply of CERs, the ban only applies to European companies and does not apply to other CDM buyers, including European countries

should they decide to use such credits in sectors not currently covered by the EU ETS for compliance against national targets.

CDM management in China

Largely driven by the main policy making body, National Development and Reform Commission (NDRC), there are a large number of Chinese governmental authorities directly involved in the management of CDM projects including the National Leading Group on Climate Change (NLGCC), the National CDM Board (NCB), and the CDM Project Management Centre (NDRC, 2005). The institutional structure for CDM management is a vertical management system. The NLGCC, consisting of 20 ministries, oversees the national CDM policies, regulation, standards and supervises the National CDM Board. The NCB is responsible for reviewing CDM projects, reporting to the NLGCC on the overall progress of CDM project activities, and making recommendations on amendments to the CDM operation regulations and procedures based on emerging issues (NDRC, 2005). China's DNA is part of NDRC, which is under the supervision of the NCB and responsible for receiving CDM project application documents, implementing the CDM administrative procedure and issuing the Letter of Approval (LoA) for the qualified CDM projects, and implementing specific CDM activities.

In addition, the CDM Fund Management Centre is a key institution within the Chinese CDM management structure. It is sponsored by the Ministry of Finance and manages the funds collected from the CER revenue fees charged by the government, which is to be used to meet its broader climate and sustainable development objectives (Lundin, Sanctuary, Chunxiu, & Liping, 2009). As of October 2010, the estimated contribution to the China CDM Fund was 279 million tCO_2e, based on total emission reductions till 2012 from registered CDM projects (Takahashi, 2010).

CDM regulation in China

The regulatory framework for CDM implementation is outlined in the Chinese government's 'Measures for the Operation and Management of Clean Development Mechanism Projects' (NDRC, 2005; NDRC, 2011). This serves as the main legal basis for the CDM implementation in China, including guidance on the eligibility of the projects, the application requirements, the approval procedure of the DNA, the priority areas of sustainable development, and the CER revenue-sharing policies.

Only Chinese enterprises are eligible to apply for CDM projects and only locally owned (at least 51% majority ownership) companies are allowed to own CDM projects in China. The Chinese government included this regulation to protect local enterprises' ability to participate in the CDM activities. However, according to a survey of European enterprises operating in China's CDM market (Hongwei, 2009), this eligibility requirement is considered as a major barrier for foreign investment and technology innovation in China.

The CDM project owner is required to submit to the DNA the following documents: the Project Design Document (PDD), certification of enterprise status (enterprises license), general description of projects, the Engineering Feasibility Approval from NDRC, and the environmental impact assessment approval from the Environmental Protection Administration (NDRC, 2005). The project owner is also required to present the Emissions Reduction Purchase Agreement (ERPA) or purchase intent, and the consultant service contract for review. The CER price agreed to in the ERPA is one of the elements to be reviewed and a minimum price, or pricing floor, is given as a 'guideline'. One argument for the price floor is that the GHG emission reduction resources are considered state-owned in China and in the early stages of CDM the local project owners may not have the capacity to negotiate the appropriate purchase price. Also, clear

guidance on CDM pricing in China can have a positive impact stabilising the international carbon market and give project owners clarity on potential CDM revenue streams. Although there is no clear framework to define which type of project will contribute the most to sustainable development in China, priority areas for CDM development include energy efficiency, renewable energy and methane recovery and utilisation, which is consistent with the country's overall climate change and energy policies.

Prioritisation of the CDM development is implemented and enforced through the CER revenue-sharing policy. According to the Chinese CDM regulation, the Chinese government owns GHG emission reduction resources and the CER revenues generated from the specific CDM projects shall be jointly owned by the project owner and the government (NDRC, 2005). This statement allows the government to charge certain percentages of the CER revenue from the different types of CDM projects. According to the different priorities set in October 2005, the government therefore collects fees at different levels from the CER revenues, based on the principles below:

- 65% for projects involving HFC and perfluorocarbon (PFC) emission reductions;
- 30% for projects involving N_2O emission reductions;
- 2% for projects in priority areas and forestry projects.

In reality, the Chinese CER revenue-sharing scheme has not served as a major deterrent to HFC projects because of high profitability of this project type, even when factoring in the high taxation rates. Also, the low taxation on priority areas does not appear to have a negative effect on the current CDM project development trend, whereby the number and the expected annual CERs of renewable energy and energy efficiency projects represent large shares of the overall Chinese CDM pipeline.

Recently, Chinese regulators have adjusted the CDM tax scheme on project types perceived to be negatively affected by the taxation. In a move to align Chinese regulation with changing market conditions, the levied tax on PFC and N_2O projects was altered per an August 2011 revision to Chinese CDM regulation (NDRC, 2011), resulting in the following tax levies which supersede the above tax guidance for these project types:

- 10% for projects involving PFC emission reductions – reduced from 65%;
- 10% for projects involving N_2O emission reductions – reduced from 30%.

These changes reflect the flexibility of the Chinese regulators who can and will make significant changes to the revenue sharing scheme, as they deem necessary to incentives utilisation. It remains to be seen if these new low taxation rates will have an effect on the value of PFC and N_2O projects.

3.1.5 CDM experience in China: Key drivers and obstacles

Key drivers

As one of the most successful CDM markets, it is useful to identify the unique drivers. Our research has found the following points to be particularly salient drivers of CDM development in China.

Firstly, stakeholder capacity building in the early stages at various levels is commonly viewed as a key driver that has facilitated CDM in China. For example, before the market began to grow in China, Government directly worked with project owners to encourage CDM uptake and ensure sufficient local capacity, as local authorities were anticipated to play a decisive role (Zhao & Michaelowa, 2006). One of the most successful of these initiatives has been the establishment of "Provincial CDM Centers", which are public entities established by the

Ministry of Science and Technology with the mandate to provide consultancy services to projects including capacity building; financial access and advice; matchmaking with foreign developers; and information and support throughout the project process. In addition to the increased capacity, this was critical to increase the confidence of foreign players in the market at a time when the domestic capacity and understanding of the CDM was perceived as very weak (Schroeder, 2009).

Secondly, the DNA is often credited with having high standards with respect to project appraisal and rigour. The DNA has also successfully streamlined the submission process within existing industry regulation, which requires much of the same documentation, thereby minimising the additional burden on project owners. Also, the IRR benchmark for demonstrating financial additionality for power projects was established to be "8% of the total investment or 10% of the equity", which has helped to reduce project approval uncertainty (NDRC, 2006).

Stakeholders find the domestic approval process relatively clear and predictable with respect to timing and application requirements. Project owners can be generally confident that projects that have passed the DNA approval process will also pass the UNFCCC approval stage. This has provided a degree of certainty to project owners and developers, where long project cycles have resulted in large gaps between project development and financial return.

Furthermore, the government has closely aligned its own credibility with Chinese CDM projects and advocates on behalf of the interests of the CDM market. For example, when the CDM EB called into question the financial additionality of Chinese wind projects in light of new feed-in tariffs in late 2009, NDRC responded with a report in their defence (CREIA, 2009), and later publically criticized the ruling as "irresponsible" and "unfair towards Chinese projects" (NDRC, 2009).

Thirdly, the Government has been successful in guiding the market according to its own sector priorities. There has been a clear top-down flow of information from strategic policies, such as the 11th and 12th five-year plans, but also at the working level through instruments such as the Provincial CDM Centres. In 2006, the Renewable Energy Law was formulated to promote the development of renewable energy in China. Furthermore, the Government's 2007 Medium- and Long-term Development Plan for Renewable Energy established specific renewable targets by 2020. The domestic energy conservation and emission reduction programme has also been intensified with various energy efficiency projects being launched. These domestic policy trends have been well matched with the CDM market development. One reason for this is the significant uptake of CDM by large-scale state-owned enterprises and investment groups that were already actively involved in similar project development in line with these policies.

The Chinese hydropower industry illustrates CDM aligning with overall Chinese development priorities. The sector had benefited from strong private investment growth since privitisation in the early 1990's. The sector offered good returns, but by 2006 low feed-in tariffs presented an increasing risk to the current investors and government investment had cooled over concerns with financial sustainability (Bartolucci et al., 2008). However, hydro projects were still in line with China's overall energy development goals and by November 2006 were able to apply as CDM projects. The sector already had the necessary equipment and expertise in place from over a decade of growth that facilitated a smooth transition into the CDM market and after 5 years growth hydropower projects now represent 41% of the China CDM pipeline (Fenhann et al., 2011).

Fourth, our research shows that CDM in China has consistently been attractive to foreign players due to the favourable investment environment, particularly with regards to cost

efficiency and volume. Specifically, the overall market structure and size in China, as well as robust GDP growth, averaging 10.6 between 2006 and 2010 (Hannon, Lui, Walker, & Wu, 2011), has provided an excellent environment for the CDM.

The booming Chinese economy is in part being catalysed by a robust financial system, which is also found to be a key determinant for CDM success. Research has shown that most underlying project finance for CDM is funded unilaterally by the host country and not by the Annex I countries (Lütken, 2008; Lütken & Michaelowa, 2008). This has created a situation whereby China is able to leverage its growing economy and financial sector to unilaterally develop a large number of CDM projects. For instance, the rapidly increasing power generation capacity and the large-scale production of cement, steel and iron has provided opportunities for renewable energy and energy-efficiency CDM projects in the power sector and energy-intensive industries.

Furthermore, China provides opportunity for high volume and replication. Without exception, CDM developers interviewed attribute China's success to market potential, political stability and the ability to effectively economise on project development costs. In particular, stakeholders recognised the benefit of publically available government calculated grid emissions factors (GEF) in facilitating project development for grid-connect renewable energy projects. Stakeholders have found that in other countries, where this is not available, this is a significant additional cost and complexity to project developers, enough to stall development for projects in the renewable energy sector.

Key obstacles

Although the rapid CDM development in China is often viewed as a success based on number of projects and CERs generated, there are various issues that have negatively affected CDM and could be improved upon.

Firstly, the institutional and policy framework in China during the early stages, that were useful in facilitating CDM as it legalised the transactions and shaped the market, is increasingly viewed to be a constraint. For instance, as a result of the national ownership regulation, foreign stakeholders are reluctant to participate in high technology transfer projects, thus limiting the development of certain CDM sectors. Moreover, the long project life cycles amidst a dynamic market have highlighted a new project risk. It is widely recognised that Chinese policy, not CDM incentives, is the main driver behind projects in the renewable energy sector, which brings additionality into question (Lewis, 2010; Wang & Chen, 2010). Sectors such as wind and biomass have experienced rapid development, to the extent that the Government has issued industry regulation, such as in feed-in tariffs reductions, which have risked the viability of new and ongoing CDM projects (He & Morse, 2010; Yang, Nguyen, De T'Serclaes, & Buchner, 2010).

Secondly, an appropriate guideline to direct CDM towards a greater focus on sustainable development is currently missing in China. As a market-based mechanism, CDM orientation can be focused on the market players' interests to the detriment of sustainable development. The DNA has the responsibility to guide the CDM towards sustainable development of the host countries and should develop comprehensive criteria for sustainable development at the early stage of CDM development. Since the CDM is continuously evolving and is a learn-by-doing process, the CDM guidance should remain flexible in order to address the emerging issues. The Chinese CDM measures that serve as the legal basis for CDM implementation were officially

formulated in 2005 and have been amended in 2011 to reflect the changes in the market. It may require further modifications to enhance the sustainability criteria of CDM in China.

Thirdly, the CDM process itself has also proven to be a significant obstacle to CDM in China in a variety of ways. The CDM timeline is viewed as too long, and thus presents a significant investment risk, especially on projects, which require high initial capital investments. The Chinese government has attempted to mitigate this risk by requiring all projects secure CER purchase agreements prior to applying for a LoA. However, interviewees consistently agreed that the long timelines and delays in the administrative process still resulted in significant financial loss.

Fourth, uncertainty surrounding the international climate change negotiations has also become a significant obstacle of CDM development in China. This has resulted in a significant loss of confidence in the market, with most investors becoming reluctant to develop projects in sectors where revenues would not be realised before the end of the current crediting period. Such negative indications on the future direction of CDM have significantly cooled the market and some investors are already exploring exit strategies.

Lastly, a sentiment is emerging that CDM is no longer sustainable in China. This is due to both the uncertainty of international political dialogues and the constraints of its own institutional arrangement both at UNFCCC and domestic level. As a result, China is now developing new systems, including a potential domestic carbon-trading scheme, in which the Climate Change Department of NDRC is highly involved and other CDM stakeholders operating in China are actively looking for opportunities to be involved. Due in large part to the CDM, the required expertise and systems to establish a domestic cap and trade system are in place, including emerging exchanges in Shanghai, Beijing and Tianjin. A Chinese voluntary offset

standard has also been established, with its first voluntary credits sold in March 2011 to a domestic buyer (Peters-Stanley, 2011). The increasingly ambitious Chinese climate targets of the 12th Five Year Plan (FYP) covering 2011-2015 point towards a potential phasing in of market mechanisms such as domestic carbon trading pilots (Hannon et al., 2011). However our research showed that stakeholders are cautious about the international credibility of any domestic scheme and do not expect any of such mechanisms to materialise within the next 5 years. To date there has not been any firm commitments from the Chinese government mandating a domestic compliance scheme, and such announcements are unlikely until there is further guidance on the international approach to addressing climate change after the end of 2012.

3.1.6 CDM in South Africa

Overview

South Africa affirmed accession to the Kyoto Protocol on 31 July 2002, entering the Protocol into force on 16 February 2005. While other BASIC countries have successfully harnessed the potential of CDM to varying extends, South Africa has consistently been a laggard since CDM inception. As of 28 January 2011, only 192 CDM projects have been submitted to the South African DNA, consisting of 155 Project Idea Notes (PINs) and 37 PDDs. Of the 37 PDDS, 19 have been registered, four having issued CERs and 18 are at different stages of the project cycle (DNA RSA, 2011).

The project types submitted to the DNA are illustrated in Figure 3.2, indicating a high percentage of renewable energy, energy efficiency, fuel switch, cogeneration and waste management. However, when viewing the CER potential from the projects approved by the DNA, the N_2O, cogeneration and methane recovery account for a majority of the credits, while

renewable energy and energy efficiency have not had much success so far in moving beyond the initial PIN stage.

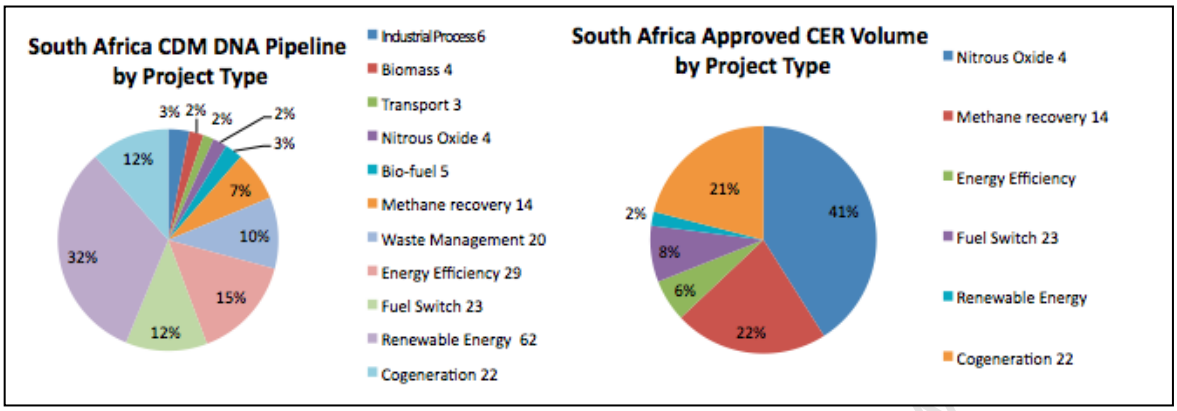


Figure 3.2: South African CDM Project Pipeline
Source: (DNA RSA, 2011)

CDM management in South Africa

The DNA, within the Department of Energy, has the legal mandate to oversee the CDM in South Africa under Section 25 of the National Environmental Management Act. Since its inception in 2004, the main task of the DNA has been to assess potential CDM projects, to determine whether they "assist South Africa in achieving its sustainable development goals and to issue formal host country approval where this is the case" (DNA RSA, 2004). The DNA has also been playing an important role in providing support to project developers and promoting CDM in South Africa to potential investors primarily because the private sector and investors have not been proactive in promoting CDM (interview with L Chauke, 28 October 2009). To overcome these challenges the South Africa Clean Development Mechanism Industry Association (SACDMIA) was launched in 2007. The intent of the association is to provide a platform for CDM industry stakeholders to promote their common interests, that is, "CDM investment promotion, capacity building, and research or facilitation dialogue with the relevant institutions, civil society and government"

(Van Den Berg, 2007). Unfortunately, the SACDMIA has thus far not been effective or active in promoting CDM in South Africa.

CDM regulation in South Africa

Project developers or owners enter the CDM project approval process through voluntary screening or mandatory submissions. The voluntary screening provides the DNA with an opportunity to carry out an initial screening of the project and provide feedback to the developer on the likely performance of the project against approval criteria. The mandatory submissions require all projects to submit a detailed description via a PDD and an application form to receive a letter of approval from the DNA. The DOE should already have validated the PDD at this stage. The PDD is posted on the DNA website for public consultation for a period of 30 days. The DNA will then provide a recommendation based on the consultation and its evaluation process and then the DNA steering committee provides comments. Based on the comments from the committee, the DNA makes its final decision on the approval of the project.

Unlike in China, the South African DNA has a set of defined sustainable development criteria that guides the evaluation of the projects. These criteria are guided by the South African government's definition of sustainable development: "the integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure that development serves present and future generations" (DNA RSA, 2004). Despite having this definition and guidelines, a DNA senior official noted that it is difficult to "measure the social development impact within CDM" (interview with L Chauke, 28 October 2009). Therefore, the DNA encourages the N_2O projects in South Africa that have minimal positive impact to social and economic development to invest in other social community projects. However, the DNA

official explained that if the number of N_2O projects increases, the DNA will consider imposing a tax on these CDM projects, as is the case in China.

3.1.7 CDM experience in South Africa: Key drivers and obstacles

Key drivers

While CDM in South Africa has not generated a large number of projects to date, there are positive aspects within the established policy and structure that could serve as the foundation to increase South African CDM uptake. The following points are positive elements the research has identified within the South African CDM experience.

Firstly, the South African DNA is well organised and highly regarded both domestically and internationally. Our research has indicated the South African DNA is doing an effective job administering the CDM limited pipeline. Stakeholders interviewed consistently regarded the DNA highly and believe sustainable development is a top priority.

Secondly, the South African economy is based on a high emission structure providing ample possibilities for CDM projects. Similar to China, South Africa has one of the highest GEFs in the world, estimated in January 2011 to be 1.048 (Takahashi & Ninomiya, 2011). Such a high dependency on coal-based power, and a growing demand for electricity provides an ideal baseline scenario for energy efficiency and renewable energy projects, creating significant potential for CDM projects (Du Toit, 2009, p. 49). While there has been slow uptake to date in these sectors, increasing electricity tariffs and improved renewable energy technologies are increasingly making renewable energy projects more cost-competitive, theoretically increasing the likelihood of implementation. In addition, there is potential for the CDM to support the government approved 'Integrated Resource Plan for Electricity 2010 – 2030', which includes

additional new capacity of 17.8 gigawatt (GW) of renewables and 8.9 GW of other generation sources, including cogeneration (DoE RSA, 2011).

Thirdly, there is a strong base of local project developers with the technical expertise to develop projects in South Africa. While most other countries in the Southern Africa region have few if any local groups with the expertise to successfully develop a CDM project, South Africa has capable project developers and CDM service providers. For example, the 2010 request for information for the pending South African REFiT programme received 384 responses from IPPs identifying approximately 20 GW of renewable energy and 4 GW of cogeneration projects at various stages of development (DoE RSA, 2010).

Key obstacles

There is a great deal of hesitancy and uncertainty regarding the perceived risks of CDM in South Africa. Throughout the research, the following issues emerged as recurrent obstacles to greater CDM uptake in South Africa.

First, potential South African projects owners in the public and private sector have a perceived lacked of the vision required to fully harness CDM opportunities. This is compounded by a lack of governmental capacity, public awareness and overall education regarding climate change and CDM. The public sector has been hesitant to take on additional responsibilities of developing CDM and the private sector is reluctant to take on the risks associated with investing in CDM projects. While local expertise is available in South Africa to navigate the intricacies of the CDM process, organisations that would own the CERs have not possessed the ability to identify quality opportunities and corresponding benefits, resulting in little uptake of potential CDM projects. In addition, the carbon markets are complicated and continually evolving, thus requiring a champion at each stage of the project development cycle in order to implement. Due

to the conservative business environment in South Africa, few project champions have emerged to date. As a result, the critical mass required to propel the CDM market forward has not been generated.

Second, the overall complexities of the CDM market have been a disincentive to both public and private entities in South Africa. The uncertainty surrounding the CDM market, including fluctuating market prices and little post-2012 clarity, has created a situation whereby the upfront investment to access the CDM is a major deterrent to moving projects forward. The long approval process and concerns regarding if a project will be registered also contributes to hesitancy of potential project owners to engage in the process. There is also a need for increased flexibility of existing approved methodologies from the CDM EB. If an existing methodology cannot be leveraged, the cost of developing a new methodology was cited during our stakeholder interviews as a prohibitive factor to CDM, and while "BRIC countries have developed numerous CDM projects, this does not mean that the opportunity automatically extends to South Africa" (DNA RSA, 2009, p. 13).

The third main obstacle identified is the financing of CDM projects, both underlying project finance and finance to create the carbon asset. Even though an implicit intent of the Kyoto Protocol is to increase foreign direct investment (FDI) for emission reduction projects, CDM experience has shown that the onus "rests almost entirely on investors in developing countries being willing to put up the financing for the projects, that through the generation of CERs help developed country emitters avoid having to make such investments" (Lütken, 2008, p. 85). Depending on project type, the income from the CERs is usually not sufficient to cover the overall project costs. As a result, there is a need to find debt or equity financing which can be difficult to secure in a reasonable timeframe. This can be extremely difficult because financial

return is not guaranteed until the CERs are delivered unless sold ex-ante, often at a significant discount. As a result, CDM financing can easily become an afterthought, which can only be leveraged after underlying project finance is organised.

Compounding this problem has been the financial crisis; high domestic lending rates and the perceived higher risk of African-based project finance has made funding even more scarce due to the current risk adverse investment climate (Interview with K Reuss, 30 October 2009). To elucidate, the average lending interest rate in South Africa from 2006 – 2010 was 12.2%, compared to 6.0% in China (World Bank, 2010). This translates into high-required equity IRR for South African projects as compared to other regions of the world, which acts as a further hurdle to project implementation. For example, the National Energy Regulator of South Africa (NERSA) has conservatively estimated the benchmark project IRR for renewable energy projects to be 12% and the equity IRR at 17%, representing a high investment hurdle when compared to the tariff rates for power in South Africa (NERSA, 2009).

In addition, the high cost of validation and lack of South African DOEs is a major bottleneck to CDM projects. All project developers contacted during our research indicated issues with DOEs as a major problem in South Africa due to cost and availability. Validation costs, which vary by project type, represent a significant investment by project developers or owners. To gain a sense of validation costs, in early 2011 six DOEs were contacted to request quotes for validating South African wind projects, validation quotes ranged from €20,000 to €37,000 equivalent plus travel expenses from overseas. Additionally, there is only one accredited African DOE based in South Africa, most are European or Asian organisations with costs usually denominated in foreign currency, adding further uncertainty due to exchange rate risks.

The fourth major obstacle our research has identified is the lack of meaningful governmental support for low carbon development in energy production or industry (Cloete & Robb, 2010; Winkler, 2010; Winkler & Marquand, 2009). This is exemplified by the dependence on high-emission coal based power through the monopolistic parastatal Eskom. The South African *White Paper on Renewable Energy* (DME RSA, 2003) set a target to produce 10,000GW hours from renewable energy sources (mainly from biomass, wind, solar and small-scale hydro) by 2013; the report also deemed this target to be economically viable through subsidies and carbon financing. To date, only three renewable energy CDM projects have been registered and no subsidies on the scale required to meet the target have been disbursed, leaving South Africa's modest renewable energy target significantly off-track to meet its 2013 goal. This is a significant point of departure for South Africa in comparison to the global CDM experience, where renewable energy projects represent 62% of the overall CDM pipeline (Fenhann et al., 2011).

As South Africa's primary energy producer and buyer, Eskom is the key player to lead both renewable energy and energy efficiency projects but has done little, internally or externally, to galvanise the renewable or CDM industries. While electricity cost is increasing on an average of 25% per year from 2011 – 2013, it is still considered among the lowest cost in the world at a standard average retail cost of 52.30 rand cent per kilowatt-hour (kWh) (DME RSA, 2008; Eskom, 2011; Pegels, 2010). The South African economy is significantly influenced by the minerals-energy complex, which has depended on access to long-term, power purchase agreements for cheap electricity (Baker, 2011). As a result, low cost coal-based electricity contributes to a slow uptake of CDM because the financial incentive and viability for energy efficiency measures or fuel switch is diminished.

In order to reverse this dearth of renewable energy in South Africa, NERSA released in March 2009 the REFiT regulatory guide (NERSA, 2009). The initial REFiT guidance document appointed Eskom, the centralised, single energy buyer in South Africa, as the Renewable Energy Purchasing Agency and initially set 2009 tariffs by renewable energy technology (see Table 3.2).

Technology	2009 REFiT (R/kWh)	2011 REFiT (R/kWh)
Wind	1.25	0.938
Small hydro	0.94	0.671
Landfill gas	0.90	0.539
CSP – w/o storage	2.09	1.938

Table 3.2: South African REFiT - Phase I Technologies
Source: (NERSA, 2011)

While the REFiT has the potential to help incentivise grid connected renewable energy and subsequent CDM development (Couth et al., 2011), its impact is severely restricted because the amount of renewable energy to be added to the grid is capped based on allocated funding. Furthermore, since the REFiT announcement in 2009, the market has been faced with continual uncertainty and delays. Further compounding the problem has been a lack of transparency by NERSA, which in March 2011 changed the amount of electricity to be purchased by technology and significantly reduced the initially released REFiT pricing as shown in Table 3.2. Then in August 2011, REFiT was cancelled in favour of a competitive bidding process. This has created a difficult business environment for developers and a hostile investment climate for investors because business models were previously based on the 2009 REFiT guidance, specifically the higher tariff rates.

Furthermore, Eskom has not successfully engaged with CDM for its own electricity generation or efficiency measures. Initially there was great excitement in 2004 at Eskom when CDM became available, however, reality around downstream funding and the difficult

registration process immediately tempered enthusiasm for CDM. This is confirmed by looking at Eskom's direct CDM experience: the parastatal submitted three PINs to the South African DNA in 2006 and one in 2007, comprising two renewable energy and two energy efficiency projects, of which none have submitted PDDs to the DNA due to lack of underlying funding for the projects (DNA RSA, 2011). Eskom's lack of willingness to engage directly with CDM or provide a conducive environment for IPPs demonstrates a need for greater coordination between the policy and development framework and key entities such as Eskom and NERSA.

3.1.8 Analysis

By comparing the policy drivers behind the CDM experience of China to South Africa, a complex picture emerges with many influencing factors. Our analysis draws out a number of contributing CDM elements, which we believe have allowed China to thrive and South Africa to lag behind. However, we acknowledge that the explanatory power of this comparison is limited due to the distinctly different socio-political, environmental and economic makeup of the two countries.

We found that the overall industrial and energy policies of the government play a significant role in the uptake of CDM. Additionally, the active engagement by key governmental and private sector stakeholders, and a business environment conducive to CDM significantly impacts utilisation of the mechanism.

National Policy Driven

Moving from the traditional carbon intensive development approach to a low carbon trajectory is extremely difficult, requiring clear policies and incentives to reduce the risk of this change and encourage private sector participation. Overall policy must prioritise low carbon development approaches and incentivise its uptake across all relevant development initiatives. The Chinese

CDM experience has demonstrated that aligning overall development policy and priorities is the fundamental factor driving emission reduction projects, with CDM serving as a tool for moving the government's prescribed agenda forward. As such, CDM is most effective when streamlined with national development and climate change policy because it follows a lower emission development agenda, not the other way around.

This is best exemplified by the renewable energy sectors in China and South Africa. Both countries have an increasing demand for power but their actions to meet this growing demand have taken completely different approaches, with a profound effect on uptake of CDM. Through supportive government policies and mandates, China has effectively promoted a rapidly expanding renewable energy sector on the supply side and massive industrial energy efficiency measures on the demand side. In contrast, CDM experience demonstrates South Africa has made little progress in reducing emissions on either the power supply or demand side. South Africa's reluctantly proposed REFiT has not been off to a promising start. After continual delays, the tariff price was reduced before the signing of a single power purchase agreement, resulting in an extremely negative environment for potential renewable energy investors and developers. As a result, policy to enable renewable energy in South Africa has been wholly ineffective and stifled by Eskom's unwillingness to add renewable energy to the overall energy mix and by their lack of interest in using CDM to support energy efficiency measures.

Proactive Engagement

An active engagement by key governmental and private sector stakeholders is also necessary to fully leverage CDM potential. The DNA should play a dual role as regulator and facilitator of the market. As this analysis has shown, proactive outreach to all potential stakeholders is a necessary catalyst to CDM as shown by China through their extensive outreach which has been absent in

South Africa awareness and understanding of the opportunities of CDM by key public and private sector decision makers at the 'Board' level is necessary to exploit CDM opportunities. Capacity building for engaging with CDM was effectively developed throughout China at both the local and national levels, supported by domestic and international funding. This is a relevant lesson for South Africa, as increased awareness and capacity by decision-makers is important to maximise CDM utilisation. While the South African DNA has been running CDM promotion workshops since 2006, the DNA acknowledges low participation from the key decision-makers that own the assets eligible for CDM projects, resulting in a communication gap that can only be bridged through combined efforts with "other government ministries, trade groups and industry associations" (Interview with L Chauke, 28 October 2009). This also presents a potential conflict of interest as the DNA assumes the dual role of promoter and regulator.

Additionally, the importance of the national CDM specific regulations has a significant impact on CDM utilisation. The Chinese government and industry decision-makers quickly recognised the national interest implications of CDM and developed a policy structure to nurture the nascent industry within the unique business, political and regulatory environment. CDM regulation, including majority local ownership, the tiered tax structure and the CER price floor, is designed to protect the domestic market, with a view to foster capacity and promote sustainable development, as defined and controlled by the Chinese government.

While it can be argued that the Chinese CDM regulation was beneficial at the beginning to develop a robust market that protects local interests, it is increasingly being viewed as an impediment to further market participation, especially in the face of uncertainty after the current commitment period concludes at the end of 2012. Capacity building for engaging with CDM was developed at both the local and national levels, through domestic and international funding. This

highlights the need for policy-makers to be continually engaged with the evolving CDM market in order to continually align and adjust regulation to fully exploit the potential incentives of CDM to their benefit. To conclude, the Chinese and South African CDM experiences highlight the need for systematic engagement to create a vibrant environment for CDM to thrive in host countries. CDM project potential and technical capacity to work through the intricacies of CDM is not sufficient to harness its full potential.

Conducive Business Environment

As the CDM is a MBI, a conducive business setting is required for successful implementation. This further elucidates our previous point that development drives CDM, not the other way around. Considering the up-front investment required for CDM, ability to source and unilaterally finance underlying project funding is a key determinant to implementing CDM projects. China's rapid expansion has been facilitated by the availability of debt and equity, while funding in South Africa has not been as readily available.

The difficulty of attracting investment in South Africa is also further complicated by the high IRR required in all sectors by project investors as compared to China. As an example, the benchmark project IRR for a typical Chinese wind project is set at 8% (He & Morse, 2010), while the benchmark project IRR for a South African renewable energy project is estimated by NERSA, to be over 12%. This contributes to increasing the overall project costs and has makes South African renewable energy projects commercially unviable in the absence of financial incentives, when compared to perceived pricing of coal based electricity in South Africa.

Furthermore, the uncertainty surrounding the post-2012 climate change regime has on-going adverse implications for all countries developing CDM projects because there is little clarity on which CERs outside of LDCs will be eligible after the current commitment period

ends. This uncertainty is causing loss of confidence in the CDM market throughout the world, and is affecting both South Africa and China. As a result, overall CDM investment is likely to slow in the near future until further clarity on market eligibility is provided.

3.1.9 Conclusion

The end of the current commitment period provides an opportunity to critically evaluate CDM worldwide and within CDM host countries to better understand if it is meeting its objective, and if not how it can be revised to better deliver emission reductions and sustainable development. This is also an ideal time for South Africa to reflect on its overall CDM experience in an effort to better streamline emission reductions and sustainable development into the overall priorities. By 'looking East' to understand the drivers of China's implementation of CDM, South Africa can explore its own experience to better understand how China has actively pursued emission reductions. At the same time, the uncertainty of the post 2012 market provides China the opportunity to adjust their approach to mitigating climate change and possibly chart their own domestic approach.

This China and South Africa comparison illustrates the CDM's limitations and cautions that its benefits should not be overstated. This study highlights that the CDM is a tool to support emission reductions but for its effective implementation a supporting national policy and a conductive business environment is necessary.

3.2 Paper 2: Market-Based Incentives in South Africa and Zambia: A Comparative Analysis of the Clean Development Mechanism

3.2.1 Introduction

MBIs have been widely recognised to maximise net environmental gains and be the least costly option for achieving pollution reduction goals (Aldy & Stavins, 2012). This belief has garnered such widespread support that the Kyoto Protocol, the main international agreement to address climate change ratified by 190 countries, is based upon market-based mechanisms dedicated to "stimulate green investment and help Parties meet their emission targets in a cost-effective way" (UNFCCC, 1997).

The literature regarding MBIs has been primarily focused on developed countries with a high level of statehood and sufficient regulatory enforcement capacity. The assumption that often underpins MBI research is that adequate government structures are in place to enforce the underlying environmental policy driving the market-based approaches (Sandor et al., 2002; Stavins, 2002). The intent of this research note is to better understand the relevance of addressing global environmental change by exploring the South African and Zambian experience with the CDM. The CDM provides a practical opportunity to research MBIs because it provides financial subsidies to developing country projects in return for the abatement of carbon emissions aligned to the host countries sustainable development priorities. Furthermore, in theory, all rational firms will take advantage of "profitable opportunities for innovation", including an abatement subsidy such as the CDM (Porter & Linde, 1995, p. 99). However, within the realities of Africa this has not occurred due to numerous multi-level complexities (Arens et al., 2011).

Despite the initial high expectations for the CDM (Jotzo & Michaelowa, 2002), it has had low utilisation across Africa. Globally, China and India have developed the majority of the CDM

projects (China 42.9%, India 24.2%) and carbon credits (China 54.8%, India 15.0%) (Fenhann et al., 2012). In comparison Africa has only 2.8% of the CDM pipeline and 3.9% of the anticipated carbon credits (Fenhann et al., 2012). Within the literature this is often attributed to a host of issues such as lack of local capabilities, limited number of attractive large-scale projects and a poor investment climate (Lütken & Michaelowa, 2008). This is despite the 2001 Marrakech Accords, which define the modalities and procedures for the CDM, explicitly stating "the need to promote equitable geographic distribution of CDM project activities at regional and sub regional levels'' (UNFCCC, 2001, p. 20).

In order to better understand the underlying reasons why the CDM has not been fully leveraged in Africa, case studies were conducted for South Africa and Zambia. These two countries are at differing stages of development and draw out idiosyncratic and shared issues affecting the use of the CDM in Africa. Zambia is an LDC, as measured by income, human capital status and economic vulnerability criterion (UN-OHRLLS, 2012). South Africa is a member of the BASIC countries, and considered an emerging middle-income nation.

Four recurring considerations influencing CDM utilisation in Africa have been identified in the CDM literature, each with implications at the international, national and local level (Arens & Kreibich, 2011; Bowen & Fankhauser, 2011; Karani & Gantsho, 2007). The first is awareness, second is eligibility to participate, third is capacity and fourth is access to finance. The remainder of this article explores each of these considerations within the context of the South African and Zambian CDM experience.

3.2.2 South African CDM Experience

South Africa is the leading African country with regard to the number of CDM projects, hosting 64 of the 217 African CDM projects (Fenhann et al., 2012). However when viewed in the global context, South Africa hosts only 0.8% of the overall CDM pipeline projects, making it a laggard when compared to other emerging economies, particularly China, that has better harnessed the potential of the CDM (Fay et al., 2012).

Awareness

In South Africa, there tends to be a general lack of public awareness and overall education regarding the CDM (Du Toit, 2009, p. 54). The overall complexity of the CDM market has been a hurdle to CDM engagement in South Africa (Little et al., 2007). The long approval process and concerns regarding if a project will be registered also contributes to hesitancy of potential project owners to engage the mechanism. Even though the South African Designated National Authority (i.e. government regulator responsible for CDM) has been active in promoting the CDM, other relevant government agencies have not been active in promoting the CDM in South Africa, a scenario that has slowed the uptake of CDM projects in the country.

Based on the complexity and uncertainties inherent to the CDM process, the South African private sector has been hesitant to engage with CDM (Little et al., 2007). This has been combined with limited binding regulatory pressure to reduce emissions, resulting in an unwillingness to make sustentative investment in the CDM (NEPAD, 2009).

Capacity

CDM projects are not easy to implement, requiring significant expertise to reach registration and then monitor, report and verify project requirements. The carbon market is also continually

evolving, requiring up-to-date knowledge of regular CDM EB rulings. While other countries in Africa have few if any local groups with the expertise to successfully develop a CDM project, South Africa has a core group of CDM service providers. This includes both local consultancies and international organisations with the technical expertise to develop projects in South Africa.

Hindering further CDM utilisation is the potential project owner. They often lack the ability to identify quality opportunities and corresponding benefits, resulting in little uptake of potential CDM projects. As a result, few project champions for the CDM have emerged, particularly when faced with more pressing business priorities. As a result, the critical mass required to propel the CDM market forward has not emerged.

Eligibility

A main eligibility concern going forward for South Africa is the European regulation restricting projects registered post 2012 from being eligible for the EU ETS. While South African projects will still be eligible to generate CDM or voluntary market credits, they will not be eligible for the compliance based EU ETS unless the project is registered before the end of 2012. This has created further uncertainty for project developers and owners because the EU ETS is the primary market for selling CDM emission reductions. As a result, being restricted from accessing the EU ETS will significantly hinder potential projects from moving forward with the CDM process post 2012.

Historically, one of the main eligibility constraints for South Africa has been at the national level. The economy is in large part based on electricity produced with an extremely high grid emissions factor. This creates an opportunity for renewable energy projects connecting to the national grid to generate one of the highest carbon credits per kWh of electricity in the world. The high dependency on coal-based power generation and an increasing demand for electricity

provides an ideal baseline scenario for energy efficiency and renewable energy projects, creating significant potential for CDM projects (Du Toit, 2009, p. 49). However, in order to take advantage, independent power producers need a stable planning horizon, binding power purchase agreements and regulatory frameworks in place that provide an adequate return to make renewable projects feasible (von Flotow & Friebe, 2011). Without these assurances on the project's financial metrics, renewable energy projects cannot be developed, which also result in a missed opportunity for leveraging the CDM.

The ability of renewable energy developers to secure an off-take agreement in South Africa has been limited, which historically has stalled renewable energy projects. However this situation has recently changed. The first round of negotiations regarding power purchase agreements (PPAs) for wind project IPPs was announced in December 2011 as part of a competitive bidding process, which allows qualified renewable energy projects to bid for above market tariff rates. As a result, renewable energy projects are now under development in South Africa and applying for CDM credits (DNA RSA, 2011).

Finance

There are numerous issues pertaining to underlying project finance required to develop a CDM project that adversely affects participation. The uncertainty surrounding the CDM market, including fluctuating market prices and uncertainty of the Kyoto Protocol, has created a situation whereby the upfront expense to access the CDM is a major deterrent to moving projects forward. The high cost of validation is also a major bottleneck to CDM projects. Project developers interviewed view the process to get a project registered as a recurrent problem in South Africa due to cost and availability. Expense for developing the required documents to access the CDM, including project design documents and associated surveys and reports, can cost more than

$50,000USD, with validation costs estimated as high as $70,000 depending on project type (Econ Pöyry, 2010, p. 6). Furthermore, if an existing methodology to access the CDM cannot be leveraged, the cost and time required to develop a new methodology is a prohibitive factor that limits the flexibility of the CDM.

The income from carbon credits is usually not sufficient to cover the overall project costs. As a result, there is a need for additional up-front and on-going funding. Leveraging future revenue from the carbon credits to access better terms for either project equity or debt can be a beneficial aspect of CDM. However the prevailing uncertainty in the carbon market makes most financial institutions reluctant to leverage future carbon revenue. As a result, CDM financing becomes an afterthought that can only be leveraged after underlying project finance is organised, which brings into question additionallity of the project, which is the key eligibility requirement of CDM projects.

3.2.3 Zambian CDM Experience

To date, Zambia has benefited very little from CDM. Only 20 CDM project idea notes have been submitted to the Zambian government as of 2010, with only one having been registered (DNA Zambia, 2010). Zambia has not been able to fully harness the CDM due to myriad of inter-linked issues. Similar to South Africa, the obstacles involving awareness, capacity, eligibility and finance have individually and collectively hindered the CDM uptake in Zambia.

Awareness

The CDM's complex nature makes communicating the potential opportunity very difficult. In Zambia, there is a low general awareness of the CDM and a corresponding reluctance to engage by public, private and the non-governmental sectors due to a perceived high level of risk.

Mitigating climate change is viewed as important but not urgent when compared to the myriad of development challenges facing the country. As a result, there is an overall low level of understanding of CDM potential. Furthermore, disconnect between projects presented to the Zambian government and subsequent follow through to registration indicates that the project sponsors may not fully understand the rigour of the CDM process. There have been numerous public and private sector CDM awareness building and training initiatives in Zambia, however these have not translated into actual projects, as key decision makers with the resources to push a project forward have typically not been involved.

Capacity

The CDM is extremely difficult to implement due to a high level of administrative and informational requirements. Local technical expertise is required for all aspects of developing and managing a CDM project. The current technical capacity within Zambia to conform to CDM methodologies, procedures and scientific analysis is limited to a few individuals. There is a need for more local capacity to identify potential projects, match the project to an appropriate methodology, specify the technical requirements, prepare the necessary documentation and facilitate the project through the CDM process. Due to a lack practical implementation in Zambia, these skills have yet to emerge locally.

Eligibility

In order to maintain environmental integrity of offset credits, CDM has taken a rigid approach to approving projects at the expense of flexibility and accessibility. The lack of flexibility has resulted in significant eligibility restrictions for Zambia that has political, equity and ethical ramifications. A major obstacle is project types applicable to the Zambian context are restricted,

by both the CDM guidelines (e.g. grid connected renewable) and the EU ETS (e.g. land-based projects).

Grid-connected renewable energy projects in Zambia have not been able to take advantage of carbon markets because of the low GEF baseline. In contrast to South Africa's high dependency on coal, Zambia's power production comes primarily from hydro, which results in a low emissions per kWh produced, which substantially reduces the number of credits for a grid connected renewable energy project. This in effect serves as a punishment to countries that have developed clean power producers like hydro as opposed countries with a high GEF derived from 'dirty' fossil fuel based power production. This negatively impacts opportunities for renewable energy or grid connected energy efficiency projects in Zambia. A regional baseline is an option to address this constraint but has not yet been utilised.

The EU ETS scheme does not allow land-use projects to be used as offsets. This is a serious detriment to the applicability of CDM to Zambia, because a significant percentage of Zambia's emissions are a result of land use change. This is further restricted at the national level in Zambia due to specific guidelines within afforestation and reforestation projects that have result in a limited definition of a forest, thereby potentially excluding promising land-use projects.

Finance

Financing a CDM project is often referred to as the major constraint to the CDM, particularly in Zambia. CDM projects are expensive and require an additional financial commitment on top of the project's operating budget. As discussed previously, extremely high and variable transaction costs of CDM is a deterrent to its utilisation. This coupled with the overall uncertainly around the post 2012 climate regime further discourages investment in CDM projects.

While financing the CDM process is always a major constraint, underlying project finance emerges as an even more pressing problem for sustainable development projects. Despite the intent of the CDM to generate 'green investment' from industrialised to developing nations, it has been found that the underlying finance from CDM projects primarily comes from the host country. A study of the first 628 registered CDM projects found that only 48 indicated in the PDD any involvement in the financing by industrialised country parties (Lütken, 2008, p. 2). This has serious ramifications for Africa because access to finance is often in short supply and therefore relies on foreign investment for CDM projects, which has historically diverted investment to lower cost emission reduction projects in Asia or South America (Jotzo & Michaelowa, 2002). Furthermore, if investment funding is available, it often comes at an exorbitant cost of capital to compensate for the risks associated with the local business and political environment. As a result, potential CDM eligible projects are often sidelined because of inability to access funding, even with the added benefit of a future revenue stream from the carbon markets.

Compounding this problem is the cash flow issue. Carbon credits are often purchased at issuance or at a deep discount if the buyer takes on additional risk and pays up front prior to issuance. While in theory carbon credits can be a future revenue stream that can enhance a project's commercial prospects, it is often a small portion of the overall capital expenditure and paid ex-post. This causes a cash flow problem for developing a project because a majority of project costs are up-front and the timing of payment for carbon credits is often two to three years after the project begins. This greatly minimises the benefit of the CDM to viable projects that are in need of financial investment up front.

3.2.4 Conclusion and Recommendations

The CDM lacks clarity but not complexity, resulting in a low level of participation. The complexities associated with the CDM are driven from the top down, flowing from the international climate regime to national government to the local participants as illustrated in Table 3.3.

Table 3.3: Multi-level Considerations for CDM in Africa

Theme / Governance Level	International (UNFCCC)	National (Government)	Local (Potential Beneficiaries)
Awareness	Complex process, methodologies and additionality requirement for African appropriate projects	Little systematic in-depth awareness of CDM opportunity within public or private sector	Limited understanding of true opportunity of CDM by decision makers
Capacity	Bottleneck issues at CDM EB increases financing lag; insufficient understanding of African context	DNA lacks resources or expertise to significantly impact market, reliant on private sector interest for uptake	Insufficient local CDM experience/expertise
Eligibility	Restrictions on Agriculture, Forestry and Other Land Use (AFOLU) and GEF issues (except SA)	Limited opportunity for "smokestack" credits; LDC post 2012 issue; Lack of forestry definition	Aggregation to reach scale requires well developed infrastructure, networks and management
Financing	Limited access to international financing for underlying project finance and CDM costs	Few national financing schemes aligned with low carbon projects (e.g. renewable promotion, conservation agriculture subsidies, etc)	Local financial institutions either have limited knowledge of CDM or view as too risky – weak financial base of potential local project developers/owners

Awareness around the CDM has been increasing as experience is gained, but progress has been slow. More targeted and effective awareness building efforts are required at the international

level to share lessons learned. At the national level, government agencies need to align development objectives with the opportunity of the CDM whenever possible. Lastly, a more proactive role by the local private sector and industry associations is needed to ensure the opportunity of CDM is fully understood.

Capacity has proven to be a large constraint in Africa. This is viewed as a lack of local capabilities and interest, especially in the case of large companies with operations in Africa. This concerns both and international stakeholders and the host countries. The CDM Executive Board also needs to do a better job of understanding African specific constraints and develop innovative ways to overcome what is lacking. One such opportunity is to simplify the CDM process, including all methodologies, benchmarks and baselines. This approach may require additional checks to ensure the integrity of the emission reductions generated, but could reduce duplication and increase overall cost effectiveness. At the national level, alignment of government sustainable development goals with private sector capacity to engage with the CDM could also motivate greater participation.

Lack of flexibility at the international level weighs heavily on the national and local perspectives. The limited scope for land-use projects in the CDM raises an overarching equity question as land-use change is claimed to account for 20% of global emissions (Collier et al., 2008). Considering small-scale farmers in Africa are likely to be most severely impacted by climate change (IPCC, 2007), provision for land-use change projects are needed to adequately address the drivers of climate change in Africa. Furthermore, the requirement to use national baselines for grid-connected electricity does not recognise the fact that carbon emissions have global impact. The CDM therefore needs to create an equitable pathway for countries that do not

generate their power from carbon intensive sources to also share in the potential benefit from carbon finance.

Lastly, lack of access to finance has had longstanding negative implications for Africa. The high cost of developing CDM projects is well known and presents a significant barrier for accessing carbon markets. Underlying project finance is extremely difficult to secure in Africa due to high levels of risk. The CDM has not galvanised significant investment from the industrialised world to developing countries as intended, therefore the onus is often on the host country to provide the up-front financing before carbon credits can be developed and issued. Considering Africa has limited opportunities to access commercial finance, it follows that CDM projects have been stifled by a lack of project finance.

The CDM, as demonstrated by the South Africa and Zambia experiences, shows the need for market-based mechanisms to overcome challenges concerning awareness, capacity, eligibility and finance. Going forward, experiences from the missed opportunity of CDM in Africa provide valuable lessons to improve the design of incentives for addressing global environmental change in Africa.

3.3 Paper 3: Market-Based Incentives in Developing Countries: Geographical Dispersion, Antecedents and Implications of the Clean Development Mechanism

3.3.1 Introduction

Aldy and Stavins' article in *Science* titled 'Climate Negotiators Create an Opportunity for Scholars' urgently calls for "innovative proposals for future international climate-policy architecture" that will engage both developed and developing countries to contribute to emission reductions (2012, p. 1044). To develop innovative proposals that are effective and efficient for developing countries, it is first necessary to fully understand the implementation experience of the existing global climate agreement, the Kyoto Protocol. All developing countries that have ratified the Kyoto Protocol are in theory equally eligible to participate in the project based offset mechanism known as the CDM. In reality, utilisation of the CDM across the developing world has been highly varied. In this article we attempt to better understand the underlying economic and non-economic factors that affect CDM utilisation via a rigourous quantitative analysis. We attempt to contribute to Aldy and Stavins' call for innovative approaches to reduce emissions by providing insight into the relationship between market incentives and the underlying country context of developing countries.

There has been a significant amount of literature regarding the CDM beginning before the 2001 Marrakech Accords defined the modalities and procedures for the CDM. Initially the CDM literature debated the role of developing countries in the Kyoto Protocol (Ellerman, Jacoby, and Decaux, 1998; Criqui and Viguier, 2000; Springer, 2003), predicted how it would perform (Jotzo and Michaelowa, 2002; Michaelowa et al., 2000; Zhang, 2004; Streck, 2004) and evaluated possible CDM investment risks (Oleschak and Springer, 2007; Laurikka and Springer, 2003; Janssen, 1998). As the CDM started to gain experience through implementing projects the

analysis largely focused on how the CDM was emerging (Lecocq and Ambrosi, 2007; Ellis et al., 2007; Michaelowa and Michaelowa, 2007; Fay et al., 2012), evaluating the role of sustainable development (Sutter and Parreño, 2007; Olsen, 2007; Pearson, 2007) and assessing the geographic distribution of the CDM and its drivers (Boyd et al., 2009; Byigero, Clancy, and Skutsch, 2010; Jung, 2006). Recently the CDM literature has explored ways to revise the CDM for the post-2012 commitment period under the Kyoto Protocol (Kolk and Mulder, 2011; Newell, 2012; Boyd et al., 2009).

While a majority of the CDM literature has been qualitative, there have also been limited attempts at using econometric modeling to determine what host country factors are likely to attract CDM projects. Dinar et al. (2008) and Dolsak and Bowerman (2007) explore international cooperation dynamics in an effort to predict FDI into CDM projects. Wang and Firestone (2009) use linear regression to highlight that the CDM favours large, emerging economies with ample opportunity to generate low cost emission reductions. Flues (2010) also uses regression analysis to explore the overall CDM distribution and concludes "economic development and growth, fossil fuel, and renewable energy generation, as well as links to developed countries and institutional quality positively affect the number of projects hosted" (p.1).

What is missing from the literature is a levelised comparison of the countries that have leveraged the CDM. The above mentioned literature has all explored the CDM on an absolute basis which we view as lacking because it treats all developing countries the same. For example, an absolute comparison between China and Lesotho is obviously inadequate because of the sheer differences in scale. While using econometric modeling on an absolute basis may be necessary to predict which countries are likely to attract CDM projects in the near term, it is not sufficient to understanding what drives market incentives in developing countries.

This article attempts to provide quantitative evidence regarding the antecedents necessary for efficient and effective incentives to reduce emissions in developing countries based on the CDM experience. We analyse CDM implementation since its inception in 2005 by exploring which host country antecedents favour CDM implementation on a levelised basis. A quantitative analysis is employed to provide a diagnostic on the regional spatial patterns of the CDM and then investigate the relationship between CDM usage and macro indicators at the country level. We aim to provide policy makers, practitioners, academics and climate change negotiators rigourous, empirical evidence on how market incentives have performed in developing economies and identifying the antecedents that enable the CDM to be leveraged.

The remainder of the paper is organised as follows: the next section provides a brief introduction to the CDM as a market incentive. Section 3.3.3 outlines the approach taken to this research and the data used to perform the analysis. Section 3.3.4 presents the research findings and discusses implications. The final section provides a summary and draws conclusions.

3.3.2 Clean Development Mechanism as a Market-Based Incentive

Environmental policies and mechanisms supporting MBIs are often recommended to maximise net environmental gains while minimising costs (Coase, 1960; Sandor, Bettelheim and Swingland, 2002; Stavins, 2002). Acceptance of MBIs as a preferred approach for environmental protection has garnered such widespread support that the 1997 Kyoto Protocol, the main international agreement to address climate change, is based on market mechanisms (Figueres and Streck, 2009). This assigns a market price to emissions that creates an incentive to emit less, either through efficiencies or offsets (Yeoh, 2008, p. 190). An underlying assumption associated with MBIs is that adequate governance and business structures are in place to facilitate market development (Hahn and Stavins, 1991). This is often not the case in developing countries due to

widely varying abilities to develop and enforce commonly binding rules (Börzel and Risse, 2010).

The CDM allows developing countries to participate in the Kyoto Protocol by hosting projects that produce emission offsets for sale to developed countries with emission reduction commitments. It is intended to create a win-win situation for developed and developing countries via the dual purpose of: 1) allowing developed countries to purchase project-based greenhouse gas emission reduction credits from developing countries to meet their binding obligations in an efficient manner; and 2) assisting developing countries "in achieving sustainable development and in contributing to the ultimate objective of the Convention", i.e. the stabilisation of greenhouse gas concentrations in the atmosphere (UNFCCC, 1997). The implicit purpose of the CDM is for developed countries, acknowledged as the historical drivers of climate change, to financially incentivise developing countries to voluntarily reduce their carbon emissions beyond business as usual scenarios.

3.3.3 Conceptual Framework

Method

We next explore how countries' socio-economic and governance characteristics relate to CDM utilisation. Firstly, CDM usage is compared at the regional level to look at the state of the CDM geographic dispersion. The 2001 Marrakech Accords define the modalities and procedures which emphasise "the need to promote equitable geographic distribution of CDM project activities at regional and sub regional levels'' (UNFCCC 2001, p. 20). In reality the spatial dispersion of CDM projects across the developing world is uneven so we explore the precise status of this inequity. Secondly, four hypotheses are tested using multivariate regression, each exploring the relationship between levelised, country-level CDM utilisation and macro indicators. The research

method is designed to provide a lens into how developing countries' characteristics and contexts relate to the performance of MBIs.

A challenge in this research has been to identify appropriate and valid macro indicators. Available indicators and data sets often provide only approximations for the underlying conceptual macro-level country characteristics of interest to us. A second limitation is that the research is a cross-sectional analysis and thus is not able to capture the continually evolving, dynamic nature of the market.

Data

CDM Data Points: CDM statistics from the 'UNEP Risoe CDM Pipeline Analysis and Database' as of April 1, 2011 are analysed. The dataset consists of 6,059 projects active in the CDM pipeline, representing an estimated 811 million credits per year (Fenhann et al., 2011). This analysis timeframe is characterised by equal eligibility for developing countries to sell their issued emission reductions to the EU ETS. Future regulation will only accept credits from projects registered in LDC post-2012, which is likely to have a significant impact on the dispersion of projects.

Geographic Groupings: To evaluate the regional dispersion of CDM projects, both the number of CDM projects and total emission reductions are evaluated in regional groupings, as well as crosscutting categories. The following regions and categories include Europe and Central Asia, Middle East & North Africa, Sub-Saharan Africa, South Asia, Latin America and Caribbean, East Asia & Pacific, LDC, African LDCs and Asian LDCs.

LDCs have been included as categories because they are considered to be laggards in implementing CDM projects. At the outset of the CDM, it was predicted that LDCs would not benefit from the mechanism (Jung 2006; Silayan 2005), and subsequent analyses of nearly six

years' experience suggests this to be the case (Arens and Kreibich 2011; Okubo and Michaelowa 2010).

Country Data: As of April 2011 there were 126 CDM eligible countries as defined by having a functioning approval body called the designated national authority. Not having the country approval body renders the CDM inaccessible so countries without one have been removed from the data set.

We are concerned with understanding developing countries, therefore CDM eligible countries at a relatively advanced stage of economic development act as outliers for this study and were removed from the regression analysis. Any country with a nominal GDP per capita over $12,000 USD in year 2010 is removed (Lütken 2011). As a result 16 countries[5] with 144 Projects (2.38% of CDM pipeline total) and over 27 million annual credits (3.41% of total credits) have been excluded (Fenhann et al. 2011). This leaves a 110-country dataset for the analysis.

There are 48 total LDCs[6] of which 38 have a country approval body and 20 have at least one project (Fenhann et al. 2011). 13 of the 33 LDCs in Africa host 43 projects (0.71% of total CDM pipeline projects) generating an anticipated 3.3 million credits per year (0.42% of total credits) (ibid). Seven of the 14 LDCs in Asia host 26 projects (0.43% total) and produce an estimated 7.1 million credits per year (0.88% total) (ibid). Haiti is the only LDC in the Latin America and Caribbean region and has not hosted any projects as of April 2011.

Control Variables: The diagnostic compares CDM usage by the regions with nominal GDP, FDI and greenhouse gas emissions, as measured by carbon dioxide equivalent (including all fossil fuel based emissions per the Carbon Dioxide Information Analysis Center, 2007 – referred to as

[5] These countries include Antigua and Barbuda, Bahamas, Bahrain, Barbados, Cyprus, Equatorial Guinea, Israel, South Korea, Kuwait, Malta, Oman, Qatar, Saudi Arabia, Singapore, Trinidad and Tobago, and UAE

[6] http://www.unohrlls.org/en/ldc/related/62/

CO_2E). These variables are then included in the regression analysis as control variables. CDM projects are privately funded and predicted to be hosted in countries where complementary assets and resources are in place (Huang and Barker, 2009; Jung, 2006; Niederberger and Saner, 2005; Byigero, Clancy, and Skutsch, 2010). FDI flows and GDP are used as control variables to normalise the economic variance of CDM eligible countries and mitigate the possibility of endogenous bias.

Countries with high levels of emissions are often considered to possess 'low hanging fruit' opportunities for relatively inexpensive carbon credits (Jotzo and Michaelowa, 2002; Okubo and Michaelowa, 2010). While most acknowledge the CDM has not been equitably distributed, Lütken (2011) has recently claimed that even though LDCs have been slow to initially leverage the CDM, there is increasingly equitable CDM usage when comparing the number of projects relative to a host country's fossil fuel based emissions. Therefore, a proxy for large-scale fossil fuel based emissions is included as a control variable.

3.3.4 Empirical Analysis and Findings

Preliminary Findings

Comparing an emerging economy to an LDC is impractical on an absolute basis. Developing countries have widely varying populations, economies and carbon emissions. Therefore, to analyse the geographic dispersion of the CDM, we evaluate on a levelised basis. To understand if levelised CDM dispersion has been equitable, comparing it to population is regarded as the most important variable because the "location of emissions of greenhouse gases has no effect on the global distribution of damages" (Stavins, 1997, p. 7).

Table 3.4 uses descriptive statistics to show which regions have done well and which have lagged behind by illustrating the regional utilisation of CDM by comparing the number of

projects by population, GDP, FDI and CO_2E. First, we analyse the availability of CDM projects at the global level. There are 1.15 projects available for every million people in the developing world, 0.39 projects for every billion dollar of economic activity, 0.03 projects per million in FDI and 0.45 projects per million tons of CO_2E. Across all measures, East Asia and Pacific emerges as the primary beneficiaries of the CDM as it has higher allocation of projects compared to global averages. South Asia has performed well in attracting CDM projects based on GDP or FDI or CO_2E. Latin America and Caribbean also does well on the basis of population and level of CO_2E.

A careful analysis reveals that South Asia, Latin America and Caribbean, and East Asia and Pacific regions have more projects on the basis of CO_2E. However, GDP and FDI criteria also show that South Asia and East Asia and Pacific regions have done well. Latin America and Caribbean and East Asia and Pacific perform better in terms of population. East Asia and Pacific, dominated by China, emerges as the clear CDM winner with all variables scoring higher than the global measure. South Asia, led by India, is a leading region when levelising by GDP, FDI and CO_2E, but falls behind the global per capita mark. Latin America and Caribbean, led by Brazil, performs extremely well on a per capita and per emission basis, but significantly falls below the global mark when levelised by GDP or FDI. Europe and Central Asia's usage scores slightly below the global average in all measures. Sub-Saharan Africa and Middle East & North Africa significantly lag behind across all measures. LDC significantly lags behind in all but CDM projects by CO_2E, which is close to the global average. Surprisingly, African LDC projects by CO_2E are higher than the global average.

Table 3.5 further investigates the dispersion of CDM by levelising the estimated annual certified emission reductions by the same indicators as Table 3.4: population, GDP, FDI and

CO_2eE. The purpose of this analysis is to investigate the impact of varying project sizes, specifically if there is an unequal dispersion of projects producing significant amounts of emission reductions, specifically industrial gas projects (e.g. HFC, PFC, N_2O) that make up less than 2% of the project pipeline until 2012 but account for 27% of the expected emission (Fenhann et al., 2011). As compared to overall global scores, Table 3.5 demonstrates East Asia and Pacific and Europe and Central Asia as the main emission reduction beneficiaries, with Latin America and Caribbean and South Asia doing fairly well. Latin America and Caribbean fairs above the global averages by population and CO_2E. South Asia has done well by GDP, FDI, and CO_2E. Again, Sub-Saharan Africa and Middle East & North Africa significantly lag behind in all measures. LDC has close results to global average in terms of projects by CO_2E but significantly lags behind in all other measures.

Of particular note, East Asia and Pacific emerges even stronger in the levelised emission reduction comparison than in the project comparison of Table 3.4. This is primarily due to the hosting of a large number of industrial gas projects in China. Overall, the variation in Table 3.5 as compared to Table 3.4 demonstrates that the average CDM project size as measured by annual estimated emission reductions is not equal across the regions.

Table 3.4 and 3.5 illustrate that overall LDCs receive low scores on a per capita, GDP and FDI basis. This indicates that the CDM has not been equitably dispersed on a levelised basis. As stated above, when comparing the number of CDM projects to emission levels the overall LDC score rises to near parity with the global score. Considering LDCs are in part selected by low-income and economic vulnerability criterion, it follows that LDCs energy usage is less carbon intensive (Bowen and Fankhauser, 2011). This highlights the overall underdevelopment in LDCs, manifested in extremely low overall emissions as a grouping.

Levelising CDM usage by emissions of LDCs does not tell a complete story because the commonly used Carbon Dioxide Information Analysis Center measurement only includes emissions from fossil fuel sources (Boden, Marland, and Andres, 2007) and does not include land use change and forestry. This is significant because land use change, primarily as a result of deforestation, represents an estimated 33% of the total emission profile in developing countries, but rises to represent 62% of total emissions in LDCs (Baumert, Herzog, and Pershing, 2005). As a result, levelised analysis of CDM dispersion by emissions produces distorted results unless the underlying measurement is able to capture the emissions from land use change in LDCs.

Table 3.6 provides a summary of statistics for selected variables influencing CDM projects. The average CDM project per capita is very low (0.001). Similar to CDM projects per capita, the average emission reduction per capita is low (0.140). Among potential determinants, the average for Environmental Performance Index (EPI) is 52.07 while the average for HDI is 0.55. The average GDP per capita is US$3,707.82 equivalent, however, it ranges from US$160 to US$9,714. This suggests the data includes projects across the range of developing countries, from the least developed to emerging economies. The average of gross fixed capital formation per capita (GFCF) per capita, FDI per capita, and CO_2E per capita is US$777.25, US$92.76, and 2.07, respectively. Overall, Table 3.6 shows the rich variation in the characteristics of the CDM projects.

Variables

In line with what has been presented in CDM literature on an absolute basis, this research indicates that the CDM has not been equitably dispersed on a levelised basis either. To better understand what drives this inequity, the remainder of the article explores how national level antecedents relate to CDM utilisation, and then attempts to understand the implication of the

findings. The following sets of variables explore CDM usage parameters at the macro level using multi-variant regression analysis.

Business Climate and Financial Capacity: Business environment measured by the 2011 World Bank/IFC Ease of Doing Business (EDB) composite score (2010) and World Development Indicator reported GFCF (2010). Any market mechanism is dependent upon an enabling business environment and access to finance, and the CDM is no exception. The business and economic environment is an important factor in determining the host country level of risk for CDM projects (Oleschak & Springer, 2007). The EDB indicator provides an aggregated ranking on ease of doing business. It is a composite figure covering nine indicator areas comprised of starting a business, dealing with construction permits, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts and closing a business (World Bank and IFC, 2010). GFCF demonstrates how much is invested in a country rather than consumed. Research has shown that a majority of CDM projects are unilaterally funded, demonstrating the need for host country financing capabilities (Lütken, 2008). The GFCF is intended to serve as an approximation of domestic finance available to fund CDM projects. Hence, we test the following:

H1: A country that has good business and economic climate is more likely to have successful CDM projects

Governance and Political Stability: Corruption and political stability as measured by the World Bank's WGI and the Economist Intelligence Unit's political instability index (PII). The host country governance, level of corruption and institutional capacity is commonly thought to be a determinant of CDM. Research has identified host country risk and governance, affecting CDM procedures such as evaluation criteria and approvals, as important to CDM investment and

implementation (Newell, Jenner, and Baker, 2009; Newell, 2008; Nhamo, 2006). WGI is used in the regression analysis as a proxy of governance. WGI is an aggregate indicator of several hundred variables in the following categories: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption (Kaufmann, Kraay, and Mastruzzi, 2010). Furthermore, political risk is commonly known to decrease investment and increase cost of capital, intuitively reducing the likelihood of CDM engagement (Jung, 2006; Oleschak and Springer, 2007). PII is used as the proxy for political risk of the host countries. It also measures economic distress and underlying vulnerability to unrest, aggregating into an index score (Economist Intelligence Unit, 2011). Based on above, we test the following:

H2: A CDM project is more likely to be implemented in a host country that has good governance and political stability

Environmental Concerns: High levels of environmental and climate risk are hypothesised to create an awareness and incentive to proactively address the cause (Nussbaumer, 2009). Environmental indicators measured by the Yale Center of Environmental Law and Policy's EPI and climate risks measured by the Center for Global Development's climate driver index (CDI) are measured to test this hypothesis. EPI ranks national environmental results by measuring public health and ecosystem vitality across 25 indicators (Emerson et al., 2010). CDI develops risk indicators to measure and compare countries vulnerability to three climate issues: weather-related disasters, sea-level rise, and loss of agricultural productivity (Wheeler, 2011).

The CDM is a mechanism that gives monetary value to emission reductions, correspondingly the market searches for the highest volumes at the lowest cost. Countries with a

high Carbon Dioxide Intensity (CO_2I) theoretically have significant potential for CDM projects that take advantage of opportunities for efficiency gains. Therefore, we test the following:

H3: A country facing threats from environmental pollution and climate risk will prioritise a response to addressing the risk, including leveraging the CDM

Human Development and Competencies: A country overall level of development signals its ability to prioritise discretionary action such as engaging with the CDM. If a country is lacking the resources to meet the basic needs of its citizens, it will be disadvantaged in sharing equitable benefits of a complex market mechanism (Fay et al., 2012; Boyd et al., 2009; McGowan, 2008). The United Nations Development Programme's HDI is used as the proxy. HDI is an aggregate score based on life expectancy, education index as defined by mean years of schooling and expected years of schooling and gross national income at purchasing power parity per capita (UNDP, 2010). This raises the following hypothesis to test:

H4: Countries at a higher level of development are able to prioritise taking action on climate change and under-developed countries must focus their limited resources on service delivery of more pressing basic needs

Multicollinearity

Next, Table 3.7 illustrates the correlation statistic of each variable. A high correlation between variables could affect the estimates quality, resulting in misleading interpretations. We apply a plus or minus 0.700 correlation threshold in order to avoid multicollinearity issues (Farrar and Glauber, 1967). The threshold is exceeded only between EDB and WGI therefore overall the indicators are deemed to be unique and stable.

CDM project per capita is positively related to GFCF per capita (0.311), EPI (0.313), WGI (0.470), and HDI (0.543). It is noteworthy that among these variables, HDI has a stronger

correlation with the CDM project per capita. As expected, PII, CDI, and EDB has negative correlation with the CDM projects.

Multivariate Regression Analysis

To estimate the dependency parameters influencing CDM usage and to test the above hypotheses, a pooled regression analysis is employed. Host country utilisation (as defined by CDM projects per capita) is the dependent variable; selected country macro indicators are independent variables. To better understand the dispersion and utilisation of CDM projects, country specific control variables of GDP, FDI, and CO_2E per capita are included in the regression model. The pooled regression model is as follows:

$$Y_i = \alpha_i + \sum_{k=1}^{k} \beta_k Z_{k,i} + \sum_{j=1}^{j} \gamma_j C_{j,i} + \varepsilon_i$$

Where Y_i is CDM projects per capita. Z_k is a vector of k potential determinants of the CDM projects. k includes the eight potential determinants of the four hypotheses: EDB, GFCF, WGI, PII, EPI, CDI, CO_2I and HDI. C_j is a vector of control variables i.e. GDP, FDI and CO_2E.

Table 3.8 presents the regression results for eight models. The coefficients of the variables and t-statistics (in parenthesis) are presented for each model. The expected sign for each variable are indicated in the second column of the Table 3.8. The sign for GDP per capita and FDI per capita can be positive or negative. The bold numbers indicate statistical significance, while the * indicates the level of significance (1% =***, 5% =**, 10% =*). Model 1 explores the relationship of CDM project per capita to EDB and control variables. A higher EDB suggests a weak business condition for the country. The regression results show that CDM project per capita is negatively and significantly related to EDB (-0.381). Model 2 shows the positive and significant relationship between CDM project and GFCF per capita (0.561) suggesting that it has

a positive impact on the number of CDM projects. We find that EDB and GFCF are influencing factors in the selection of countries to host CDM projects. The findings suggest that business and economic conditions have positive influence on the CDM projects as hypothesised.

The quality of governance and political stability is anticipated to have a positive impact on the business environment. Model 3 confirms this relationship as WGI (0.472) is positively and significantly related to CDM projects. The results for political instability do not show a significant relationship with the CDM projects. Hence, model 3 and 4 suggest that good governance and political stability encourage CDM projects as indicated in hypothesis 2.

Models 5, 6 and 7 test the environment and climate vectors. As expected, EPI has positive and significant coefficient (0.320) on CDM project implementation, while CDI has negative and significant coefficient (-0.186). Surprisingly, CO_2I is not found to be an influencing factor for CDM projects. Overall, the results suggest that CDM projects move to the countries that are being affected by environmental issues.

Model 8 tests hypothesis 4. The results show that HDI has a strong and positive coefficient (0.691) with the implementation of CDM projects. The estimate (coefficient 0.691) and significance level (*t*-statistics 6.91) for HDI is the highest among all potential determinants. This suggests that HDI is an important determinant in hosting CDM projects. Including all other significant determinants in Model 9 further tests the power of HDI. The results show HDI retains a positive and significant relationship with CDM projects, as demonstrated by an increased coefficient of HDI (0.793) at the 1% significance level (*t*-statistics 4.03)[7].

Regression Robustness

[7] The regression results in all models do not have any multicollinearity issue among independent variables.

Further testing the robustness of the results, we include all determinants for each hypothesis in a single regression model. Table 3.9 presents the results for each hypothesis tested in separate models. The results clearly identify the significant factor in each model. Hypothesis 1 shows EDB (-0.384) and GFCF (0.570) to be significant factors when regressed together in the same model. As expected hypothesis 2 shows continued significance of WGI (0.213) and insignificant results for PII. Hypothesis 3 results suggest EPI (0.270) to be the dominant factor, with insignificant results for CDI and CO_2 intensity. Hypothesis 4 model results remain the same as reported in Table 3.8.

The above regression results indicate that HDI has the most economic and significant value for the implementation of CDM projects. Now it is imperative to test the presence of HDI with other significant, influencing factors. Hence, HDI is interacted with the significant variables obtained from above regressions. This provides analysis of the moderating effect of other variables on HDI.

Table 3.10 presents the results for the interaction variables with respect to HDI. Model 1 and 2 use significant variables associated with hypothesis 1. Though the interaction terms are not significant in both models, HDI is positively and significantly related to CDM projects. Model 3 represents the interaction terms for the significant variable of hypothesis 2. The interaction term WGI with HDI is positive and significant (0.237). HDI is also positive and highly significant, indicating that WGI is also an important influence on CDM projects. Similarly, as environmental concerns suggested in hypothesis 3, model 4 shows a positive and significant result for interaction term EPI with HDI. The model excludes HDI to avoid multicollinearity issue. Model 5 uses the significant variable CDI with HDI as the interaction term. The results show that HDI is again a positive and significant factor for CDM projects. Overall the regression results show

that while other significant factors have a moderating effect on HDI, it retains a significant influence throughout each model.

3.3.5 Conclusion

The initial CDM assumption that all host countries will equitably exploit economic incentives proves inaccurate when moving across the developing world. This article's analysis demonstrates that Sub-Saharan Africa, the Middle East and North Africa, and LDCs are laggards in nearly all categories when analysing CDM dispersion on a levelised basis. The HDI emerges as the most important factor suggesting that CDM applicable countries need to reach a minimum level of development in order to foster an environment conducive to CDM implementation. Countries that are unable to provide a minimum service level around basic needs are unlikely to mobilise resources for reducing emissions when faced with competing priorities and interests. Meeting basic needs is an immediate concern of developing countries, while reducing emissions below business as usual is not likely to be considered a priority. The result is that it is difficult to prioritise and enforce emission reductions over competing interests that are viewed as more important by when faced with limited resources and capacity to meet the basic needs of the country.

The findings of this article suggest that without having achieved a minimum threshold of development, even the most economically advantageous incentive will not be fully maximised. This suggests that the one-size-fits all approach of the CDM is problematic if equity across all participating countries is desirable. In summation, in order to answer Aldy and Stavins' call for proposals to reduce emissions in developing countries, the host country level of development must be a top consideration in the design of any future mechanism if it is to be effective or efficient.

Appendices

Table 3.4: CDM Geographical Dispersion by Number of Projects

This table describes the geographical dispersion of CDM projects globally and region wise. The projects are presented by number of projects per million populations, per billion dollar gross domestic products, per million dollar foreign direct investment, per million ton CO_2 emissions.

Regions	**Projects by Population (millions)**	**Projects by GDP (billions)**	**Projects by FDI (millions)**	**Projects by CO_2 Emissions (millions)**
Global – Total Projects	1.15	0.39	0.03	0.45
Europe & Central Asia (ECA)	0.79	0.33	0.01	0.25
Middle East & North Africa (MNA)	0.31	0.05	0.004	0.05
Sub-Saharan Africa (SSA)	0.15	0.13	0.01	0.19
South Asia (SAS)	1.08	1.01	0.07	0.96
Latin America and Caribbean (LAC)	1.67	0.25	0.01	0.67
East Asia & Pacific (EAP)	1.62	0.44	0.08	0.42
Least Developed Country (LDC)	0.09	0.14	0.01	0.44
Least Developed Country in Africa	0.09	0.13	0.01	0.63
Least Developed Country in Asia	0.10	0.18	0.02	0.30

Note: (1) World Bank Statistics, Population, Total, 2010
(2) Gross Domestic Product, Current USD, 2009
(3) Foreign Direct Investment, Net Inflows, Current USD, 2009
(4) Carbon Dioxide Information Analysis Center, Fossil Fuel

Table 3.5: CDM Geographical Dispersion by Carbon Emission Reductions

This table describes the geographical dispersion of projects based on carbon emission reductions globally and region wise. The projects are presented by number of projects per million populations, per billion dollar gross domestic products, per million dollar foreign direct investment, per million ton CO_2 Emissions.

Regions	Projects by Population (millions)	Projects by GDP (billions)	Projects by FDI (millions)	Projects by CO_2 Emissions (millions)
Global – Total Projects	0.15	52	4.40	60
Europe & Central Asia (ECA)	0.19	80	2.80	61
Middle East & North Africa (MNA)	0.05	9	0.80	9
Sub-Saharan Africa (SSA)	0.03	26	1.20	38
South Asia (SAS)	0.10	96	6.60	91
Latin America and Caribbean (LAC)	0.17	25	1.30	66
East Asia & Pacific (EAP)	0.26	70	12.00	66
Least Developed Country (LDC)	0.01	22	1.00	67
Least Developed Country in Africa	0.01	10	0.40	50
Least Developed Country in Asia	0.03	49	0.25	82

Note: (1) World Bank Statistics, Population, Total, 2010
(2) Gross Domestic Product, Current USD, 2009
(3) Foreign Direct Investment, Net Inflows, Current USD, 2009
(4) Carbon Dioxide Information Analysis Center, Fossil Fuel

Table 3.6: Summary Statistics of CDM Project Variables

This table presents descriptive statistics of variables examined subsequently as determinants of CDM projects. *CDM Projects* and *CER* are the CDM projects by country population. *Carbon Dioxide Intensity by the Country – Emission by Oil Equivalent Energy Use* is the CDM Projects divided by fossil fuel emissions as reported by Carbon Dioxide Information Analysis Center. *Political Instability Index* is used as the proxy for political risk of the host countries measuring economic distress and underlying vulnerability to unrest, aggregating into an index score. *Climate Driver Index* is a barometer of risk indicators to measure and compare countries vulnerability to three climate issues: weather-related disasters, sea-level rise, and loss of agricultural productivity. *Environmental Performance Index* indicates national environmental results by measuring public health and ecosystem vitality across 25 indicators. *World Governance Indicator* is the aggregate indicator of several hundred variables in the following categories: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption. *World Bank / IFC Ease of Doing Business by Country* is the aggregated ranking based on a composite figure covering nine indicator areas comprised of starting a business, dealing with construction permits, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts and closing a business. *Human Development Index* is the aggregate score based on life expectancy, education index as defined by mean years of schooling and expected years of schooling and gross national income at purchasing power parity per capita. *Gross Fixed Capital Formation per Capita* demonstrates how much is invested in a country per capita rather than consumed. *Gross Domestic Product per Capita* is the dollar income per capita of a country. *Foreign Direct Investment per Capita* is the foreign direct investment per capita in the country. *Carbon Dioxide Emissions per Capita* is the proxy for large-scale fossil fuel based emissions of a country.

Variables	N	Mean	Median	Standard Deviation	Minimum	Maximum
Clean Development Mechanism Projects per Capita	110	0.001	0.002	0.001	0.000	0.006
Certified Emission Reduction per Capita	110	0.140	0.024	0.645	0.000	7.000
Carbon Dioxide Intensity by the Country – Emission by Oil Equivalent Energy Use	78	1.970	1.962	0.970	0.000	4.000
Political Instability Index	110	5.946	6.600	1.984	0.000	8.800
Climate Driver Index	109	25.620	24.165	17.139	-9.000	100.000
Environmental Performance Index	109	52.067	54.400	16.841	0.000	86.400
World Governance Indicator	109	-0.459	-0.440	0.692	-2.280	1.580
World Bank / IFC Ease of Doing Business by Country	104	111.190	116.500	45.425	12.000	183.000
Human Development Index	101	0.546	0.589	0.154	0.140	0.815
Gross Fixed Capital Formation per Capita	104	777.25	458.82	1056.40	13.00	8750.00
Gross Domestic Product per Capita	109	3707.82	2067.58	7195.88	160.00	9714.00
Foreign Direct Investment per Capita	109	92.76	32.85	177.11	-242.00	980.00
Carbon Dioxide Emissions per Capita	106	2.070	1.000	3.618	0.001	33.000

Table 3.7: Correlation Matrix of CDM Project Variables

This table presents the correlation coefficients between CDM projects and their determinants. The variables are defined in Table 3.6 legend.

Variables	Clean Development Mechanism Projects per Capita	Carbon Dioxide Intensity by the Country – Emission by Oil Equivalent Energy Use	Political Instability Index	Climate Driver Index	Environmental Performance Index	World Governance Indicator	World Bank / IFC Ease of Doing Business by Country	Human Development Index	Gross Fixed Capital Formation per Capita	Gross Domestic Product per Capita	Foreign Direct Investment per Capita	Carbon Dioxide Emissions per Capita
Clean Development Mechanism Projects per Capita	1.000											
Carbon Dioxide Intensity by the Country – Emission by Oil Equivalent Energy Use	0.236	1.000										
Political Instability Index	-0.032	-0.125	1.000									
Climate Driver Index	-0.237	-0.176	-0.036	1.000								
Environmental Performance Index	0.313	0.246	0.053	-0.352	1.000							
World Governance Indicator	0.47	0.208	-0.117	-0.168	0.203	1.000						
World Bank / IFC Ease of Doing Business by Country	-0.409	-0.434	0.178	0.251	-0.265	-0.734	1.000					
Human Development Index	0.543	0.666	-0.172	-0.498	0.599	0.54	-0.628	1.000				
Gross Fixed Capital Formation per Capita	0.311	0.366	-0.216	-0.264	0.189	0.397	-0.39	0.576	1.000			
Gross Domestic Product per Capita	0.172	0.26	-0.177	-0.223	0.238	0.153	-0.356	0.513	0.662	1.000		
Foreign Direct Investment per Capita in the Country	0.146	0.248	-0.295	-0.115	-0.142	0.408	-0.262	0.406	0.268	0.098	1.000	
Carbon Dioxide Emissions per Capita	0.187	0.424	-0.14	-0.253	0.169	0.197	-0.372	0.494	0.659	0.659	0.015	1.000

Table 3.8: Multivariate Analysis for Potential Determinants of CDM Projects

This table presents results of the analysis of CDM project per capita and its potential determinants. It reports the estimates of the pooled OLS regression. The regression models present the effect of macroeconomic variables on CDM projects after controlling for economic factors. We use economic factors such as Gross Domestic Product per Capita, Foreign Direct Investment per Capita, and Carbon Dioxide Emissions per Capita. The variables are defined in Table 3.6 legend. The estimates of regression models are reported in the upper part. Numbers in parentheses are *t*-statistics. The asterisks ***, **, and * indicate the significance level of 1%, 5%, and 10%, respectively.

Variables		**CDM Project per Capita as Dependent Variable**								
		Hypothesis 1		**Hypothesis 2**		**Hypothesis 3**			**Hypothesis 4**	**All**
	Sign	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
World Bank / IFC Ease of Doing Business by Country	-	**-0.381*** (-3.62)**								0.033 (0.22)
Gross Fixed Capital Formation per Capita	+		**0.561** (2.60)**							**0.358* (1.70)**
World Governance Indicator	+			**0.472*** (4.84)**						0.217 (1.46)
Political Instability Index	-				0.045 (0.44)					
Environmental Performance Index	+					**0.320*** (3.33)**				-0.202 (-1.53)
Climate Driver Index	-						**-0.186* (-1.88)**			0.035 (0.37)
Carbon Dioxide Intensity by the Country – Emission by Oil Equivalent Energy Use	+							0.164 (1.27)		
Human Development Index	+								**0.691*** (6.07)**	**0.793*** (4.03)**
Gross Domestic Product per Capita	No	0.005 (0.04)	-0.013 (-0.10)	0.076 (0.65)	0.070 (0.54)	-0.014 (-0.12)	0.050 (0.39)	0.077 (0.51)	-0.124 (-1.05)	-0.139 (-1.13)
Foreign Direct Investment per Capita	No	0.045 (0.46)	0.001 (0.01)	-0.055 (-0.57)	0.150 (1.48)	**0.190** (2.02)**	0.180 (1.23)	0.096 (0.82)	-0.122 (-1.27)	**-0.357*** (-2.84)**
Carbon Dioxide Emissions per Capita	-	0.041 (0.33)	-0.283 (-1.37)	0.044 (0.38)	0.144 (1.12)	0.139 (1.13)	0.105 (0.82)	0.065 (0.40)	-0.071 (-0.60)	**-0.401** (-2.00)**
Intercept		0.002 (4.98)	0.001 (3.45)	0.001 (6.50)	0.001 (0.96)	-0.001 (-1.56)	0.001 (3.87)	0.001 (0.81)	-0.002 (-4.46)	-0.002 (-1.82)
Adjusted R^2		0.17	0.12	0.24	0.06	0.15	0.09	0.08	0.32	0.41
# of Observations		104	104	106	106	106	106	78	101	101

Table 3.9: Factors Affecting the CDM Projects

This table reports the estimates of the pooled OLS regression of factors affecting the CDM projects after controlling for economic factors. We use economic factors such as Gross Domestic Product per Capita, Foreign Direct Investment per Capita, and Carbon Dioxide Emissions per Capita. The variables are defined in Table 3.6 legend. The estimates of regression models are reported in the upper part. Numbers in parentheses are *t*-statistics. The asterisks ***, **, and * indicate the significance level of 1%, 5%, and 10%, respectively.

Variables		**CDM Project per Capita as Dependent Variable**			
		Hypothesis 1	**Hypothesis 2**	**Hypothesis 3**	**Hypothesis 4**
	Sign	**Model 1**	**Model 2**	**Model 3**	**Model 4**
World Bank / IFC Ease of Doing Business by Country	-	**-0.384** **(-3.79)**			
Gross Fixed Capital Formation per Capita	+	**0.570** **(2.82)**			
World Governance Indicator	+		**0.213***** **(4.80)**		
Political Instability Index	-		0.030 (0.33)		
Environmental Performance Index	+			**0.270**** **(2.14)**	
Climate Driver Index	-			-0.090 (-0.74)	
Carbon Dioxide Intensity by the Country – Emission by Oil Equivalent Energy Use	+			0.081 (0.62)	
Human Development Index	+				**0.619***** **(6.07)**
Gross Domestic Product per Capita	No	-0.075 (-0.61)	0.079 (0.67)	-0.004 (-0.02)	-0.124 (-1.05)
Foreign Direct Investment per Capita	No	-0.094 (-0.89)	-0.046 (-0.46)	0.153 (1.28)	-0.122 (-1.27)
Carbon Dioxide Emissions per Capita	-	**-0.392**** **(-1.99)**	0.047 (0.39)	0.084 (0.53)	-0.071 (-0.60)
Intercept		0.002 (4.89)	0.001 (2.51)	-0.001 (-0.62)	-0.002 (-4.46)
Adjusted R^2		0.24	0.24	0.16	0.32
# of Observations		104	106	78	101

Table 3.10: The Effect of the Human Development with Other Determinants on CDM Projects

This table reports the estimates of the pooled OLS regression of the effect of the human development interacting with other determinants on CDM projects after controlling for economic factors. We use economic factors such as Gross Domestic Product per Capita, Foreign Direct Investment per Capita, and Carbon Dioxide Emissions per Capita. The variables are defined in Table 3.6 legend. The estimates of regression models are reported in the upper part. Numbers in parentheses are *t*-statistics. The asterisks ***, **, and * indicate the significance level of 1%, 5%, and 10%, respectively.

Variables		**CDM Project per Capita as Dependent Variable**				
	Sign	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
World Bank / IFC Ease of Doing Business by Country * Human Development Index of the Country		-0.119 (-1.13)				
Gross Fixed Capital Formation per Capita * Human Development Index of the Country			-0.040 (-0.31)			
World Governance Indicator * Human Development Index of the Country				**0.327** **(3.87)**		
Environmental Performance Index * Human Development Index of the Country					**0.327***** **(3.87)**	
Climate Driver Index * Human Development Index of the Country						-0.023 (-0.26)
Human Development Index	+	**0.727***** **(6.23)**	**0.721***** **(4.79)**	**0.644***** **(6.02)**		**0.695***** **(6.02)**
Gross Domestic Product per Capita	No	-0.142 (-1.21)	-0.132 (-1.09)	-0.176 (-1.59)	0.123 (0.99)	-0.130 (-1.08)
Foreign Direct Investment per Capita	No	-0.160 (-1.61)	-0.128 (-1.31)	**-0.193**** **(-2.12)**	0.139 (1.50)	-0.128 (-1.29)
Carbon Dioxide Emissions per Capita	_	-0.073 (-0.62)	-0.061 (-0.50)	-0.030 (-0.27)	-0.026 (-0.20)	-0.072 (-0.60)
Intercept		-0.002 (-4.00)	-0.002 (-3.88)	-0.002 (-3.56)	-0.001 (-0.80)	-0.002 (-4.25)
Adjusted R^2		0.34	0.32	0.42	0.20	0.32
# of Observations		101	101	101	101	101

3.4 Paper 4: An Index-Based Model for Determining the Investment Benchmark of Renewable Energy Projects in South Africa

3.4.1 Introduction

In order to effectively mitigate climate change, alternatives to fossil fuel based energy sources need to be cost competitive. There has been progress towards increasing renewable energy from its modest contribution to the overall global energy supply. The 'Renewables 2011 Global Status Report' highlights that in 2010 an estimated 19.4% (16.1% hydro & 3.3 other renewables) of electricity consumption was supplied by renewable energy with nearly half the added electricity capacity of approximately 194 gigawatts (39 GW Wind, 30 GW Hydro, 17 GW Solar photovoltaic) coming from renewable sources (Janet & Martinot, 2011). The contribution of renewable energy toward added capacity is particularly important because worldwide demand for energy continues to increase, particularly from emerging economies such as South Africa. In order to avoid locking-in traditional fossil fuel systems, alternative energy sources must become a major contributor to meet future energy demand of developing economies. The 21st century global centres of growth have also shifted, which has important implications for the geographical focus of renewable energy deployment. The "developed countries" are no longer the drivers as "non-OECD countries account for 90% of population growth, 70% of the increase in economic output and 90% of the energy demand growth over the period from 2010-2035" (IEA, 2011). In order to shift from the traditional fossil fuel based power systems to renewable energy, the underlying local financial drivers must be fully understood if renewable energy such as wind and solar are to play a major role in the provision of electricity in emerging economies.

Many investors face difficulty in assessing proper return in relatively new sectors like renewable energy, making them averse to financing such projects, affecting trans-border project

development opportunities. The required rate of return to investors in large-scale power projects varies significantly country by country, reflecting the differing risk profiles. The aim of this paper is to introduce an index-based model capable of estimating the rate of return required for the equity investors of renewable energy projects in South Africa.

A recent survey exploring investor's preferences for different framework conditions for investments in wind farms in emerging countries concluded that:

> "Investors want to reduce political investment risks (framework conditions) as much as possible. An increased risk in comparison to an ideal scenario can cause investors to hold back their investment or at least raise their return expectations correspondingly in order to compensate for the increased risk." (von Flotow & Friebe, 2011, p. 7)

In today's globalized world, financial markets observe the optimal level of asset allocation and returns based on risk inherent in the underlying economies. Whether public or private investors, they need to have a maximum possible return on their investment given the finite resources. In developing countries like South Africa, an arbitrary choice of discount rate[8] or cost of capital for renewable energy project evaluations has the potential to negatively affect the design of financial incentives and consequently investor interest.

Our paper provides a simple and concise model to estimate the cost of capital for renewable energy projects. We use the CAPM approach to propose an index-based model (Sharpe, 1964). The proposed model makes a fair estimate of the required discount rate using financial markets observation. It is parsimonious and captures common macroeconomic factors. It aims to contribute to a better and transparent process for required discount rate for the

[8] Internal rate of return refers to discount rate in evaluating a project.

investors and the Kyoto Protocol's CDM additionality determination. More specifically, it provides a simple and effective mechanism to calculate the discount rate required for South African renewable energy projects.

3.4.2 Background

In August 2011, South Africa announced a phased competitive bidding tender for renewable energy IPPs to decide long-term PPAs. This process, commonly referred to as renewable energy bidding, requires renewable energy developers to bid a tariff price for electricity generated, requiring each project seeking a PPA to be price competitive while also meeting the required return to equity investors. This was a shift from the anticipated REFiT announced in 2009, which had set an attractive tariff price for renewable technology, thus providing a reasonable required return to attract project developers and investors. However, the 2011 cancellation of REFiT in favour of the REIPPP process has reduced certainty that projects will receive a sufficient tariff rate to meet the investment return demanded by investors. This presents a challenge to renewable energy developers because their projects are not certain to be provided a PPA, increasing the risk profile even further.

South African renewable energy projects are also eligible to apply for CDM financing. At the high level, CDM is designed to stimulate "sustainable development and emission reductions" in developing countries (UNFCCC, 1997). The CDM is intended to provide financial incentive for emission reduction projects that would otherwise not be able to deliver a return high enough to compensate for the inherent project and local risk. This is necessary because the barriers to mobilize foreign capital for projects in countries with a high perceived country and political risks are significant.

At the practical level, CDM provides financial incentive to projects in developing countries that reduce carbon emissions over the business as usual scenario. As of September 2011, renewable energy projects make up 64% of the 6,724 projects in the CDM pipeline globally (Fenhann et al., 2011). CDM has been little used in South Africa, to date only 21 projects have been registered, of which only nine of the registered projects have issued credits (Designated National Authority South Africa, 2012; Fay et al., 2012). In order to access the CDM, projects must become registered through a multi-step process that requires an investment, barrier, or common practice analysis to prove additionality, with investment analysis being the most commonly used approach (UNFCCC, 2008). Simply stated, this asks if the project is feasible or not without the carbon revenue.

An investment benchmark analysis is used to determine if a project is worth pursuing in comparison to other opportunities. Similarly, for renewable energy projects to be registered under the CDM, project or equity IRR is compared to an appropriate and independently verified benchmark IRR (UNFCCC, 2011). As few projects are financed without equity investors, the required minimum rate of return on equity for the developers usually determines the viability of the project. However, the CDM methodology panel in its 50th meeting reported, "there is no consistency in the process of estimating the minimum equity rate of return to implement the project" (annex 8, page 1). As a result, developers use several methods such as CAPM, government mandated method, weighted average cost of capital, bank rates, etc. Considering the importance that equity IRR plays in deciding the overall financial viability of a project, a transparent and reliable method is needed to estimate it for investors and for the CDM process.

3.4.3 Renewable Energy Projects – Internal Rate of Return

Renewable energy projects compete for capital with all firms and particularly utilities and infrastructure related firms. Further, these projects in developing countries are largely dependent on external or global financing for equity investment. Global capital, particularly private money, has become a potential resource for developing countries. However, investors prefer investing in countries with manageable country and political risks[9]. They will only invest in high risk projects if they get a high IRR compared to low risk investment options. For example, an investor in a renewable energy project in Europe or North America might be content with an IRR of 6% while he may ask for a significant premium over and above that for a project in South Africa.

A project presents its own set of inherent risks. In theory, a project is taken up when its IRR exceeds the minimum acceptable rate of return or cost of capital. Hence, the IRR is a persuasive measure of acceptable rate of return for a project. In other terms, it is the discount rate to evaluate the desirability of a project.

A well-adapted renewable energy tariff scheme requires an acceptable rate of return to project investors. If investors do not find an attractive enough rate of return from renewable energy projects, they will move to other regimes to seek their remuneration. Allowing for a reasonable rate of return to the investors is a central feature of any initiative to promote renewable energy. Therefore, a benchmark IRR is important because it will help determine the minimum tariff required from the utility over a set period.

[9] Aggregate market risk premium has been used to derive the expected rate of return. The aggregate risk premium is associated with the development of equity markets, legal institutions, and securities regulation (La Porta, Lopez-de-Silanes, and Schleifer, 2006).

3.4.4 CAPM Discussion

Finance literature follows CAPM to compute the cost of equity that is the ex-post return (Sharpe, 1964; Lintner, 1965; Mossin, 1966). The evidence suggests that the ex-post returns are an imprecise proxy for expected cost of equity. Such models can provide imprecise ex-ante cost of equity, particularly for long gestation projects. Furthermore, finance literature (Roll, 1977; Fama and French, 1997) criticizes using such models to estimate proxy for the cost of equity. As an alternative, ex-ante rate of return for cost of equity using the discounted cash flow method is proposed. However, there is little consensus throughout the financial and accounting literature, with numerous models proposed (Claus and Thomas, 1998; Gebhardt, Lee, and Swaminathan, 2001; Easton, 2004; Ohlson and Juettner-Nauroth, 2005). The key differences of the various models are the underlying assumptions, including long-term forecasts earnings, growth rates, dividend payout ratio, amongst others. Unfortunately, the cost-of-capital estimates derived from ex-ante return on capital from these models have been unsatisfactory due to their assumptions and inputs.

Bruner et al. (1998) researched the leading firms identified in a report 'Creating World Class Financial Management: Strategies of 50 Leading Companies' for their excellence in strategic financial management. They conclude that these firms prefer CAPM to estimate the cost of equity. Kaplan and Peterson (1998) suggest that the CAPM has a strong theoretical foundation and simplicity, one of the reasons for its widespread use in practice. However, CAPM is criticized due to its simplified assumptions and to a certain extent for relying on wrong assumptions, calling into question the utility of the model (Fama and French, 1997). A key assumption in the CAPM model is that all assets are traded and accessible to all investors. In reality, this underlying assumption may be unrealistic and problematic. Critiques cite that if the

model makes a small deviation in the assumption, the expected return estimation can move far beyond the actual return. However, even with its weaknesses, the CAPM provides investors with useful and influential concepts for analyzing required return on investments. It is the position of the authors that CAPM criticism can be in large part addressed by inducting full-information industry beta into the model.

CAPM is widely used to estimate the cost of equity (Graham and Harvey, 2001), allowing managers to obtain a cutoff IRR for project analysis. There are numerous variants of the CAPM. The basic CAPM is a univariate equation for estimating the risk-adjusted cost of equity capital. Further, it values any kind of investment such as a project that uses a discounted cash flow with a risk-adjusted discount rate. It is consistent with the appropriate public utility regulatory and economic standards. The basic CAPM is as follows:

$$R = R_f + \beta*(R_m - R_f) \quad (1)$$

where R denotes the discount rate or cost of equity capital; R_f is the risk free rate; R_m is the expected return on the market and β is the beta of the cash flows or stock being valued. A market risk premium is estimated from $(R_m - R_f)$ where the term $\beta*(R_m - R_f)$ is the additional return for the firm. The beta (β) is an important measure of risk that adjusts the discount rate. It represents the volatility in a firm's stock price in relation to the rest of the market.

CAPM has several underlying assumptions including how to implement risk-free rate of return measurement, beta measurement, appropriate market proxy, and data observations in project evaluation. Beta is usually estimated from historical prices of the security. The absence of historical price information for a new project type can create problems with estimating and using betas for cost of capital. Other concerns are levered or unlevered beta measurement, size effect of a firm, appropriate adjustment factor for beta, industry risk, and company specific risk.

However, in terms of the appropriate economic standards, the CAPM produces return estimates that meet investors' opportunity costs and satisfy the demands of the risk/return trade-off.

3.4.5 Proposed Index-Based Model – Investment Benchmark

The cost of capital is notoriously difficult to measure and it is based on the operations risk of a project. In renewable energy project, equity investors have to consider many factors including the economic, political, legal, and industry conditions. The proposed model is an index-based model where the rate of return on a broad index of securities acts as a valid proxy for common macroeconomic factors. The broad index return represents the market observations based on the enduring economic relationships between elements of the real economy. Therefore, a more systematic and consistent benchmark IRR can be estimated using an index-based model.

The broad index return provides the cumulative assessment of investors about their expected return from the country's economy. Practitioners routinely use the market / index total returns to estimate expected returns on investments or cost of equity. The cost of equity tends to differ from the required minimum rate of return on equity. In a long-term project, the market sensitivity (beta) shows a tendency to evolve toward 1 over time. Thus, long-term projects avoid the need of estimating beta measurement. However, it is important to understand the risk attributes specific to the project and its industry. In the case of the South African renewable sector, where market data is not available for a long period of time, it is necessary to include a new industry risk in the index-based model.

In an investment decision, investors ask for additional compensation for the equity compared with the debt. Basically, investors look an equity risk premium that is the compensation required by investors for the additional risk of equity compared with debt. For

renewable projects in South Africa where IPPs currently represent an insignificant percentage of the overall energy supply industry, it is important for the investors to extrapolate the risk premium on the renewable energy projects based on equity risk premium of the entire market. These projects have long gestation periods requiring a similar time period of the risk free rate to be used for the benchmark. Yield to maturity (YTM) in the secondary market on a long-term government bond or bond index can be used. The model requires index-based data inputs that are largely objective and can be easily relied upon. The proposed index model to estimate the cost of capital for renewable energy projects is proposed as follows:

$$E(R_e) = \textit{YTM on a Long Term Government Bond} + \textit{Equity Risk Premium} + \textit{New Industry Risk Premium} \quad (2)$$

The equation is the bond-yield plus risk premium for equity and industry in estimating the expected return on equity. Adding variables such as size or liquidity, even ones that may appear significant, sometimes can be hazardous to forecast precision. A parsimonious model that is stingy about inclusion of variables is often superior (Bodie, Kane, & Marcus, 2009). Too many variables introduce errors on the precision of coefficient estimates and precision of forecasting. The above model has the clear practical advantage on both counts. Following CAPM assumption, the proposed index-based model allows the investors to be compensated in two ways: time value of money and risk. The model estimates are market driven and, therefore, an objective consensus of all investors in the financial market.

YTM on a Long Term Government Bond

In this case, "long term" is associated 10 years. For a long gestation project, valuation analysts often use 10 years Treasury bond YTM as a proxy for the risk-free rate. Considering the life span

of a renewable energy project is often 10+ years, the 10-year bond YTM should be used in the equation.

Equity Risk Premium

The equity risk premium is commonly viewed as the extra return needed to induce investors to put money in the equity of a company compared to the safe government bonds. Following basic economic principles, economic risk taking is rewarded with extra return. The equity risk premium can be used in three perspectives. First, from the investors' point of view, it is the excess expected return of equities over bonds. Second, from the firms' point view, the equity risk premium helps in estimating the cost of capital and subsequently the weighted average cost of capital. Third, from the valuation point of view, the premium figures into a discount rate that is used in calculating the present value. The equity risk premium is the same from all three perspectives, except for some potential market imperfection adjustments, such as taxes and transaction costs.

New Industry Risk Estimation

New industry risk is represented by industry beta that is calculated for a group of firms in the same industry. Industry risk premium is the excess return that investors expect from the industry. Ibbotson Associates full-information beta estimation process (Barad and McDowell, 2002) is used to compute the industry risk premium as presented in equation:

$$IRPi = (RIi \times ERP) - ERP \quad (3)$$

Where *IRPi* indicates the expected industry risk premium for industry *i*; *RIi* is the risk index (full -information industry *i* beta); and *ERP* represents the expected equity risk premium.

3.4.6 Use of Index-Based Model for Benchmark Rate of Renewable Energy Projects

Johannesburg Stock Exchange (JSE) provides three benchmark interest rate indices to asset managers and investors to assess their portfolio performance. These indices are the total return indices that accurately measure the performance of the bond market over time. Based on market capitalization and liquidity, the All Bond Index (ALBI), consists of the top 20 listed bonds. The Government Bond Index (GOVI) represents the South Africa bonds of the ALBI in which the South African Reserve Bank obliges the Primary Dealers to make a market. The Other Bond Index (OTHI) comprises the remainder of the bonds in the ALBI. The interest rate market data on these three indices are presented in Table 3.11 of the annexure.

Renewable energy projects in South Africa are in a nascent stage. It is difficult to derive expected return or equity risk premium for a single project. However, the country has reasonably developed capital markets where equities and bonds have been traded in the secondary market for a considerable period of time. Hassan and Biljon (2010) examine 105 years data to determine the equity premium in South Africa. They compute equity premium over bonds and bills for yearly-realised premium in 3, 5, 10 and 20 years moving averages. They find that the equity premium has been positive in all time horizons. It varies 7.7% to 9.3% over bonds and bills. Table 3.12 of annexure presents the equity premium in South Africa as reported by Hassan and Biljon (2010). Geometric averages incorporate compounding effects. Hence, Geometric mean of equity risk premium is preferred in the proposed model to estimate benchmark IRR.

Equation 3 suggests new industry risk in the proposed market model. Grid connected renewable energy projects are new to South Africa therefore it is difficult to obtain industry beta for this sector. It is important to find a reasonable substitution to estimate the new industry risk premium. The equity market in South Africa continues to evolve. There are not yet exchange-

traded funds (ETFs) that invest in alternative or clean energy firms through the Johannesburg stock exchange. Since new industry risk premium is a key variable in estimating the cost of capital, we are concerned about using beta of international ETFs or mutual funds as differences in the market sensitivity could affect the results. To address this concern, Harvey (1995) suggests that it is common in international studies to use the U.S. Treasury bill as a proxy for the risk-free rate in all countries by converting the variables in dollar terms. This approach essentially allows the market sensitivity as reflected in the beta coefficient to be used across countries. It is of course possible that the betas of local funds would differ. Therefore, we address this concern by using the average beta of 1.69 from the top ten alternative energy ETFs as the proxy of new industry risk premium, as illustrated in Table 3.13 of annexure.

Benchmark Equity IRR Estimation

To calculate the cost of capital or a benchmark IRR, the market data should be used for at least 10-year period instruments considering the life span of renewable energy projects. Investors in South African renewable energy projects would expect the following return on their investments.

$E(R_e)$ = *YTM on GOVI Index + 10-Year Equity Risk Premium*

+ New Industry Risk Premium

New Industry Risk Premium = *(RI x ERP) – ERP*

= (1.69*7.29%) - 7.29%

= 5.03%

$E(R_e)$ = 10.64% + 7.29% + 5.03%

= 22.96%

The index-based model suggests that given the market level expectation in South Africa, current investors would expect 22.96% return on their investments in the renewable energy industry.

Is the Level of Expected Return (22.96%) in South Africa Justifiable?

To test the index-based model expected return, we look at the market data of stock market performance, return on equity for all traded firms, prime lending, and risk free rates for the period 2002 to 2010. Financial Times Stock Exchange (FTSE) / JSE All-Share Index represents the market performance. It includes 99% of the full market capital value of all ordinary securities listed on the JSE. All firm data show stocks traded on the South African stock market. Prime lending rate is the interest rate charged by the banks to their most creditworthy customers. The rate is approximately the same amongst major banks.

The returns on index and interest rates are obtained from publicly available sources. South African companies' data is obtained from Damodaran online website.[10] The database includes all listed firms on the JSE that have a market capitalization more than USD 5 million. Overall, we find 280 firms in the data file. The Damodaran database provides the return on equity (RoE) of the firms.

Table 3.14 of the annexure presents the annual market returns; RoE for all firms weighted average by firm value and market capitalization, prime lending, and risk free rates. The market returns as represented by the FTSE / JSE All-Share Index show that the return fluctuates from -23.20% to 47.30% during the period 2002 to 2010. The average RoE for all publicly traded firms in South Africa provide an indication that the proposed index model provides a reasonable estimation for RoE or cost of capital. Column 3 and 4 present the average RoE for all firms weighted average by firm value and market capitalization. The average RoE for all firms weighted by firm value varies from 22.83% (year 2009) to 31.76% (year 2005). Similarly, the average RoE for market capitalisation-weighted firms is between 25.40% (year 2007) to 31.88%

[10] http://pages.stern.nyu.edu/~adamodar/New_Home_Page/sitemap.htm [accessed 11/01/2011]

(year 2005). We find a clear understanding that during 2002 to 2010, the investors have generally had returns of 25% or above on their capital. Thus, we find that the index-based model result correlates the actual returns on equity for the investors. While these analyses suggest that our findings are quite vigorous and not spurious, we acknowledge that some concerns about measurement error remain.

Table 3.14 of the annexure further supports our model estimation via the average annual prime lending and risk free rates during the same period. Prime lending rate is as low as 9.50% and as high as 15.50%. Similarly, the low and high-risk free rate is 6.42% and 11.17%, respectively. Table 3.15 of the annexure presents the longer duration average market returns and prime-lending rate over different investment horizons.

3.4.7 Conclusion

To attract capital, projects must compensate investors based on time value of money and risk. An arbitrary choice of discount rate for the project can limit investor interest and adversely affect the ability of South African renewable energy projects to leverage the CDM. To mitigate this potential problem, we propose an index-based model that makes a fair estimate of equity IRR using financial markets observation. The index-based model is parsimonious and it captures the common macroeconomic factors. More specifically, it provides a simple and effective mechanism to calculate expected IRR for renewable energy projects in South Africa.

ANNEXES

Table 3.11: Johannesburg Stock Exchange Interest Rate Market Data

The interest rate indices traded in on the board of the JSE are reported as on July 01, 2011. It includes all bond index, government bond index, and other bond index.

Interest Rate Index	Total Return Year on Year on 7/01/2011
ALBI Index	10.78%
GOVI Index	10.64%
OTHI Index	11.63%

Source: Johannesburg Stock Exchange

Table 3.12: Equity Premium over Different Investment Horizons in South Africa

Equity premium is the excess return that the overall stock market provides over a risk-free rate. This excess return is to compensate the investors for taking on the relatively higher risk of the equity market. Hassan and Biljon (2010) illustrate the geometric and arithmetic means over bond and bills for different investment horizons.

Year	Return	Equity Premium (%) over Bond	Equity Premium (%) over Bills
Yearly	Geometric Mean	5.37%	6.17%
	Arithmetic Mean	7.08%	8.22%
3-year	Geometric Mean	6.36%	7.24%
	Arithmetic Mean	6.89%	7.92%
5-year	Geometric Mean	6.68%	7.62%
	Arithmetic Mean	6.97%	7.96%
10-year	Geometric Mean	7.29%	8.15%
	Arithmetic Mean	7.43%	8.30%
20-year	Geometric Mean	8.14%	8.94%
	Arithmetic Mean	8.19%	9.00%

Source: South African Journal of Economics
The above table was reported in the article "The Equity Premium and Risk-free Rate Puzzles in a Turbulent Economy: Evidence from 105 Years of Data from South Africa by Shakil Hassan and Andrew Van Biljon, South African Journal of Economics Vol. 78:1 March 2010".

Table 3.13: Beta of Exchange Traded Funds (ETFs) of Clean Energy Investments

The Stock Exchange provides vehicles for the investors to invest in alternative energy investments opportunity through Exchange Traded Funds (ETFs). The ETFs track a specified Alternative Energy Index. The table reports the beta of clean energy ETFs as of July 2012.

Clean Energy Exchange Traded Funds	Beta
S&P Global Clean Energy Index (ICLN)	1.96
PowerShares WilderHill Clean Energy (PBW)	1.71
PowerShares Global Wind Energy Portfolio (PWND)	1.49
PowerShares Cleantech Portfolio (PZD)	1.43
Powershares Wilderhill Progressive Energy Portfolio (PUW)	1.43
Van Eck Global Alternative Energy (GEX)	1.66
Winslow Green Growth Inv (WGGFX)	1.42
First Trust Global Wind Energy (FAN)	1.50
Van Eck Global Solar Energy (KWT)	2.11
Guggenheim Global Solar (TAN)	2.20
Average Beta	**1.69**

Source: Google Finance

Table 3.14: Annual Index Return, Average Return on Equity, Prime Lending and Risk Free Rate in South Africa

The JSE index indicates the annual returns. The average return on equity for all firms is computed using weighted average firm value and market capitalization. Prime lending and risk free rates are the average lending rate during the year.

Year	FTSE/JSE Africa All Share Index Return	Average Return on Equity for All Firms		Prime Lending Rate	Risk Free Rate
		Weighted Average by Firm Value	Weighted Average by Market Capitalization		
2002	-8.10%	26.21%	26.51%	15.50%	11.17%
2003	16.10%	28.03%	30.92%	13.40%	10.65%
2004	25.40%	27.36%	28.42%	11.00%	7.53%
2005	47.30%	31.76%	31.88%	10.50%	6.90%
2006	41.20%	26.86%	25.92%	11.75%	7.34%
2007	19.20%	25.19%	25.40%	13.75%	9.11%
2008	-23.20%	28.91%	29.89%	15.17%	10.81%
2009	32.10%	22.83%	25.78%	12.10%	7.86%
2010	19.00%	25.57%	27.17%	9.50%	6.42%

Source: Johannesburg Stock Exchange

Table 3.15: Average Index Return and Prime Lending Rate in South Africa

The geometric and arithmetic means for index returns are computed from its annual index returns for 12 years, 10 years, and 5 years, respectively. Similarly, geometric and arithmetic means are reported for the prime-lending rate for the same period.

Particulars	Return	1999-2010	2001-2010	2006-2010
FTSE/JSE Africa All Share Index Return	Geometric Mean	14.62%	17.86%	15.23%
	Arithmetic Mean	18.52%	19.81%	17.66%
Prime Lending Rate	Geometric Mean	12.84%	12.73%	12.30%
	Arithmetic Mean	12.99%	12.90%	12.45%

Source: Johannesburg Stock Exchange

3.5 Paper 5: Renewable Energy Incentives across Varying Levels of Statehood

3.5.1 Introduction

Climate change governance includes contributing toward mitigating GHG emissions in order to maintain a stable climate as an essential public good. This paper explores the mitigation aspect of climate change governance by assessing MBIs that promote renewable energy. This research illustrates the central role that statehood plays in renewable energy development, specifically with regard to financing considerations that are generally considered separately from socio-political factors. The private sector IPP is often dependent on the state to provide and maintain financial incentive over the lifetime of the project to ensure a sufficient return on investment for its renewable energy projects. Conversely, the state is dependent on the IPP to deliver clean energy to the country's electricity supply at the lowest possible cost in order to maximise use of limited governmental resources. However, in developing countries, MBIs need to also provide investors with a return commensurate to the risk associated with a lower level of statehood, thus serving as the functional equivalent to the state's shadow of hierarchy (Börzel and Risse 2010).

The objective of this paper is to identify how financial considerations affect deployment of renewable energy in developing countries. This research analyses the cost of capital required for the renewable energy projects to establish a quantifiable proxy of the risk profile that is, in large part, determined by the countries' level of statehood. In order to purposefully build the theory, case studies of South Africa and Germany were drawn from a non-random theoretical sampling (Eisenhardt and Graebner, 2007; Eisenhardt, 1989). The case studies focus on the various contextual features influencing project finance, as illustrated in hypothetical wind farm projects. The two countries were selected because both have implemented MBIs to promote

renewable energy. Germany and South Africa also differ significantly with regard to their degree of statehood and level of socio-economic development. South Africa is an emerging economy with a nascent wind energy sector, while Germany is a developed country with an advanced wind energy industry. Data has been collected through literature review, document analysis and interviews with renewable energy sector stakeholders in Germany and South Africa.

In the remainder of this paper, the background of renewable energy MBIs and considerations for renewable energy in developing countries is discussed. Next, a comparative analysis of hypothetical wind energy projects in South Africa and Germany is explored with the cost of capital resulting from variance in host country level of statehood being emphasised. Lastly, international and national policies to adapt MBI design to the host country level of statehood are discussed.

3.5.2 Renewable Energy Incentive Background

Limiting the long-term average temperature increase to 2°Celsius, commonly correlated with CO_2 ppm of 450, has been established as the consensus mitigation target to maintain a stable climate (Pachauri and Reisinger, 2007; IEA, 2008; IEA, 2011). Unfortunately, by not fully accounting for the negative externalities to the environment, carbon intensive power generation benefits from artificially low tariff prices that in part help to create a cost advantage over renewable based electricity generation (Menanteau et al. 2003; Dinica 2006). As a result, it is anticipated that the global emissions trajectory will go well beyond the target 450 scenario.

The World Energy Outlook 2011 sounds an alarm with the following prediction, "If stringent new action is not forthcoming by 2017, the energy-related infrastructure in place will generate all the CO_2 emissions allowed in the 450 Scenario up to 2035" (IEA, 2011, p.2). This

illustrates the urgent need to increase renewable energy in the overall electricity supply. However this is easier said than done because a main cause of the looming lock-in challenge is that renewables are historically not perceived to be cost competitive when compared with fossil fuel based electricity generation (Arent et al., 2011; Haas et al., 2004).

Recently there has been progress towards increasing renewable energy's contribution to the overall global energy supply. In 2010 an estimated 19.4 per cent (16.1 per cent hydro and 3.3 per cent other renewables) of overall electricity consumption was supplied by renewable energy, with nearly half the 2010 added electricity capacity of approximately 194 gigawatts (39 GW Wind, 30 GW Hydro, 17 GW Solar photovoltaic) coming from renewable sources (Janet and Martinot, 2011). The contribution of renewables toward added capacity is particularly important because worldwide demand for energy continues to increase, particularly from emerging economies such as China, India and South Africa.

In order to avoid locking in traditional fossil fuel systems, alternative energy sources must become a major contributor to meet the future energy demand of developing economies. The 21st century global centres of growth have shifted, which has important implications for the geographical focus of renewable energy MBIs. The OECD countries are no longer the drivers as "non-OECD countries account for 90 per cent of the energy demand growth over the period from 2010-2035" (IEA, 2011). Such growth trends highlight the need for effective renewable energy promotion policies that address the challenges inherent to developing countries with limited statehood.

While the potential of MBIs to deliver cost-effective environmental policies has been widely recognised by policymakers, the focus of MBI theory has largely been placed on OECD countries (Stavins, 2002; Sandor et al., 2002; Aldy and Stavins, 2012). As a consequence, limited

research exists on the applicability of MBIs in areas of limited statehood, particularly developing countries where the state capacity to fully implement and enforce policy mandates is often lacking due to their limited ability to effectively implement and enforce policy (Börzel and Risse, 2010). As pointed out by Börzel et al. (2010), even in South Africa where legal standards and regulation are quite advanced, capacity for implementation and compliance is often lacking.

To overcome the challenges to renewable energy deployment, a policy shift supported by effective incentive mechanisms is needed to catalyse a rapid transition toward renewable energy sources (Christensen et al., 2006). A number of approaches have been implemented to promote renewable energy, each requiring significant involvement from the state. The ongoing debate over what approach is the most successful and effective focuses on price driven versus demand driven strategies (Haas et al., 2004). Price driven strategies are characterised by the state setting a price that is intended to reduce uncertainty and attract IPPs. The best known mechanism is the REFiT, whereby the government sets premium tariff prices through long-term contracts for electricity from renewable energy generated by IPPs (Huang and Wu, 2011). On the other side of the debate is the demand driven approach. Within this strategy the state sets an objective to be reached, typically through quotas on electricity suppliers through a system of tradable green certificates (Menanteau et al., 2003).

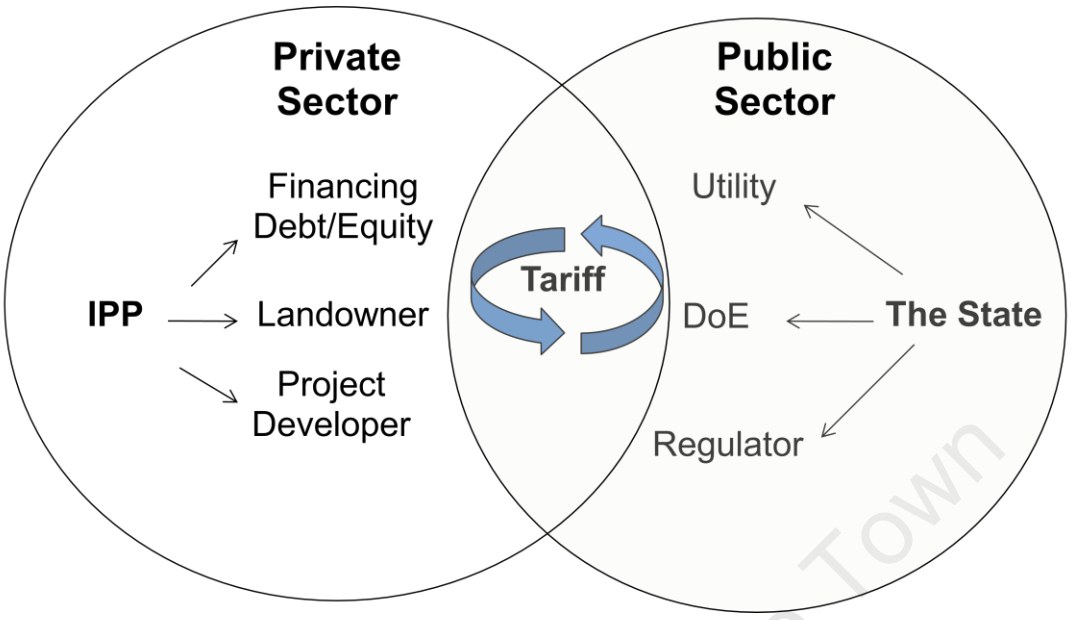
Fixed price REFiTs have been effectively used to exceed renewable energy targets in Germany (Janet and Martinot, 2011). However they have been criticised on the basis of not being cost efficient (Frondel et al., 2010; Butler and Neuhoff, 2008; Krewitt and Nitsch, 2003). To address this, the German Renewable Energy Sources Act is periodically reviewed and REFiT tariffs revised to align with the maturing renewable industry and decreasing installation costs. A fixed price REFiT was initially planned for South Africa (NERSA, 2009). However, this was

abandoned in favour of a competitive bidding process whereby REFiT prices are determined through a staged competitive bidding process that began in August 2011.

Furthermore, an enabling environment must be created within local, national or international structures that can generate sufficient incentive for IPPs to engage at a project level (Dunkerley, 1995). Such incentives for promoting renewable energy should "offer a reasonable risk-return ratio to investors and … minimise the total costs for society" (von Flotow and Friebe 2011, p.9). To effectively address both these requirements, MBIs develop in a co-evolutionary manner. The IPP's need for financial incentive and the state's willingness and ability to subsidise is what makes possible the co-evolutionary relationship. The desired outcome is a well-designed MBI emerging through co-evolutionary interactions between IPPs and the state, which culminate in incentives set to entice private sector participation at the lowest cost to society.

The players within government will, at a minimum, include the department of energy, the state energy regulator, the utility that supplies and/or distributes the electricity via the power grid (or multiple utility companies when deregulation has occurred) and the local municipal government. On the other hand, the renewable energy private sector includes a range of organisations that come together to form or support IPPs, such as project developer, equipment manufacturers, debt and equity providers and the landowners. Figure 3.3 is a high-level illustration of the key actors in the co-evolutionary framework.

Figure 3.3: Co-Evolution of Renewable Energy Incentive Design



The IPP is dependent on the state to ensure a sufficient return on investment for its renewable energy projects, and the state is dependent on the IPP to deliver clean energy to the country's electricity supply. Due to limited resources in developing countries, any additional costs associated with promoting renewable energy must be fully understood and evaluated within the context of all other immediate development challenges facing the host country.

The private sector is primarily concerned with achieving their expected rate of return for the project, which is based on the underlying risk profile of the venture. It has also been acknowledged that non-economic factors (i.e. administrative hurdles, grid access procedures, non-transparency) influence decision making by project developers (Lüthi and Prässler, 2011). However, assuming sufficient natural resources exist and authorisation is feasible, the main concern of the business organisation is an acceptable financial return in line with the risk profile of the project and host country. As a result the IPP is motivated by the business opportunity

established by the state and is incentivised to actively engage with defining the rules and regulation that result in an attractive MBI (Toke, 2007; Dinica, 2006).

3.5.3 Considerations of Renewable Energy Promotion in Areas of Limited Statehood

Effective MBIs in developing countries must be cognisant of the host country level of statehood and the corresponding perceived risk. In developing countries, MBIs act in part as the functional equivalent to the shadow of hierarchy cast by the state (Börzel and Risse, 2010). MBIs are required to bridge the cost differential between traditional fuel sources and renewables, and provide assurance that IPPs will receive a financial return that corresponds with the host countries' risk.

The financial support to the tariff price is a result of the current *tariff price differential* between fossil fuel based power generation and renewable energy. The key challenge is to determine a price per kWh that can provide an appropriate private sector return on investment. The desired outcome is a tariff price that represents the lowest possible cost of renewable energy but is still attractive to IPPs. Key considerations include: What is the differential cost between renewable energy cost and the current tariff rate? Who will pay the differential between the existing electricity price and the cost of renewable energy? What is the price sensitivity of the end electricity consumer? These questions have different answers depending on the country's context and level of statehood. Within South Africa, even though climate change threatens to have a disproportionally negative impact on Africa (Stern, 2007; Parry, 2009), paying higher costs for electricity is often viewed as unacceptable considering the numerous and more urgent development challenges facing the country (Fay et al., 2012; Vorster et al., 2011).

The private sector has an entirely different set of drivers compared to the state. Classic risk

versus reward analysis is invoked, with level of statehood as a key determinant of risk. Moving from developed to developing countries has significant overall cost implications because investors demand an increased IRR[11] in areas with a lower level of statehood. Renewable energy projects are highly dependent on financing terms, with the IRR in large part determined by the risk associated with anticipated cash flows (Wiser and Pickle, 1998). This means that IPPs must have confidence that the host country government will honour contractual obligations and continually fund the subsidy over the long term.

Global capital has become a potential resource for developing countries and power projects are often dependent on global financing for investment. Investors prefer investing in countries with manageable country and political risks. They will only invest in higher risk projects and countries if they receive a higher return compared to lower risk investment options in developed countries. The viability of any renewable energy project is determined by its ability to achieve a financial return in excess of the perceived risk associated with the project. IPPs decide on projects based on their potential to achieve the equity IRR that is determined by the risk profile of the project and host country.

A recent survey conducted by von Flotow and Friebe (2011) exploring investor's preferences for different framework conditions for investments in wind parks in emerging and developing countries concluded that:

> "Investors want to reduce political investment risks (framework conditions) as much as possible. An increased risk in comparison to an ideal scenario can cause investors to hold back their investment or at least raise their return expectations

[11] Internal rate of return is the metric used to measure and compare the profitability of potential investments.

correspondingly in order to compensate for the increased risk." (p.19)

This runs counter to the need for the governance system to minimise the overall cost of electricity. As a result, it becomes more difficult to make a compelling financial case for promoting renewable energy in developing countries and underscores the importance of effective MBI design. Next, a comparison between Germany and South Africa is presented to highlight how perceived level of statehood affects the financing of renewable projects.

3.5.4 Germany and South Africa Wind Energy Projects in Comparative Analysis

There are wide variations in the cost of wind energy projects across countries in large part due to level of statehood (Schwabe et al., 2011). In an effort to elucidate these profound differences, a comparative analysis of wind energy in Germany and South Africa is provided. First, the expected IRR benchmark is estimated for South Africa and Germany. Then using the estimated IRR benchmarks, the tariff price required to meet this investment hurdle is modelled using hypothetical wind farms in both countries.

Estimating the cost of capital for renewable energy projects is subjective, with little consensus on the preferred approach. The main options for estimating cost of capital are to use: 1) historical market data (ex-post) using the CAPM; 2) estimate future cash flows (ex-ante) to determine rate of return of equity using the discounted cash flow method. For the purpose of this analysis, CAPM using historic market data is selected. This method is used because it incorporates the risk attributes specific to the country, project and industry. South Africa and Germany both have well functioning financial systems with decades of reliable market data to draw upon. Furthermore, research has shown this approach is preferred in practice. Bruner et al. (1998) researched the leading firms identified in a report 'Creating World Class Financial

Management: Strategies of 50 Leading Companies' for their excellence in strategic financial management. They conclude that these firms prefer CAPM to estimate the cost of equity. Furthermore, Kaplan and Peterson (1998) suggest that the CAPM has a strong theoretical foundation and simplicity, one of the reasons for its widespread use in practice.

In the case of renewable energy projects, equity investors have to consider many factors including the economic, political, legal, and industry conditions of the host country. The proposed model to estimate required IRR is a market-based model where the return on a broad index of securities acts as a valid proxy for these common macroeconomic factors. This represents the market observations based on the enduring economic relationships between elements of the real economy, which can be viewed as an approximate measure of statehood. Specifically, the market proxies used for estimating the equity IRR are the YTM on long-term government bonds and the equity risk premium.

Furthermore, wind power is new to South Africa. The first ever round of negotiations for power purchase agreements for renewable IPPs were announced in December 2011 as part of the competitive bidding process. The lack of South African experience with wind power causes further uncertainty for investors relating to the wind resource, construction, operations, and maintenance of turbines. As a result a new industry risk premium is applied by investors to compensate for the nascent stage of the wind power sector in South Africa. However, over time as South Africa gains experience wind power, the new industry variable will decrease to zero.

The CAPM approach to estimate the equity IRR for renewable energy projects has been developed in previous work by Fay and Kumar (2011). The model allows the investors to be compensated in two ways: time value of money and risk. The estimates are market driven and,

therefore, an objective consensus of all investors in the financial market. The proposed model to estimate the cost of capital for renewable energy projects is as follows:

Expected return on equity $E(R_e)$ = YTM on a long term government bond + equity risk premium + new industry risk premium

Applying the model to South Africa as of January 2012 yields an expected rate of return of 20.77 per cent:

South African $E(R_e) = 8.45\% + 7.29\% + 5.03\% = 20.77\%$

The YTM on the Long Term Government Bond rate of 8.45 per cent is reported from the Johannesburg Stock Exchange's GOVI Index as of 3 January 2012. The 10-year equity risk premium of 7.29 per cent is taken from Hassan and Van Biljon's analysis (2010). The new industry premium of 5.03 per cent is calculated using the Ibbotson Associates full-information beta estimation process[12].

By comparison, Germany, with a higher perceived level of statehood and a more advanced wind sector than South Africa, benefits from a much lower expected rate of return at 7.30 per cent:

Germany $E(R_e) = 1.90\% + 5.40\% + 0\% = 7.30\%$

The YTM on the long-term government bond rate of 1.90 per cent is from 3 January 2012 and is based on the German government backed 10-year bond (Bloomberg 2012). The equity risk premium of 5.40 per cent is estimated via an in-depth survey approach performed by Fernandez, Aguirreamalloa and Corres (2011). Germany has one of the most developed renewable energy

[12] *IRPi = (RIi x ERP) – ERP;* where *IRPi* indicates the expected industry risk premium for industry *i*; *RIi* is the risk index (full information industry *i* beta) estimated using the top ten alternative energy exchange-traded funds as the proxy of new industry risk premium (beta =1.69); and ER*P* represents the expected equity risk premium.

sectors in the world. It is a leader in the manufacture of wind turbines and had over 27.2 GW of wind operating at the end of 2010 (Janet and Martinot, 2011, p. 20). Due to the advanced state of the wind sector in Germany, the new industry risk premium of zero is applied.

The IRR benchmarks demonstrate a significant difference between cost of capital in Germany and South Africa. Germany, with a high level of statehood and an advanced wind energy sector, benefits from a low cost of capital for the wind projects. Conversely, South Africa has a lower level of statehood that is combined with a nascent wind energy sector, resulting in a higher perceived risk, that in turn demands a higher cost of capital.

Next, the effect of cost of capital on the overall tariff price is explored for Germany and South Africa. A financial model is developed for hypothetical 100 megawatt (MW) wind farms in both countries in order to estimate the tariff price required to meet the projects expected return on equity. Hypothetical wind farms, as opposed to actual wind farms, were modelled because of the competitive nature of the on-going REIPPP process in South Africa. The purpose of this analysis is to illustrate the overall price (as measured by required tariff) variation between comparable renewable power generation projects. Table 3.16 provides a summary of the key variables input into the financial model for the hypothetical South African and German wind farms. Indicative quotes from actual operating and maintenance service providers are used uniformly across both projects. All other uniform assumptions are wind industry norms or estimates from best available data. The lifespan of both projects is 20 years. The key variable inputs are capital expenditure per MW wind installed, capacity factor, consumer price index (CPI) and the interest rate for debt financing.

Table 3.16: Hypothetical Wind Farm Financial Modelling Assumptions

Technical	South Africa	Germany	Unit
Wind Turbine Capacity	2.5	2.5	MW
Turbines	40	40	Turbines
Total Capacity	100.0	100.0	MW
Wind Capacity Factor	27.17%	25.80%	%
Estimated annual net generation	238,009	226,008	MWh
Operating	**Value**	**Value**	**Unit**
O&M cost annual (indexed by inflation)	29.66	29.66	Million Rand
Socio-Economic Development Fee	2.1%	0.0%	% Revenue
Annual escalation in Tariff (CPI)	5.0%	2.3%	% Increase
Inflation (CPI)	5.0%	2.3%	%
Land Rental Fee	1.5%	1.5%	% Revenue
Salvage Value	5%	5%	% of turbine cost
Financial	**Value**	**Value**	**Unit**
Capital Expenditure	R 1,473.71	R 1,399.16	Million Rand
Debt	70.00%	70.00%	%
Equity	30.00%	30.00%	%
Equity IRR	20.77%	7.30%	%
Interest rate – Debt	9.00%	3.58%	%
Loan repayment tenure	15	15	Years
Tax rate	28.00%	28.00%	%
Exchange Rate	1 Rand	10 Euro	Rand to Euro

For the South African model, the Standard Bank benchmark of US$2,000,000 per MW installed is used to estimate the cost of building wind farms in South Africa (Standard Bank, 2011). The 9 per cent interest rate used is the South African prime-lending rate as of January 2012, and the CPI is the 2011 average of 5 per cent (Statistics South Africa, 2012). The potential wind resource uses a capacity factor of 27.17 per cent as estimated by a capacity study that relates to the first 2000 MW of installed wind capacity in South Africa (Werner et al., 2011).

While capital expenditure outlays have varied over the years by project, an average German specific benchmark of €1,373,000 per MW installed, determined by the International Energy Agency is used (Schwabe et al., 2011). The interest rate of 3.58 per cent is sourced from

Bundesbank, using the rate that the domestic banks in Germany charge on euro-denominated loans to non-financial corporations domiciled in the Euro area as of November 2011. The inflation rate used is Germany's 2011 average CPI of 2.32 per cent (CPI, 2011). The estimated average capacity factor for Germany is 25.8 per cent, based on 2008 wind farm performance results (Schwabe et al., 2011)

The above analysis results in a rough estimation of the inflation indexed tariff rate necessary over a 20-year period for IPPs to engage in South Africa and Germany. A tariff rate of €6.3c per kWh is necessary to meet the expected return on equity of 7.30 per cent in Germany, while a tariff rate of €9.7c is necessary to meet the expected return on equity of 20.77 per cent in South Africa. This represents a 54 per cent higher cost to generate wind energy in South Africa. Such a profound price differential, even with the better-anticipated wind resource in South Africa, underscores the implications of the host country risk on financing. The financial engineering of renewable energy projects further compounds the difficulties because of the substantial up front capital needed and the long-term repayment based on the power purchase agreement. As a result, cost of capital plays a larger role in the viability of renewable energy projects in countries with higher levels of limited statehood, and any incentive mechanism must understand and address each country's specific cost of capital situation.

From the perspective of the state, it is important to understand the cost differential between renewable energy and the current tariff price. Even though direct comparisons of IPP generation costs and existing tariffs from national utilities are difficult to fully discern (Eberhard and Gratwick, 2011), they are useful for providing a basic understanding of the price differential when including new energy sources to an incumbent system. Table 3.17 compares the hypothetical tariff rate required by wind energy IPPs, the current retail household kWh tariff rate

and the on-shore wind tariff rate offered in both countries. What emerges from the German case is that the retail price of €26.7c is significantly higher than the estimated cost of €6.3c for wind energy generation. This is not a straight comparison because the overall tariffs in Germany are comprised of numerous taxes and charges; therefore exact cost of generation can only be estimated. For example, an analysis of the 2005 electricity tariff in Germany found that 60 per cent of the tariff contributed to electricity generation, transmission and marketing; 10 per cent to a concession charge and the remaining 30 per cent toward taxes (Wenzel, 2006).

Table 3.17: Tariff Pricing Comparison

Country	Estimated Wind Generation Cost	Household Tariff kWh	Wind Energy Pricing
Germany	6.3c[13]	26.7c *	5c – 9c ***
South Africa	9.7c	6.07c **	11.5c ****

Euro cent denominated
* June 2011 retail household end-user with consumption of 3 500 kWh/year, source: http://www.energy.eu/
** 2012/2013 standard average price, Source: http://www.eskom.co.za/c/53/tariffs-and-charges/
*** Estimated German REFiT pricing 2011, Source: http://www.energy.eu/#Feedin
**** Maximum bid allowed under REIPPP for on-shore wind energy is 115c ZAR

To estimate the actual cost of electricity generation for Germany, the average base price for electricity on the European Power Exchange Spot market for Germany/Austria was €51.12 per MW hour in 2011, which corresponds to approximately €5.1c per kWh (EPEX Spot, 2012). The REFiT pricing used in Germany shows that the estimated generation cost for 2011 electricity in the German grid network is only slightly above the hypothetical cost for wind power and at the low end of the German REFiT. This implies that wind energy in Germany is getting close to being cost competitive versus traditional generation.

In direct contrast, the South African state has fewer options available to promote renewable energy because the gap in price differential between wind and the retail electricity

[13] Exchange rate of 10 to 1 is utilised to convert from Rand to Euro

price is significant. ESKOM, the monopolistic South African utility, currently provides electricity to households at a retail price of approximately €6.07c (NERSA, 2012). This tariff price includes increases over the past three years of approximately 25 per cent in 2010 and 2011 and 16 per cent in 2012 (ESKOM, 2011). However, even with these increases, the cost of generating coal-based power using South Africa's legacy infrastructure is still comparatively inexpensive (Pegels, 2010). This presents a challenge to fund the differential between the current tariff and the estimated €9.7c to generate wind energy in South Africa.

Another important consideration that underpins this analysis is the willingness and ability of the end electricity consumer to absorb higher costs for electricity. As is the case with most developing countries, South Africa has high levels of poverty and inequality, resulting in substantial price sensitivity for a large part of the population to tariff price increases. Compounding the problem is that the government has limited resources and must prioritise the most immediate needs such as health and education, to name a few. Subsidy funding for renewable energy, as a result, is secondary because the country faces a host of developmental challenges that are perceived as more important and immediate than climate change (Winkler and Marquand, 2009). On the other hand, Germany has a much higher electricity price and a populace less sensitive to price increases. There has also been a consistent willingness to buy renewable energy at a higher price by the German consumer (Wüstenhagen and Bilharz, 2006), providing much more flexibility and support for renewables in Germany.

3.5.5 Discussion: MBI Policy in Areas of Limited Statehood

The energy sector is dynamic and constantly changing, with a number of trends supporting renewable energy deployment. The overall costing trend for installing renewable capacity has

been decreasing each year as technology improves and greater scale is achieved. Furthermore, renewables generally reduce the overall volatility of energy project pricing structures because there is no fuel costs. Wind energy investors have relatively certain knowledge of the lifetime cost of the plant from the outset because installed costs and mean wind speed are known, and there are low variable costs, zero fuel cost, and no carbon emission costs (Schwabe et al., 2011).

On the other hand, underlying fuel costs of traditional energy sources (i.e. coal, oil, gas, nuclear) are highly variable and increasing because they are subject to the world market and the increasing demand for energy. The cost differential between renewables and fossil fuel based electricity is also highly country specific, because both renewable energy potential and availability of fossil fuels differ from country to country. Furthermore, developing countries are often characterised by dominant state-owned utilities that are "rarely exposed to market costs of capital" (Eberhard and Gratwick, 2011, p.5542). This manifests in widely varying price differentials between the current electricity tariff offered by incumbent national utilities and the price required by IPPs to profitably provide electricity from renewable sources.

For renewable energy in developing countries to reach the scale required to meet the 450 scenario, MBI design must carefully consider cost of capital and the potential role of incentives in decreasing project risk. By doing so, MBIs will increase their cost-efficiency and shorten the timeframe until renewable electricity generation reaches parity with traditional energy systems. This will require innovative approaches to incentivise both the state and IPPs.

Recommendations include implementing mechanisms that provide below market rate loans and loan guarantees to the IPP in order to reduce risk and drive down the cost of capital. The host countries' level of statehood could be the determining factor if the mechanism is managed by the international climate regime or the national government. Countries with limited

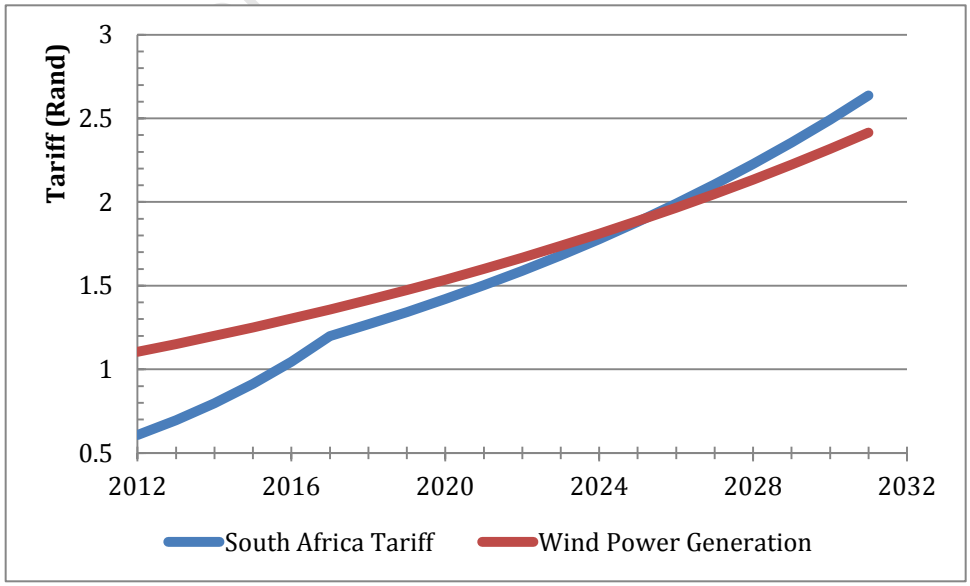
statehood would then benefit from an international mechanism, which could draw down the project's host country risk. Precedent exists for such mechanisms at the national level. For example, the German government has successfully provided below market rate loans to support its renewable energy sector. As early as the 1990s, wind energy plants and PV roof systems were eligible for soft loans with an interest rate reduction of 4.5 per cent as compared to standard loans (Paolo, 2006; Rosaria Di Nucci et al., 2007). In 1999, Germany introduced the market incentive programme for smaller scale renewable energy systems that provided direct investment subsidies and soft loans with long term repayment conditions and partial debt forgiveness if certain conditions were met (Bechberger and Reiche, 2004). In 2011, South African government even began exploring such options through an initiative called South African Renewables Initiative (SARI), a collaboration with global donors and foreign governments to explore innovative funding mechanisms to lower the cost of renewable energy deployment (Creamer, 2011). However, as of 2013, no activity of note has advanced as a result of SARI.

Another recommendation is to address the tariff price differential with mechanisms specifically designed to leverage the stable cost of wind energy versus the increasingly volatile fossil fuel based electricity costs. Theoretically, an international financing mechanism could engage directly with South Africa to provide immediate financial support to meet the incremental tariff price difference for wind energy. The business as usual tariff price could be marked to the predominant fuel source used in the host country, for example coal in South Africa. If designed effectively, opportunity may exist for funds to be repaid if and when wind energy becomes cheaper than coal based electricity generation. In theory, the country that receives the initial financial payment to cover the present day negative tariff price differential could eventually be paid back by a future positive tariff price differential. The global coal price

could be used as the benchmark to assess the traditional cost of power. This approach could allow developing countries to immediately benefit from inclusion of renewable energy without having to absorb the present day higher cost. This is a reverse lock-in strategy because South Africa would secure the power it needs to grow the economy via renewable energy at the same cost of coal-based generation.

Figure 3.4 illustrates the expected tariff pricing in South Africa versus an estimated wind energy tariff from 2012 to 2032. This demonstrates the potential competitiveness of wind generation over the long term. The South African overall tariff price is based on Eskom's multi-year tariff pricing proposal till 2018 (de Lange, 2012), then reverting to a historical average of CPI from 1997 to 2012 of 5.79 per cent per annum (Eskom, 2012). The wind energy tariff is stable as it is set by the competitive bidding guidance from NERSA at 4.2 per cent (DoE RSA, 2011) and assumes a 14 per cent mark-up to the estimated generation costs to include distribution and marketing (Wenzel, 2006).

Figure 3.4: South Africa Electricity Tariff vs. Estimated Wind Power Tariff



This incentive mechanism is a long-term, speculative proposition dependent on the variable cost of fossil fuel based electricity versus the stable cost of wind energy. While risky from a purely financial perspective, such an approach could be a cost efficient and effective way for the international climate change regime to promote the global public good of reducing carbon emissions. Such a mechanism offers a sustainable alternative to fossil fuel based power generation, while at the same time supporting climate smart development because it does not require the host country government to divert its limited resources to finance the more expensive current day cost of renewable energy.

3.5.6 Conclusion

In order to meet the challenge posed by climate change, the current dependence on fossil fuel based electricity generation needs to undergo dramatic transformation in the immediate future or risk locking in carbon intensive power installations that will push the world past the 450 ppm threshold. This calls for bold climate change governance, whereby both the public and private sector must effectively work together through a co-evolutionary framework to establish and implement effective incentives for renewable energy that are customised to the host countries level of statehood.

Global climate change governance needs to place special focus on developing countries, which are the future demand centres for electricity. To do so, challenges that are inherent to areas of limited statehood need to be better understood and addressed. MBI approaches from the developed world may not work well in developing countries because host country contexts are different. The host country level of statehood is a key determinant of any renewable energy project's risk profile, manifesting in significantly higher required rate of return for South Africa

as compared to Germany, irrespective of the new industry risk. This in turn influences the cost of capital. The result is renewable energy is significantly more expensive in the developing world than in OECD countries, expanding the tariff price differential and hindering the state's ability to prioritise the large-scale promotion of renewables. To overcome this challenge, international and national MBIs are needed to reduce the required cost of capital arising from developing countries lower level of statehood.

4.0 Discussion

This section summarises how the empirical papers collectively make a theoretical contribution. The empirical papers are discussed to draw out the broader implications for the research and practice of market-based environmental policy. The intent of this thesis was to explore what constitutes an effective host country environment for MBIs in developing countries, and specifically, but not exclusively, investigate the role of the state. Based on the collective findings of the empirical papers, this section discusses the overall theoretical contribution of this thesis and recommends opportunities to improve the efficiency and effectiveness of MBIs in developing countries.

4.1 Key Theoretical Contributions

The following overarching research question is explored throughout the thesis: How does the host country context affect MBIs in developing countries? Two key theoretical contributions are drawn from the empirical papers that further the knowledge of MBIs in developing countries. The first relates to precisely what host country variables affect MBIs in developing countries, including prioritisation by the state, private sector support structures and private sector financial requirements. The second is the ability to generalise MBIs across developing countries, with a specific focus on cost of capital.

4.1.1 Host Country Considerations

Investigating MBIs within developing countries is a relatively new area of inquiry, as is exploring MBIs within the context of limited statehood. The five papers, individually and collectively, contribute to the literature summarised in Section 2. Most notable is how the papers collectively reinforce the conclusion by Stavins (1991) that feasibility of MBIs is reliant upon the

underlying political, technical, legal and economic environment. The research in this thesis provides further precision to Stavins' finding by identifying which aspects of the host country contextual environment are particularly important and how they influence the efficiency and effectiveness of MBIs in developing countries. The three key considerations identified by the papers are: 1) prioritisation by the state; 2) supporting structures and policies that generate awareness and build capabilities to enable private sector participation; and 3) access to finance, with a specific focus on cost of capital.

Prioritisation by of the State

The effectiveness of an MBI is likely to increase if it is considered a priority by the host country state. However, as explained previously, it is very difficult for developing countries to prioritise subsidies only focused on emission reductions. The qualitative findings of paper 1 and 2 highlight that low carbon development in developing countries is ideal in theory but not considered a top priority by the state in reality when compared to all other pressing developmental needs. Paper 3 highlights a statistically significant relationship between CDM utilisation, and human development and governance indicators which implies that the lower the level of statehood the less likely the state will be able to focus on and prioritise MBIs. Paper 5 highlights that it may not be politically acceptable to pay a premium for renewable energy in South Africa when compared to other pressing needs such has health, education and equality. Papers 4 and 5 make clear that low carbon activities in developing countries face greater challenges than within developed countries because the overall cost increases as the level of statehood decreases, placing further demands on already limited resources. The resulting implication is that for MBIs to be effective in developing countries, they need to be capable of broadly supporting the overall development objectives of the country. For example, increasing

renewable energy in China is part of the country's overall development strategy (e.g. China Renewable Energy Law) and it corresponds to a significant uptake of the CDM. On the other hand, South Africa has been slow to implement the REIPPP programme or other renewable energy promotion activities, resulting in little uptake of CDM.

Support Structures

In addition to being aligned to the developmental priorities of the host country, MBIs also need to be aligned to the interests and capabilities of the private sector. Transforming a country's development approach from carbon intensive to low carbon requires an overall enabling environment equal to this momentous task. Relating to the literature on governance in areas of limited statehood, my analysis has shown that for MBIs to be effective, the private sector cannot replace the role of the state. Lacking a strong shadow of hierarchy to enforce public good provision by the private sector, developing countries require an integrated approach that reinforces private sector participation throughout all relevant facets of policy and enabling environment.

The CDM and renewable energy promotion provide practical examples to explore the role of the state versus that of the private sector in achieving a desired environmental outcome within developing countries. The majority of the regulatory oversight and subsidy financing of the CDM is provided outside developing countries through the UNFCCC, while the regulatory structure of renewable energy promotion is the responsibility of the host country. What I found in both cases is that the state plays a key role, whether it be actively promoting the MBI to the private sector as in the case of the CDM or fully regulating and administering the MBI as in the case of renewable energy promotion.

Governance structures, provided by the state or an international entity, need to evaluate all obstacles to low carbon development that are inherent to the host country and take steps to remove or mitigate them. Simply establishing a MBI without considering the enabling private sector environment in developing countries significantly reduces the probability that the mechanism will be effective or efficient. Papers 1 and 2 point out that the CDM eligibility and regulation determined by the UNFCCC are often viewed as a major hurdle to engaging the CDM, particularly in SSA. Paper 2 highlights how MBI considerations need to be evaluated across multiple levels, including the international, national and local perspective if it is to achieve the intended results because the common challenges related to awareness, capacity, eligibility and finance impact countries differently depending on their level of statehood. Of interest is how this relates back to Sidgwick's (1887) conclusion that "no one could appropriate and sell improvements in climate" (p. 407). Paper 1 and 2 describe how, 125 years after Sidgwick's statement, the CDM attempts to appropriate and sell climate improvements, and details the numerous difficulties inherent to the quantification and trade of emission reductions.

Papers 4 and 5 demonstrate a co-evolutionary framework between the public and private sector that is required if IPPs are to participate in increasing the amount of renewable energy in a country's overall energy mix. These papers show how the current state of renewable energy requires subsidy to compete with the prevailing fossil fuel based energy systems, thus adding to the total fiscal burden when compared to the business as usual approach.

Collectively the first three papers demonstrate how voluntary agreements (i.e. Kyoto Protocol and the CDM) mandated by the UNFCCC attempt to engage both the state and private sector to incentivise contributions to the public good (emission reductions above business as usual). The conclusion reached is that in addition to the regulatory structure (as provided mainly

by the UNFCCC), the CDM requires systematic private sector support measures in the host country. Paper 1 also points out how China has developed an environment that reinforces the utilisation of the CDM, as opposed to simply leaving it to market forces. Active engagement and policy alignment by the state have resulted in China fully leveraging the CDM opportunity. For example, institutional (e.g. CDM Project Management Centre and Provincial CDM Centres) support structures by the Chinese state have contributed to its high utilisation. Alternatively, less engagement to provide coordinated support from South Africa and Zambia respectively has resulted in a corresponding under-utilisation of the CDM.

Financial Considerations

Access to finance, with a specific focus on the overall cost of capital, and its relationship to the host country context is identified as a significant consideration for MBIs in developing countries. Papers 1 and 2 broadly highlight the importance of cost of capital to CDM projects in China, South Africa and Zambia.

Papers 4 and 5 expand the research by examining the relationship between the state and the private sector regarding renewable energy promotion with a focus on determining a kWh price for renewable energy that maximises societal benefit (i.e. the lowest possible price) but attractive private sector IPPs (i.e. high enough to achieve private sector IRR requirements). More specifically, paper 4 demonstrates in detail the causal relationship between the host country context and the cost of capital by proposing an index-based model for determining the required equity IRR for renewable energy projects in South Africa. Paper 5 then takes this a step further to show how the perception of developing countries impacts the overall cost of renewable energy. This is done by demonstrating how cost of capital precisely affects the price of

electricity, using the example of wind-based electricity in South Africa and Germany to highlight how host country context impacts the overall cost.

The comparison to Germany demonstrates precisely how cost of capital is a key variable in the overall cost of producing renewable energy. The analysis of papers 4 and 5 further demonstrates how MBIs are part and parcel to their host country context, and how the perceived higher risk of a developing country can significantly increase the cost of wind energy in South Africa on an absolute basis when compared to Germany. This implies that the host country context can be part of the problem that drives costs up if it cannot inspire confidence to private sector investors and developers.

4.1.2 Generalisation of MBIs

An overarching contribution, which follows the analysis of specific host country considerations, is that broad generalisation across all developing countries for MBIs proves insufficient. An important contribution is that it is not just about identifying the key underlying factors supporting MBIs, but also understanding when and how important each of these factors are within the local context in which they are situated.

This thesis has demonstrated that MBIs need be responsive to the host country level of development, developmental priorities, capabilities and financial considerations. These considerations are inter-linked and are important host country considerations for MBIs in developing countries. MBIs, as pointed out as early as the 1950's by Meade, are highly dependent upon the pollutant they are trying to reduce and the underlying setting it is based. Reducing global GHG emissions through incentives is an extremely complex endeavour that requires alignment to common MBI principles as well as the distinct characteristics of the host

country. The collective research of this thesis demonstrates that the overall host country context, not only the regulatory capability of the host country, is a significant determinant of the efficiency and effectiveness of MBIs in developing countries. The result is that MBI approaches are unlikely to be uniform across developing countries and that flexibility in MBI approach is necessary to meet the needs of all developing countries.

4.2 Policy Recommendations to Improve the Efficiency and Effectiveness of MBIs

Aldy and Stavins (2012b) call for scholars to contribute transformative proposals to address global climate change, highlighting, "research must address how developed and developing countries can both contribute to emission reductions" (p.1043). They further emphasise that research must play a role in informing future climate policy to effectively and efficiently facilitate meaningful emission reductions "while meeting the UNFCCC's principle of differentiated responsibilities and respective capabilities" (Aldy & Stavins, 2012b, p. 1044). Inherent in this call for transformative proposals is the need to expand beyond the geographical confines of developed countries that have characterised market-based environmental policy research to developing countries. The research in this thesis, through the individual and collective contribution of the five empirical papers, has taken up this challenge by exploring how host country context impacts MBIs. The remainder of this section highlights two key recommendations relevant for future climate policy decision makers.

The first recommendation is drawn from the principle that to engage the private sector in the provision of public good, a market return is necessary in exchange for their expertise and involvement. In developing countries, the lack of consolidated statehood can erode confidence that the state will be able to sustain incentive commitments that are necessary to attract private sector participation. The state can become an impediment to low carbon development, adding

risk that must be compensated for with additional return to the private sector. The recommendation is that MBIs for developing countries be focused not just on the host countries' regulatory capabilities, but also on broader considerations regarding level of development, including capacity, access to finance and prioritisation.

An example pertinent to developing countries with limited state or private sector capabilities is to select, in collaboration with relevant state actors, a specific low carbon activity that supports the overall development strategy of the country, then provide a standard suite of support services to the business organisations that meets a basic eligibility criteria that are designed to build the local private sectors capabilities to implement the activity (e.g. capacity building, networking, training, etc.) Furthermore, as recommended in paper 5, access to finance challenges in developing countries could be addressed by making available subsidised below market rate loans and loan guarantees to the eligible business organisation in order to reduce risk and drive down the cost of capital. The host countries' level of statehood could be the determining factor if the mechanism is managed by the international climate regime or the national government. Developing countries with particularly low levels of statehood would then benefit from an international mechanism that draws down the host country risk and increases the feasibility of implementing low carbon activities.

The second recommendation to the decision makers of future climate policy is to include instruments that specifically address the obstacles that hinder the leveraging of MBIs in developing countries. This refers to mitigating or eliminating the factors that drive overall MBI costs up, including political risk and non-payment risk. To make clear, perceived risks inherent to developing countries make low carbon development more difficult than in developed countries. Most developing countries have high price sensitivity, and even if low carbon

technology continues to improve and decrease in price, implementation will remain constrained by the risk and uncertainty associated with a developing country context. As proposed in paper 5, risk and uncertainty could be mitigated by international transfers from an international mechanism (i.e. developed countries to developing countries) that focuses on funding the cost differential between low carbon and carbon intensive approaches. This has the potential to reduce the perceived high non-payment risk in developing countries, which contributes to driving up a business organisations cost of capital. Therefore, it is recommended to focus MBIs not only on the specific low carbon activities, but also on the actual host country risks that drive up the cost of private sector participation.

5.0 Conclusion

5.1 Summary

If a stable climate is to be maintained, the need for low carbon development capable of meaningful emission reductions over the business as usual scenario is necessary in both the developed and developing world. This is a vexing problem because the dependence on fossil fuel based development that has enabled societal gains is now considered to be a leading cause of global climate instability. To address climate change, a new development approach is needed that is capable of producing the same societal advancements but without the accompanying negative environmental externalities.

Climate change is not only a problem to be addressed by the developed countries, but also by developing countries that are emerging to increase their standard of living and are now significantly contributing to GHG emissions. An immediate switch to a low carbon development model is needed if the 450-ppm scenario is to be achieved. This thesis has explored the role of MBIs facilitating this transition in developing countries.

The overall intent of this thesis has been to identify and explain how specific host country considerations affect MBIs in developing countries. This thesis has built upon the literature on market-based environmental policy and governance in areas of limited statehood to explore the role of both the state and the private sector. The thesis has focused on approaches to address global climate change by investigating practical examples of MBIs in developing countries. The experience with MBIs in SSA is compared within the continent (South Africa and Zambia) and contrasted outside the continent with countries that have fully leveraged the CDM (China) and renewable energy promotion (Germany). The main theoretical contribution of this thesis is that

in developing countries a regulatory structure capable of administering an MBI is a necessary condition but not a sufficient condition for efficient and effective MBIs. Other key variables in addition to state regulatory capabilities include prioritisation, additional support structures to increase capabilities to take advantage of MBIs and access to finance.

The findings highlight the importance of understanding the host country context and aligning it with the specific market mechanism. MBIs are policy instruments reliant upon a host country environment, and therefore engagement by the state to align priorities and reduce uncertainty and risk is necessary to enable private sector engagement, regardless if the MBI is internationally or nationally mandated. As highlighted by Meade (1952), promoting low carbon development is likely to be a net addition to the overall financial burden of society and will thus require subsidy. As a result, MBI design needs to be effective and efficient in order to maximise limited resources for societal benefit and entice the necessary actors to participate. This is important particularly for the governance of both renewable energy promotion and the future conceptualisation of the CDM, if they are to play a significant role in promoting low carbon development in developing countries.

An understanding of how cost of capital impacts an MBI has been shown to be important for understanding the relationship between the MBI and the host country. If low carbon development is deemed politically, technically and administratively feasible, mechanisms should extend beyond the MBI specific regulation to mitigate the host country risks that increase the overall cost and uncertainty in developing countries. This will help make low carbon development more cost competitive with carbon intensive approaches, and hopefully assist developing countries advance their developmental objectives of today without sacrificing a stable climate of tomorrow.

5.2 Future Research Opportunities

The findings of this thesis give rise to opportunities for future research that would be valuable for MBI research and for future climate policy. In line with the finding that MBIs cannot always be broadly generalised across the developing world, further research to refine what is acceptable and practical within differing host country contexts is necessary. For example, further research on determining the optimal level of MBI complexity based on the specific host countries level of development is necessary. Also, research on the effectiveness of support structures to increase the capacity of the private sector in developing countries with regard to MBIs could help to make MBIs more applicable in developing countries.

As low carbon technologies become more cost competitive on an absolute basis with fossil fuel based technology, the opportunity for MBIs to promote low carbon development will become increasingly relevant in developing countries. This research has demonstrated the significant impact of host country considerations on MBIs in developing countries. This shows the need for further research, for example, on specific ways to mitigate the risk and uncertainty associated with cost of capital in developing countries. To conclude, this thesis points to the need for further research on how to better structure both internationally and nationally mandated MBI mechanisms to maximise efficiency and effectiveness within the developing country context.

6.0 References

Aberbach, J. D., & Rockman, B. A. (2002). Conducting and Coding Elite Interviews. *Political Science and Politics*, *35*(4), 673–676. doi:10.2307/1554807

Aldy, J. E., & Stavins, R. N. (2012a). Using the Market to Address Climate Change: Insights from Theory & Experience. *Daedalus*, *141*(2), 45–60.

Aldy, J. E., & Stavins, R. N. (2012b). Climate Negotiators Create an Opportunity for Scholars. *Science*, *337*(6098), 1043–1044. doi:10.1126/science.1223836

Arens, C., Burian, M., Sterk, W., Schnurr, J., Beuermann, C., Blank, D., … Schwan, S. (2011). *The CDM Project Potential in Sub-Saharan Africa with Focus on Selected Least Developed Countries*. Berlin: Wuppertal Institute for Climate, Environment and Energy, and GFA Envest GmbH.

Arens, C., & Kreibich, N. (2011). CERs from Least Developed Countries: The African Perspective. *Joint Implementation Quarterly*, *17*(2). 1-19.

Arent, D.J., Wise, A., & Gelman, R. (2011). The status and prospects of renewable energy for combating global warming. *Energy Economics*, *33*(4), 584-593.

Babiker, M., Reilly, J. M., & Jacoby, H. D. (2000). The Kyoto Protocol and developing countries. *Energy Policy*, *28*(8), 525–536. doi:10.1016/S0301-4215(00)00033-1

Baffoe-Bonnie, J., & Khayum, M. (2003). *Contemporary Economic Issues in Developing Countries*. New York: Greenwood Publishing Group.

Baker, L. (2011). Governing electricity in South Africa: wind, coal and power struggles. Working Paper 015, *Governance of Clean Development Working Paper Series.* School of International Development, University of East Anglia.

Banks, D., & Schäffler, J. (2006). *The potential contribution of renewable energy in South Africa.* Johannesburg: Sustainable Energy & Climate Change Project.

Barad, M. & McDowell, T. (2002). *Capturing industry risk beta in a build-up model*. Chicago: Ibbotson Associates.

Bartolucci, F., Oliver, P., Jie, S., & van Sambeek, E. (2008). *The Value of Carbon in China. Carbon Finance and China's Sustainable Energy Transition*. Hong Kong: WWF Hong Kong.

Bator, F. M. (1958). The Anatomy of Market Failure. *The Quarterly Journal of Economics*, *72*(3), 351–379. doi:10.2307/1882231

Baumert, K., Herzog, T., & Pershing, J. (2005), *Navigating the Numbers: Greenhouse Gas Data and International Climate Policy*. Washington DC: World Resource Institute.

Baumol, W. J. (1972). On Taxation and the Control of Externalities. *The American Economic Review*, *62*(3), 307–322.

Baumol, W. J., & Oates, W. E. (1971). The Use of Standards and Prices for Protection of the Environment. *The Swedish Journal of Economics*, *73*(1), 42–54. doi:10.2307/3439132

Bechberger, M., & Reiche, D. (2004). Renewable energy policy in Germany: Pioneering and exemplary regulations. *Energy for Sustainable Development*, *8*(1), 47–57. doi:10.1016/S0973-0826(08)60390-7

Bernard, H. (2005). *Social Research Methods: qualitative and quantitative approaches*. Thousand Oaks, California: Sage Publications.

Blackman, A., & Harrington, W. (1999). *The Use of Economic Incentives in Developing Countries: Lessons from International Experience with Industrial Air Pollution* (Discussion Paper 99-39). Washington, DC: Resources for the Future.

Bloomberg. (2012). *Germany Government Bond Yield & Interest Rates* (7 January 2012). New York: Bloomberg.

Boden, T. A., Marland, G., & Andres, R. J. (2007), *Global, Regional, and National Fossil-Fuel CO2 Emissions.* Oak Ridge, Tennessee: Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy.

Bodie, Z., Kane, A., & Marcus, A. J. (2009). *Investments* (8th ed.). Columbus, Ohio: McGraw-Hill/Irwin.

Böhm, S., & Dabhi, S. (2009). *Upsetting the offset : the political economy of carbon markets*. London: MayFlyBooks.

Bond, P. (2012). Emissions Trading, New Enclosures and Eco-Social Contestation. *Antipode*, *44*(3), 684–701. doi:10.1111/j.1467-8330.2011.00890.x

Börzel, T. A. (2012). *How Much Statehood Does it Take–And What For?* (Working Paper Series 29). Berlin: SFB-Governance.

Börzel, T. A., Héritier, A., Kranz, N., & Thauer, C. (2010). Racing to the Top? In T. Risse (Ed.), *Governance Without a State*. New York: Columbia University Press.

Börzel, T. A., & Risse, T. (2007). Public-private partnerships: Effective and legitimate tools of international governance. In Grande E. & Pauly L. W. (Eds.), *Complex Sovereignty: Reconstituting Political Authority in the Twenty-First Century*. Toronto: University of Toronto Press.

Börzel, T. A., & Risse, T. (2010). Governance without a state: Can it work? *Regulation & Governance*, *2010*(4), 113–134. doi:10.1111/j.1748-5991.2010.01076.x

Bowen, A., & Fankhauser, S. (2011). Low-Carbon Development for Least Developed Countries. *World Economics*, *12*(1), 145–162.

Boyd, E., Hultman, N., Timmons Roberts, J., Corbera, E., Cole, J., Bozmoski, A., … Liverman, D. M. (2009). Reforming the CDM for sustainable development: lessons learned and policy futures. *Environmental Science & Policy*, *12*(7), 820–831. doi:10.1016/j.envsci.2009.06.007

Bruggink, J. (2012). Energy aid in times of climate change, designing climate compatible development strategies. *ECN Policy Studies*, *12*(6), 1-39.

Bruner, R. F., Eades, K. M., Harris, R. S., & Higgins, R. C. (1998). Best practices in estimating the cost of capital: Survey and Synthesis. *Financial Practice and Education*, Spring/Summer, 13-28.

Bryman, A. (1992). *Quantity and Quality in Social Research*. New York: Routledge.

Bryman, A., & Bell, E. (2007). Business Research Methods. Oxford: Oxford University Press.

Bumpus, A., & Liverman, D. (2008). Accumulation by Decarbonization and the Governance of Carbon Offsets. *Economic Geography, 84*(2), 127-155.

Butler, L., & Neuhoff, K. (2008). Comparison of feed-in tariff, quota and auction mechanisms to support wind power development. *Renewable Energy, 33*(8), 1854–1867. doi:10.1016/j.renene.2007.10.008

Byigero, A. D., Clancy, J., & Skutsch, M. (2010). CDM in sub-Saharan Africa and the prospects of the Nairobi Framework Initiative. *Climate Policy, 10*(2), 181–189. doi:10.3763/cpol.2009.0645

Campbell, D. T. (1975). "Degrees of Freedom" and the Case Study. *Comparative Political Studies, 8*(2), 178–193.

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and Quasi-experimental Designs for Generalized Causal Inference*. Boston: Houghton Mifflin.

Chinese Renewable Energy Industry Association [CREIA]. (2009). *Study Report on Development of Policy of Chinese Wind Power Tariff*. Beijing: Chinese Renewable Energy Industry Association.

Christensen, J., Denton, F., Garg, A., Kamel, S., Pacudan, R., & Usher, E. (2006). *Changing Climates: The Role of Renewable Energy in a Carbon-Constrained World*. New York: United Nations Environment Programme.

Claus, J., & Thomas, J. (1998). *The equity risk premium is much lower than you think it is: Empirical estimates from a new approach*. New York: Columbia University.

Cloete, B., & Robb, G. (2010). Carbon pricing and industrial policy in South Africa. *Climate Policy, 10*(5), 494-510. doi:10.3763/cpol.2010.0104

Coase, R. H. (1960). The Problem of Social Cost. *Journal of Law and Economics, 3(1)*, 1-44.

Collier, P., Conway, G. & Venables, T. (2008). Climate change and Africa. *Oxford Review of Economic Policy, 24*(2), 337–353.

Comim, F. (2008). Climate Injustice and Development: A capability perspective. *Development, 51*(3), 344–349. doi:10.1057/dev.2008.36

Consumer Price Index [CPI]. (2011). *Inflation Germany 2011*. Available at: http://www.inflation.eu/inflation-rates/germany/historic-inflation/cpi-inflation-germany-2011.aspx.

Cook, T. D., & Campbell, D. T. (1979). *Quasi-Experimentation: Design & Analysis Issues for Field Settings*. Boston: Houghton Mifflin.

Corley, K. G., & Gioia, D. A. (2011). Building theory about theory building: what constitutes a theoretical contribution? *Academy of Management Review, 36*(1), 12–32.

Couth, R., Trois, C., Parkin, J., Strachan, L. J., Gilder, A., & Wright, M. (2011). Delivery and viability of landfill gas CDM projects in Africa – A South African experience. *Renewable and Sustainable Energy Reviews, 15*(1), 392-403. doi:10.1016/j.rser.2010.08.004

Creamer, T. (2011). Renewables procurement process may be extended beyond the first phase. *Engineering News*. 16 December 2011.

Creswell, J., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research* (2nd ed.). Los Angeles: Sage Publications.

Criqui, P., & Viguier, L. (2000). Kyoto and Technology at World Level: Costs of CO2 Reduction Under Flexibility Mechanisms and Technical Progress. *International Journal of Global Energy Issues, 14*(1), 155–168.

Daily, G. C., & Ehrlich, P. R. (1992). Population, Sustainability, and Earth's Carrying Capacity. *BioScience, 42*(10), 761–771. doi:10.2307/1311995

Dales, J. H. (1968). *Pollution, Property & Prices: An essay in policy-making and economics*. Cheltenham UK: Edward Elgar Publishers.

Davis, M. S. (1971). That's interesting. *Philosophy of the Social Sciences, 1(2*), 309-344.

De Boer, Y., & Van Bergen, B. (2012). *Expect the unexpected: Building business value in a changing world*. Geneva: KPMG International.

de Lange, J. (2012). Industry seeks talks over Eskom tariff. *BDO South Africa*. 16 July 2012.

Denzin, N. (1989). *The Research Act: A theoretical introduction to sociological methods* (3rd ed.). Englewood Cliffs NJ: Prentice Hall.

Denzin, N. (2010). Moments, Mixed Methods, and Paradigm Dialogs. *Qualitative Inquiry, 16*(6), 419–427. doi:10.1177/1077800410364608

Department of Environmental Affairs, Republic of South Africa [DEA RSA] (2010). Joint statement issued at the conclusion of the second meeting of Ministers of BASIC group, New Delhi: DEA RSA.

Department of Energy Republic of South Africa [DoE RSA]. (2011). *Integrated Resource Plan for Electricity 2010-2030* (Revision 2 Final Report). Pretoria: DoE RSA.

Department of Energy Republic of South Africa [DoE RSA]. (2011). *Renewable Energy IPP Procurement Programme: Renewable Energy Bidders Conference* (14 September 2011). Pretoria: DoE RSA.

Department of Energy Republic of South Africa [DoE RSA]. (2010). *Procurement process for renewable energy independent power producers under the REFiT programme gets underway with the analysis of 384 responses to the request for information*. (Press Release December 6). Pretoria: DoE RSA.

Department of Minerals and Energy, Republic of South Africa [DME RSA]. (2003). *White Paper on the Renewable Energy Policy of the Republic of South Africa*. Pretoria: DME RSA.

Department of Minerals and Energy, Republic of South Africa [DME RSA]. (2008). *National Response To South Africa's Electricity Shortage* (Press Release, January). Pretoria: DME RSA.

Designated National Authority Republic of South Africa [DNA RSA] (2004). *October 14. Sustainable Development Criteria for the Approval of CDM projects by the DNA of the Clean Development Mechanism South Africa*. Pretoria: DNA RSA.

Designated National Authority Republic of South Africa [DNA RSA] (2009). *The CDM in South Africa: Current Status and Way Forward*. Pretoria: DNA RSA.

Designated National Authority Republic of South Africa [DNA RSA] (2011). *South Africa's CDM Project Portfolio: Up to 28 January 2011*. Pretoria: DNA RSA.

Designated National Authority Republic of South Africa [DNA RSA] (2012). *South African CDM Projects Portfolio, Up to June 2012.* Pretoria: DNA RSA

Designated National Authority Zambia [DNA Zambia]. (2010). Report: Zambian CDM Projects Status. 10 June 2010. Lusaka: DNA Zambia.

Dinar, A., Ambrosi, P., Rahman, M., & Donald, L. (2008). *Factors Affecting Levels of International Cooperation in Carbon Abatement Projects* (World Bank Policy Research Paper). Washington DC: World Bank Group.

Dinica, V. (2006). Support systems for the diffusion of renewable energy technologies —an investor perspective. *Energy Policy, 34*(4), 461-480.

Dolšak, N., & Bowerman, E. (2007, March). *Investments in Global Warming Mitigation: The Case of Clean Development Mechanisms*, Paper presented at the annual meeting of the Western Political Science Association, Las Vegas, Nevada.

Dunkerley, J. (1995). Financing the energy sector in developing countries: Context and overview. *Energy policy*, *23*(11), 929–939.

Du Toit, L. (2009). Promoting Clean Development Mechanism in South Africa: Law and Policy. *South Africa Public Law*, *24*(1), 33-55.

Easton, P. (2004). PE ratios, PEG ratios, and estimating the implied expected rate of return on equity capital. *The Accounting Review, 79*, 73–95.

Eberhard, A., & Gratwick, K. N. (2011). IPPs in Sub-Saharan Africa: Determinants of success. *Energy Policy*, *39*(9), 5541–5549. doi:10.1016/j.enpol.2011.05.004

Economist Intelligence Unit. (2011). *Political Instability Index 2009/2010*. London: The Economist.

European Power Exchange [EPEX]. (2012). *European Power Exchange Spot* (01 February 2012). Paris: EPEX.

Econ Pöyry. (2010). *Southern African Development Committee Clean Development Mechanism Action Programme* (Report: 2010-039, version 1.2). Cape Town: Econ Pöyry.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *The Academy of Management Review*, *14*(4), 532–550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory Building from Cases: Opportunities and Challenges. *Academy of Management Journal*, *50*(1), 25–32.

Ellerman, A. D., Jacoby H. D., & Decaux, A. (1998). *Effects on Developing Countries of the Kyoto Protocol and Carbon Dioxide Emissions Trading* (Volume 2019). Washington DC: World Bank Publications.

Ellis, J., Winkler, H., Corfee-Morlot, J., & Gagnon-Lebrun, F. (2007). CDM: Taking stock and looking forward. *Energy Policy, 35*(1), 15-28. doi:10.1016/j.enpol.2005.09.018

Emerson, J., Esty. D., Kim, C., Srebotnjak, T., Levy, M.A., Mara, V., de Sherbinin, A., & Jaiteh, M. (2010). *Environmental Performance Index*. New Haven: Yale Center for Environmental Law and Policy.

Eskom. (2011). *Eskom Retail Tariff Adjustment for 2011/12* (Press Release February 24). Pretoria: Eskom.

Eskom. (2012). *Average Price Increases. Eskom Tariffs and Charges*. Pretoria: Eskom. Accessed at: http://www.eskom.co.za/c/article/143/average-price-increases/

European Commission. (2011). *Emissions trading: Commission welcomes vote to ban certain industrial gas credits* (Europa Press Release January 21). Brussels: European Commission.

Fama, E., & French, K. (1997). Industry costs of equity. *Journal of Financial Economics*, *43*(2), 153–94.

Farrar, D., & Glauber R. (1967). Multicollinearity in Regression Analysis: The Problem Revisited. *The Review of Economics and Statistics, 49*(1), 92-107.

Fay, J., Kapfudzaruwa, F., Na, L., & Matheson, S. (2012). A comparative policy analysis of the Clean Development Mechanism in South Africa and China. *Climate and Development*, *4*(1), 40-53.

Fay, J., & Umesh, K. (2011, June). *A market model based financial benchmark required to access finance for renewable energy projects in South Africa*. Paper presented at the Green Economics: Theory and Practice presented at the AESS Annual Meeting 2011, Burlington, Vermont.

Fenhann, J., Staun, F., Karavai, M., & Bertule, M. (2011). *UNEP Risoe CDM/JI Pipeline Analysis and Database*. Risøe Denmark: United Nations Environment Program, Risøe Centre. Retrieved from http://cdmpipeline.org/

Fenhann, J., Staun, F., Karavai, M., & Bertule, M. (2012). *UNEP Risoe CDM/JI Pipeline Analysis and Database*, Risøe Denmark: United Nations Environment Program, Risøe Centre. Available at: http://cdmpipeline.org/.

Fernandez, P., Aguirreamalloa, J. & Corres, L. (2011). Market risk premium used in 56 countries in 2011: A survey with 6,014 answers. Barcelona: IESE Business School.

Figueres, C., & Streck, C. (2009). *Enhanced Financial Mechanisms for Post 2012 Mitigation* (Policy Research Working Paper No. 5008). Washington DC: The World Bank.

Flues, F. (2010). Who Hosts the Clean Development Mechanism? Determinants of CDM Distributions. *CIS Working Paper*, 53, 1-40.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry, 12*(2), 219–245. doi:10.1177/1077800405284363

Food and Agriculture Organisation of the United Nations [FAO]. (2000). *Global Forest Resources Assessment 2000* (FAO Forestry Paper – 140). Rome: FAO.

Frondel, M., Ritter, N., Schmidt, C. M., Vance, C., (2010). Economic impacts from the promotion of renewable energy technologies: The German experience. *Energy Policy*, *38*(8), 4048-4056.

Fuhr, H., & Lederer, M. (2009). Varieties of Carbon Governance in Newly Industrializing Countries. *The Journal of Environment & Development*, *18*(4), 327-345. doi:10.1177/1070496509347079

Fullerton, D. (2001). A Framework to Compare Environmental Policies. *Southern Economic Journal*, *68*(2), 224–248.

Gibbert, M., Ruigrok, W., & Wicki, B. (2008). What passes as a rigorous case study? *Strategic Management Journal*, *29*(13), 1465–1474.

Gebhardt, W., Lee. C., & Swaminathan. B. (2001). Toward an implied cost of capital. *Journal of Accounting Research*, *39*, 135–76.

Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics*, *60*(2), 187-243.

Grant, A. M., & Pollock, T. G. (2011). Publishing in AMJ--Part 3: Setting the Hook. *Academy of Management Journal*, *54*(5), 873–879. doi:10.5465/amj.2011.4000

Guba, E., & Lincoln, Y. (1994). Competing paradigms in qualitative research. In N. Denzin & Y. Lincoln (Eds.), *The Handbook of Qualitative Research* (pp. 105–117). Thousand Oaks, California: Sage Publications.

Gupta, S., & Bhandari, P.M. (1999). An effective allocation criterion for CO2 emissions. *Energy Policy*, *27*(12), 727–736. doi:10.1016/S0301-4215(99)00058-0

Haas, R., Eichhammer, W., Huber, C., Langniss, O., Lorenzoni, A., Madlener, R., … Verbruggen, A. (2004). How to promote renewable energy systems successfully and effectively. *Energy Policy*, *32*(6), 833–839. doi:10.1016/S0301-4215(02)00337-3

Haas, R., Resch, G., Panzer, C., Busch, S., Ragwitz, M., & Held, A. (2011). Efficiency and effectiveness of promotion systems for electricity generation from renewable energy sources - Lessons from European Union countries. *Energy*, *36*(4), 2186–2193. doi:16/j.energy.2010.06.028

Hahn, R. W. (1989). Economic prescriptions for environmental problems: How the patient followed the doctor's orders. *The Journal of Economic Perspectives*, *3*(2), 95–114.

Hahn, R. W., & Stavins, R. N. (1991). *Economic Incentives for Environmental Protection: Integrating Theory and Practice*. Boston: Harvard University Kennedy School of Government.

Hahn, R. W., & Stavins, R. N. (1991). Incentive-based environmental regulation: A new era from an old idea. *Ecology LQ*, *18*(1), 1–42.

Hahnel, R., & Sheeran, K. A. (2009). Misinterpreting the Coase theorem. *Journal of Economic Issues*, *43*(1), 215–238.

Hamann, R. (2012). The Business of Development: Revisiting Strategies for a Sustainable Future. *Environment: Science and Policy for Sustainable Development, 54*(2), 18–29. doi:10.1080/00139157.2012.657570

Hamel, J., Dufour, S., & Fortin, D. (1993). *Case Study Methods*. Thousand Oaks, California: Sage Publications.

Hannon, A., Lui, Y., Walker, J., & Wu, C. (2011). *Delivering Low Carbon Growth: A Guide to China's 12th Five-Year Plan*. Beijing: The Climate Group.

Hart, S. (1997). Beyond Greening: Strategies for a Sustainable World. *Harvard Business Review*. January, 66-76

Harvey, C. (1995). Predictable risk and returns in emerging markets. *The Review of Financial Studies, 8*(5), 773–816.

Hasenclever, A., Mayer, P., & Rittberger, V. (1997). *Theories of International Regimes*. Cambridge UK: Cambridge University Press.

Hassan, S., & Van Biljon, A. (2010). The Equity premium and risk-free rate puzzles in a turbulent Economy: Evidence from 105 years of data from South Africa. *South African Journal of Economics, 78*(1), 23-39.

He, G., & Morse, R. (2010). *Making Carbon Offsets Work in the Developing World: Lessons from the Chinese wind controversy* (Working Paper No. 90). Palo Alto, California: Stanford Program on Energy and Sustainable Development.

Heinelt, H. (2002). *Participatory governance in multi-level context: concepts and experience*. Berlin: Leske & Budrich.

Held, A., Ragwitz, M., & Haas, R. (2006). On the success of policy strategies for the promotion of electricity from renewable energy sources. *Energy & Environment*, *17*, 849–868. doi:10.1260/095830506779398849

Héritier, A., & Lehmkuhl, D. (2008). The shadow of hierarchy and new modes of governance. *Journal of Public Policy*, *28*(1), 1–17.

Héritier, A., & Rhodes, M. (2011). *New Modes of Governance in Europe: Governing in the Shadow of Hierarchy*. Hampshire UK: Palgrave Macmillan.

Héritier, A., & Eckert, S. (2007). New Modes of Governance in the Shadow of Hierarchy: Self-regulation by Industry in Europe. *Journal of Public Policy*, *28*(1) 113–138. doi:10.1017/S0143814X08000809

Hongwei, Y. (2009). *Improvement of CDM Policies in China*. Beijing: CDM Project Management Centre Energy Research Institute of China.

Huang, Y. H., & Wu, J. H. (2011). Assessment of the feed-in tariff mechanism for renewable energies in Taiwan. *Energy Policy*, *39*(12), 8106–8115. doi:10.1016/j.enpol.2011.10.005

Huang, Y. H., & Barker, T. (2009). *The Clean Development Mechanism and Sustainable Development: A Panel Data Analysis* (Tyndall Working Paper 130). Cambridge: Tyndall Centre for Climate Change Research.

Huber, R., Ruitenbeek, J., & Seroa da Motta, R. (1998). *Market-based instruments for environmental policymaking in Latin America and the Caribbean: Lessons from eleven countries*. Washington DC: World Bank.

International Energy Agency [IEA]. (2008). *World Energy Outlook 2008*. Paris: IEA.

International Energy Agency [IEA]. (2011). *World Energy Outlook 2011*. Paris: IEA.

International Panel on Climate Change [IPCC]. (2007). *Climate Change 2007 Synthesis Report.* Geneva: IPCC.

Jaffe, A. B., Newell, R. G., & Stavins, R. N. (2004). *Technology policy for energy and the environment*. Cambridge, Massachusetts: The MIT Press.

Jaffe, A. B., & Stavins, R. N. (1995). Dynamic incentives of environmental regulations: The effects of alternative policy instruments on technology diffusion. *Journal of environmental economics and management*, *29*(3), 43–63.

Jaffe, A. B., Newell, R. G., & Stavins, R. N. (2002). Environmental Policy and Technological Change. *Environmental and Resource Economics*, *22*(1), 41–70. doi:10.1023/A:1015519401088

Janet, S., & Martinot, E. (2011). *Renewables 2011: Global Status Report*. Paris: REN21. Retrieved from www.ren21.net

Janssen, J. (1998). Strategies for Risk Management of Joint Implementation Investments. In Smith, A., Riemer, P., & Thambimuthu, K. (Eds.), *Greenhouse Gas Mitigation: Technologies for Activities Implemented Jointly* (pp. 357–365). Amsterdam: Elsevier.

Jick, T. D. (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly*, *24*(4), 602-611.

Johnson, D. B. (1973). Meade, Bees, and Externalities. *Journal of Law and Economics*, *16*(1), 35–52.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, *33*(7), 14–26. doi:10.3102/0013189X033007014

Joskow, P. L., & Schmalensee, R. (1998). Political Economy of Market-Based Environmental Policy: The U.S. Acid Rain Program. *Journal of Law & Economics, 41*, 37-59.

Jotzo, F., & Michaelowa, A. (2002). Estimating the CDM market under the Marrakech Accords. *Climate Policy, 82*(1), 1-23.

Jung, M. (2006). Host country attractiveness for CDM non-sink projects. *Energy Policy*, *34*(15), 2173-2184.

Kaplan, P. D., & Peterson, J. D. (1998). Full-information industry beta. *Financial Management*, *27*(2), 85-93.

Kapp, K. W. (1963). *The Social Costs of Business Enterprise*. Bombay: Asia House Publishing.

Karani, P., & Gantsho, M. (2007). The Role of Development Finance Institutions (DFIs) in Promoting the Clean Development Mechanism in Africa. *Environment, Development and Sustainability*, *9*(3), 203–228.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2010), *The Worldwide Governance Indicators* (Working Paper 5430). Washington DC: World Bank Policy Research.

Kimchi, J., Polivka, B., & Stevenson, J. S. (1991). Triangulation: operational definitions. *Nursing Research*, *40*(6), 364-366.

Knight, F. H. (1924). Some Fallacies in the Interpretation of Social Cost. *The Quarterly Journal of Economics*, *38*(4), 582–606. doi:10.2307/1884592

Kolk, A, & Mulder, G. (2011), Regulatory Uncertainty and Opportunity Seeking: The Case of Clean Development. *California Management Review, 54*(1), 88-106.

Kowalski, M., Swilling, M., Von Weizsacker, E. U., Ren, Y., Moriguchi, Y., Crane, W., … Sewerin, S. (2011). *Decoupling natural resource use and environmental impacts from economic growth, A Report of the Working Group on Decoupling to the International Resource Panel.* Paris: United Nations Environment Programme.

Krasner, S. D. (1984). Approaches to the State: Alternative Conceptions and Historical Dynamics. *Comparative Politics*, *16*(2), 223–246. doi:10.2307/421608

Krasner, S. D. (1985). *Structural Conflict: The Third World Against Global Liberalism*. Ewing N.J.: University of California Press.

Krasner, S. D. (2009). *Power, the State, and Sovereignty: Essays on International Relations*. Oxford: Taylor & Francis.

Krewitt, W., & Nitsch, J. (2003). The German Renewable Energy Sources Act—an investment into the future pays off already today. *Renewable Energy*, *28(4),* 533-542.

La Porta, R., Lopez-de-Silanes F., & Schleifer, A. (2006). What works in securities laws? *The Journal of Finance*, *61*(1), 1–32.

Lane, R. (2012). The promiscuous history of market efficiency: the development of early emissions trading systems. *Environmental Politics*, *21*(4), 583–603. doi:10.1080/09644016.2012.688355

Laurikka, H., & Springer, U. 2003. Risk and Return of Project-based Climate Change Mitigation: A Portfolio Approach. *Global Environmental Change*, *13*(3), 207–217.

Lazarowicz, M. (2009). *Global carbon trading: A framework for reducing emissions*. Belfast: Crown.

Lecocq, F., & Ambrosi, P. (2007). The Clean Development Mechanism: History, Status, and Prospects. *Review of Environmental Economics and Policy, 1*(1), 134 –151.

Lewis, J. I. (2010). The evolving role of carbon finance in promoting renewable energy development in China. *Energy Policy*, *38*(6), 2875-2886. doi:10.1016/j.enpol.2010.01.020

Liese, A., & Beisheim, M. (2010). Transnational Public-Private Partnerships and the Provision of Collective Goods in Developing Countries. In Risse, T. (Ed.), *Governance Without a State? Policies and Politics in Areas of Limited Statehood* (pp. 115–143). New York: Columbia University Press.

Lintner, J. (1965). The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budget. *Review of Economics and Statistics*, *47*(1), 13-37.

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

Lohmann, L. (2008). Carbon Trading, Climate Justice and the Production of Ignorance: Ten examples. *Development*, *51*(3), 359–365. doi:10.1057/dev.2008.27

Lohmann, L., Kill, J., Erion, G., & Dorsey, M. K. (2005). Is the US experience with pollution markets really an argument for global carbon trading? Innovation, measurement and sustainability. *Development.*

Lovell, H. C. (2010). Governing the carbon offset market. *Climate Change*, *9*(3), 353-362. doi:10.1002/wcc.43

Lufumpa, C. L. (2005). The Poverty-Environment Nexus in Africa. *African Development Review*, *17*(3), 366–381. doi:10.1111/j.1017-6772.2006.00120.x

Lundin, N., Sanctuary, M., Chunxiu, T., & Liping, L. (2009). *The Pre-2012 CDM Market in China. Policy Context and Current Developments*. Beijing: EU- China CDM Facilitation Project.

Lüthi, S., & Prässler, T. (2011). Analyzing policy support instruments and regulatory risk factors for wind energy deployment–A developers' perspective. *Energy Policy, 39*, 4876–4892.

Lütken, S. (2008). Developing Country Financing for Developed Countries Commitments? In K. Olsen, H. & Fenhann, J. (Eds.), *A Reformed CDM - including new Mechanisms for Sustainable Development*. Roskilde, Denmark: Capacity Development for CDM Project.

Lütken, S., & Michaelowa, A. (2008). *Corporate strategies and the clean development mechanism: Developing country financing for developed country commitments?* Cheltenham UK: Edward Elgar.

Lütken, S. (2011), *Indexing CDM Distribution: Leveling the Playing Field* (CD4CDM Working Paper Series). Risø Denmark: United Nations Environmental Programme.

Mason, J. (2002). *Qualitative researching* (2nd ed.). Thousand Oaks, California: Sage Publications.

Martinot, E., Chaurey, A., Lew, D., Moreira, J. R., & Wamukonya, N. (2002). Renewable Energy Markets in Developing Countries. *Annual Review of Energy and the Environment*, *27*(1), 309–348.

Mathison, S. (1988). Why Triangulate? *Educational Researcher*, *17*(2), 13–17. doi:10.2307/1174583

Mayer, F., & Gereffi, G. (2010). Regulation and Economic Globalization: Prospects and Limits of Private Governance. *Business and Politics*, *12*(3). doi:10.2202/1469-3569.1325

Mayntz, R. (2003a). From government to governance: Political steering in modern societies. *Institute for Ecological Economy Research*. Cologne: Max Planck Institute.

Mayntz, R. (2003b). New Challenges to Governance Theory. In Bang, H. P. (Ed.), *Governance, As Social And Political Communication*. Manchester: Manchester University Press.

McDonough, W., & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things*. New York: North Point Press.

McGowan, A. H. (2008). The CDM: A Mechanism for Eliminating Poverty? *Environment*, *50*(3), 1-14. DOI:10.3200/ENVT.50.3.C2

Meade, J. E. (1952). External Economies and Diseconomies in a Competitive Situation. *The Economic Journal*, *62*(245), 54–67. doi:10.2307/2227173

Menanteau, P., Finon, D., & Lamy, M.L. (2003). Prices versus quantities: choosing policies for promoting the development of renewable energy. *Energy Policy*, *31*(8), 799–812. doi:10.1016/S0301-4215(02)00133-7

Menkhaus, K. (2007). Governance without Government in Somalia: Spoilers, State Building, and the Politics of Coping. *International Security*, *31*(3), 74–106. doi:10.1162/isec.2007.31.3.74

Michaelowa, A., & Michaelowa, K. (2007). Climate or Development: Is ODA Diverted from Its Original Purpose? *Climatic Change, 84*(1), 5–21.

Michaelowa, A., Jusen, A., Krause, K., Grimm, B, & Koch, T. (2000). *CDM Projects in China's Energy Supply and Demand Sectors–Opportunities and Barriers* (HWWA Discussion Paper). Hamburg: Institute of International Economics.

Miles, M. B. (1979). Qualitative Data as an Attractive Nuisance: The Problem of Analysis. *Administrative Science Quarterly*, *24*(4), 590–601. doi:10.2307/2392365

Mossin, J. (1966). Equilibrium in a Capital Asset Market. *Econometrica*, *34*(4), 768-783.

National Development and Reform Commission [NDRC]. (2005). *Measures for Operation and Management of Clean Development Mechanism Projects in China*. Beijing: NDRC.

National Development and Reform Commission [NDRC]. (2006). *The Economic Assessment Method and Parameters for Capital Construction Project* (version 3). Beijing, China: NDRC.

National Development and Reform Commission [NDRC]. (2011). *Measures for Operation and Management of Clean Development Mechanism Projects in* China (Revision dated 03 August 2011). Beijing: NDRC.

National Development and Reform Commission [NDRC]. (2009). *UN wind farm decision unfair, irresponsible-China*. Clean Development Mechanism in China, Department of Climate Change, Beijing: NDRC.

National Energy Regulator of South Africa [NERSA]. (2009). *Renewable Energy Feed In Tariff*. Pretoria: NERSA.

National Energy Regulator of South Africa [NERSA]. (2011). *Review of Renewable Energy Feed-In Tariffs* (Consultation Paper). Pretoria: NERSA.

National Energy Regulator of South Africa [NERSA]. (2012). *NERSA review of Eskom's tariffs for the period 01 April 2012 to 31 March 2013*. Pretoria: NERSA.

New Partnership for Africa's Development [NEPAD]. (2009). *Boosting Africa's Energy Sector through Carbon Finance.* (Background Paper for the Ministerial Meeting and Expert Roundtable of the NEPAD-OECD Africa Investment Initiative, November 11-12). Johannesburg: NEPAD.

Newell, P. (2008). Civil Society, Corporate Accountability and the Politics of Climate Change. *Global Environmental Politics, 8*(3), 122-153.

Newell, P. (2012). The political economy of carbon markets: The CDM and other stories. *Climate Policy*, *12*(1), 135–139. doi:10.1080/14693062.2012.640785

Newell, P., & Paterson, M. (2010). *Climate Capitalism: Global Warming and the Transformation of the Global Economy*. Cambridge University Press.

Newell, P., Jenner, N., & Baker, L. (2009). Governing Clean Development: A Framework for Analysis. *Development Policy Review, 27*(6), 717-739.

Newell, R. G., & Pizer, W. A. (2003). Regulating stock externalities under uncertainty. *Journal of Environmental Economics and Management*, *45*(2), 416–432.

Nganga, J., Wohlert, M., Woods, M., Becker-Birck, C., Jackson, S., & Rickerson, W. (2012). *Powering Africa through Feed-in tariff Policies Advancing renewable energy to meet the continent's electricity needs*. Nairobi: World Future Council, Heinrich Boll Foundation, Friends of Earth.

Nhamo, G. (2007, May). *CDM project approval and evaluation criteria: Comparative study of Morocco and South Africa.* Presented at the Air Pollution XV Conference, Algarve, Portugal.

Nhamo, G. (2006), Institutional and legal provisions for the Clean Development Mechanism in South Africa. In Aravossis, K., Kakaras, E., Brebbia, C.A. & Kungolos, A. (eds.) *Environmental economics and investment assessment* (167-176). Southampton: WIT.

Niederberger, A., & Saner, R. (2005). Exploring the relationship between FDI flows and CDM potential. *Transnational Corporations 14*(1), 1-40.

Nussbaumer, P. (2009). On the contribution of labelled Certified Emission Reductions to sustainable development: A multi-criteria evaluation of CDM projects. *Energy Policy*, *37*(1), 91-101. doi:10.1016/j.enpol.2008.07.033

Ohlson, J., & Juettner-Nauroth, B. (2005). Expected EPS and EPS growth as determinants of value. *Review of Accounting Studies*, 10(2-3), 349–365.

Okubo, Y., & Michaelowa, A. (2010). Effectiveness of subsidies for the Clean Development Mechanism: Past experiences with capacity building in Africa and LDCs. *Climate and Development*, *2*(1), 30-49. doi:10.3763/cdev.2010.0032

Oleschak, R., & Springer, U. (2007). Measuring host country risk in CDM and JI projects: A composite indicator. *Climate Policy*, *7*(1), 470-487.

Olsen, K. H. (2007). The clean development mechanism's contribution to sustainable development: a review of the literature. *Climatic Change*, *84*(1), 59-73. doi:10.1007/s10584-007-9267-y

Pachauri, R. K., & Reisinger, A. (Eds.). (2007). *Climate Change 2007: Synthesis Report, Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Bonn: International Panel on Climate Change.

Pagiola, S., Bishop, J., & Landell-Mills, N. (2002). *Selling forest environmental services: Market-based mechanisms for conservation and development*. London: Earthscan Publications.

Paolo, A. (2006). Use of economic instruments in the German renewable electricity policy. *Energy Policy*, *34*(18), 3538-3548.

Parry, W. H., & Williams III, R. C. (1999). A second-best evaluation of eight policy instruments to reduce carbon emissions. *Resource and Energy Economics*, *21*(3), 347–373.

Parry, M. (2009). Climate change is a development issue, and only sustainable development can confront the challenge. *Climate and Development*, *1*(1), 5–9. doi:10.3763/cdev.2009.0012

Parry, M. L., Palutikof, J. P., Van der Linden, P. J., & Hanson, C. E. (2007). IPCC Fourth Assessment Report (AR4): Climate Change 2007: Impacts, Adaptation and Vulnerability. Cambridge: Cambridge University Press.

Pearson, B. (2007). Market failure: Why the Clean Development Mechanism won't promote clean development. *Journal of Cleaner Production*, *15*(2), 247-252. doi:10.1016/j.jclepro.2005.08.018

Pegels, A. (2010). Renewable energy in South Africa: Potentials, barriers and options for support. *Energy Policy*, *38*(9), 4945-4954. doi:10.1016/j.enpol.2010.03.077

Peters-Stanley, M. (2011). March 30. China Transacts First Panda Standard VERs. *Ecosystem Marketplace*. Beijing, China.

Peters, B. G., & Pierre, J. (1998). Governance without government? Rethinking public administration. *Journal of public administration research and theory*, *8*(2), 223–243.

Pettit, J. (2004). Climate Justice: A New Social Movement for Atmospheric Rights. *Institute of Development Studies Bulletin*, *35*(3), 102–106. doi:10.1111/j.1759-5436.2004.tb00142.x

Pigou, A. C. (1920). *The Economics of Welfare* (1st ed.). Edinburgh: R.&R. Clark.

Porter, M. E., & Linde, C. van der. (1995). Toward a New Conception of the Environment-Competitiveness Relationship. *The Journal of Economic Perspectives*, *9*(4), 97–118.

Prag, A., Briner, G., & Hood, C. (2012). *Making Markets: Unpacking Design and Governance of Carbon Market Mechanisms*. Paris: Organisation for Economic Co-operation and Development, International Energy Agency.

Resnier, M., Wang, C., Du, P., & Chen, J. (2007). The promotion of sustainable development in China through the optimization of a tax/subsidy plan among HFC and power generation CDM projects. *Energy Policy*, *35*(9), 4529-4544. doi:10.1016/j.enpol.2007.03.016

Risse, T. ed., (2010). *Governance without a State? Policies and Politics in Areas of Limited Statehood*. New York: Columbia University Press.

Risse, T., & Lehmkuhl, U. (2006). *Governance in Areas of Limited Statehood-New Modes of Governance?* Berlin: SFB 700.

Rivers, N., & Jaccard, M. (2006). Choice of environmental policy in the presence of learning by doing. *Energy Economics*, *28*(2), 223–242. doi:10.1016/j.eneco.2006.01.002

Roll, R., (1977). A Critique of the Asset Pricing Theory's Tests. *Journal of Financial Economics*, *4*(2), 129-176.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., … Foley, J. A. (2009). A safe operating space for humanity. *Nature*, *461*(7263), 472–475. doi:10.1038/461472a

Rosaria Di Nucci, M., Mez, L., Reiche, D., & Bechberger, M. (2007). *Intelligent Energy Europe: Country Report Germany* (Work package 3 No. 2). Berlin: Freie Universitat Berlin: Environmental Policy Research Centre.

Sandor, R. L., Bettelheim, E. C., & Swingland, I. R. (2002). An overview of a free-market approach to climate change and conservation. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *360*(1797), 1607–1620. doi:10.1098/rsta.2002.1022

Savedoff, W. (2011). *Incentive Proliferation? Making Sense of a New Wave of Development Programs.* Washington D.C.: Center for Global Development. Retrieved from www.cgdev.org/content/publications/detail/1425405

Sawin, J. (2006). National policy instruments: Policy lessons for the advancement & diffusion of renewable energy technologies around the world. In D. Assmann, U. Laumanns, & D. Uh (Eds.), *Renewable Energy: A Global Review of Technologies, Policies and Markets.* Trowbridge: Earthscan.

Schmalensee, R., & Stavins, R. N. (2012). The SO2 Allowance Trading System: The Ironic History of a Grand Policy Experiment. *The Journal of Economic Perspectives*, 12(3) 69-99.

Schneider, S. H., & Goulder, L. H. (1997). Achieving low-cost emissions targets. *Nature*, *389*(6646), 13–14.

Schroeder, M. (2009). Measuring Impact of Chinese Provincial CDM Centers for Local Market Development. In R. Van den Berg & O. Feinstein (Eds.), *Evaluating climate change and development*. New Brunswick NJ: Transaction Publishers.

Schwabe, P., Schwabe, S., & Hand, M. (2011). Multi-national case study of the financial cost of wind energy (Wind Task 26: Work Package 1 Final Report). Paris: International Energy Agency.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *Journal of Finance, 19*(3), 425-442.

Sidgwick, H. (1887). *The principles of political economy* (1st ed.). London: Macmillan.

Siggelkow, N. (2007). Persuasion with Case Studies. *Academy of Management Journal*, *50*(1), 20–24. doi:10.5465/AMJ.2007.24160882

Silayan, A. (2005). *Equitable Distribution of CDM Projects Among Developing Countries* (Discussion Paper). Hamburg: Hamburg Institute of International Economics.

Someshwar, S. (2008). Adaptation as "Climate-Smart" Development. *Development*, *51*(3), 366–374. doi:10.1057/dev.2008.31

Springer, U. (2003). The Market for Tradable GHG Permits Under the Kyoto Protocol: A Survey of Model Studies. *Energy Economics, 25*(5), 527–551.

Standard Bank. (2011). The independent power producers procurement process request for proposal. Johannesburg: Standard Bank.

Statistics South Africa. (2012). *Consumer Price Index (CPI), Past CPI Releases: January 2012*, Pretoria: Statistics South Africa.

Stavins, R. N. (2002). Lessons from the American Experiment with Market-Based Environmental Policies. *SSRN Electronic Journal*. *22*(2002), 1-32. doi:10.2139/ssrn.285998

Stavins, R. N. (1998). What Can We Learn from the Grand Policy Experiment? Lessons from SO2 Allowance Trading. *The Journal of Economic Perspectives*, *12*(3), 69–88. doi:10.2307/2647033

Stavins, R. N. (1997). Policy Instruments for Climate Change: How Can National Governments Address a Global Problem? *The University of Chicago Legal Forum*, *97*(11).

Stavins, R. N., & Whitehead, B. (1997). Market Based Policies. In *Thinking Ecologically, The Next Generation of Environmental Policy* (105–107). New Haven: Yale University Press.

Staw, B. M. (1994). *Repairs on the road to relevance and rigor: Some unexplored issues in publishing organizational research*. In P. J. Frost & S. M. Taylor (Eds.) The Rhythms of Academic Life. New York: Jossey-Bass.

Stern, N. (2007). *The Economics of Climate Change: The Stern Review*. Cambridge UK : Cambridge University Press.

Stewart, R. B. (1991). Models for Environmental Regulation: Central Planning Versus Market-Based Approaches. *Boston College Environmental Affairs Law Review*, *19*(3), 555-559.

Streck, C. (2004). New Partnerships in Global Environmental Policy: The Clean Development Mechanism. *The Journal of Environment & Development 13*(3), 295–322.

Sutter, C., & Parreño, J. C. (2007). Does the current Clean Development Mechanism deliver its sustainable development claim? An analysis of officially registered CDM projects. *Climatic Change*, *84*(1), 75-90. doi:10.1007/s10584-007-9269-9

Szarka, J. (2006). Wind power, policy learning and paradigm change. *Energy Policy*, *34*(17), 3041–3048. doi:10.1016/j.enpol.2005.05.011

Takahashi, K. (2010). *Clean Development Mechanism in China: Current Status of CDM in China*. Tokyo: IGES Market Mechanism Group.

Takahashi, K., & Ninomiya, Y. (2011). *IGES CDM ERs Calculation Sheet: Grid Emission Factors*. Tokyo: IGES Market Mechanism Group.

Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Applied Social Research Methods Series (Vol. 46). Thousand Oaks California: Sage.

Thurmond, V. A. (2001). The Point of Triangulation. *Journal of Nursing Scholarship*, *33*(3), 253–258.

Tietje, O., & Scholz, R. W. (2001). *Embedded Case Study Methods: Integrating Quantitative and Qualitative Knowledge*. Thousand Oaks California: Sage Publications.

Toke, D. (2007). Renewable financial support systems and cost-effectiveness. *Journal of Cleaner Production*, *15*(3), 280-287.

United Nations Development Programme [UNDP]. (2011). Regional and National Trends in the Human Development Index 1980-2011. *International Human Development Indicators*. Database. Retrieved March 7, 2011, from http://hdr.undp.org/en/data/trends/

United Nations Development Programme [UNDP]. (2010). *Human development report 2010 : Overcoming barriers : Human mobility and development.* Basingstoke: Palgrave Macmillan.

United Nations [UN]. (1992). *United Nations Framework Convention on Climate Change.* New York: United Nations.

United Nations Framework Convention on Climate Change [UNFCCC]. (1997). *Kyoto Protocol*. Kyoto: United Nations. Available at: http://unfccc.int/resource/docs/convkp/kpeng.html.

United Nations Framework Convention on Climate Change [UNFCCC]. (2001). *Modalities and procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol*. Marrakech: UNFCCC.

United Nations Framework Convention on Climate Change [UNFCCC]. (2008). *Tool for the demonstration and assessment of additionality* (CDM Executive Board 39 Report, Annex 10, Version 5.2). Bonn: UNFCCC.

United Nations Framework Convention on Climate Change [UNFCCC]. (2011). *Guidelines on the assessment of investment analysis*. (Executive Board 62 Report, Annex 5, Version 5). Bonn: UNFCCC.

United Nations Framework Convention on Climate Change [UNFCCC]. (2012). *Executive Board of Clean Development Mechanism Sixty-Ninth Meeting Report* (Number CDM-EB-69). Bangkok, Thailand. Retrieved from http://cdm.unfccc.int/EB/Meetings

United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States [UN-OHRLLS]. (2012). Criteria for identification of LDCs. New York: UN-OHRLLS. http://www.unohrlls.org/en/ldc/related/59/. Accessed 29 February 2012.

Unruh, G. C., & Carrillo-Hermosilla, J. (2006). Globalizing carbon lock-in. *Energy Policy*, *34*(10), 1185–1197. doi:10.1016/j.enpol.2004.10.013

Van Den Berg, J. (2007). South Africa launches a CDM industry association. *25 Degrees in Africa*, *2*(4).

Van Maanen, J., Sørensen, J. B., & Mitchell, T. R. (2007). The Interplay Between Theory and Method. *Academy of Management Review*, *32*(4), 1145–1154.

Veit, S. (2010). *Climate Risk Management for the Energy Sector in Africa: The Role of the African Development Bank*. In A. Troccoli (Ed.), Management of Weather and Climate Risk in the Energy Industry (pp. 121–135). Netherlands: Springer.

von Flotow, P., & Friebe, C. (2011). *Framework conditions for Investments in Wind Parks in Emerging and Developing Markets the Investors' Perspective*. Oestrich-Winkel: Sustainable Business Institute.

Vorster, S., Winkler, H., & Jooste, M. (2011). Mitigating climate change through carbon pricing: An emerging policy debate in South Africa. *Climate and Development*, *3*(3), 242-258. doi:10.1080/17565529.2011.598367

Wang, Q., & Chen, Y. (2010). Barriers and opportunities of using the clean development mechanism to advance renewable energy development in China. *Renewable and Sustainable Energy Reviews*, *14*(7), 1989-1998. doi:10.1016/j.rser.2010.03.023

Wang, H., & Firestone, J. (2009). *The Analysis of Country-to-country CDM Permit Trading Using the Gravity Model in International Trade* (Working Paper). New York: Social Science Research Network.

Weitzman, M. L. (1974). Prices vs. Quantities. *The Review of Economic Studies*, *41*(4), 477–491. doi:10.2307/2296698

Welch, C., Marschanpiekkari, R., Penttinen, H., & Tahvanainen, M. (2002). Corporate elites as informants in qualitative international business research. *International Business Review*, *11*(5), 611–628. doi:10.1016/S0969-5931(02)00039-2

Wenzel, B. (2006). *What Electricity from Renewable Energies Costs.* Berlin: Germany Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

Werner, D., Aphane, O., Otto, A., & Leask, K. (2011). *Capacity Credit of Wind Generation in South Africa*. Pretoria: Deutsche Gesellschaft für Internationale Zusammenarbeit, Department of Energy and Eskom.

Wheeler, D. (2011). *Quantifying Vulnerability to Climate Change: Implications for Adaptation Assistance* (Working Paper 240). Washington DC: Center for Global Development.

Wigley, T. M. L., Richels, R., & Edmonds, J. A. (1996). Economic and environmental choices in the stabilization of atmospheric CO2 concentrations, *379*(6562), 240–243. doi:10.1038/379240a0

Winch, D. (1969). Review of Pollution, Property and Prices, by J.H. Dales. *The Canadian Journal of Economics*, *2*(2), 322–324.

Winkler, H. (2010). *Taking action on climate change: Long term mitigation scenarios for South Africa*. Claremont South Africa: UCT Press.

Winkler, H., & Marquand, A. (2009). Changing development paths: From an energy-intensive to low-carbon economy in South Africa. *Climate and Development*, *1*(1), 47-65. doi:10.3763/cdev.2009.0003

Wiser, R. H., & Pickle, S. J. (1998). Financing investments in renewable energy: The impacts of policy design. *Renewable and Sustainable Energy Reviews*, *2*(4), 361–386.

World Bank. (2010). *World Development Indicators.* Washington DC: World Bank.

World Bank and International Finance Corporation. (2010). *Doing Business 2011: Making a difference for entrepreneurs: Comparing business regulation in 183 economies.* Washington DC: World Bank /IFC.

Wüstenhagen, R., & Bilharz, M. (2006). Green energy market development in Germany: effective public policy and emerging customer demand. *Energy Policy*, *34*(13), 1681-1696.

Yang, M., Nguyen, F., De T'Serclaes, P., & Buchner, B. (2010). Wind farm investment risks under uncertain CDM benefit in China. *Energy Policy*, *38*(3), 1436-1447. doi:10.1016/j.enpol.2009.11.024

Yeoh, P. (2008). Is carbon finance the answer to climate control? *International Journal of Law and Management*, *50*(4), 189-206. doi:10.1108/17542430810890369

Yin, R. K. (1994). *Case study research: Design and methods*. Thousand Oaks California: Sage Publications.

Zhang, Z. (2004). Meeting the Kyoto Targets: The importance of developing country participation. *Journal of Policy Modeling*, *26*(1), 3–19.

Zhao, X., & Michaelowa, A. (2006). CDM potential for rural transition in China case study: Options in Yinzhou district, Zhejiang province. *Energy Policy*, *34*(14), 1867-1882. doi:10.1016/j.enpol.2005.01.004

Yin, R. K. (1981). The Case Study Crisis: Some Answers. *Administrative Science Quarterly*, *26*(1), 58–65.