The Impact Of Clean Development Mechanism Projects On Sustainable Development In South Africa

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ABSTRACT

Clean Development Mechanisms (CDM) have achieved a certain level of cost-effective emission reductions in developing countries. In this context the uneven distribution of CDM projects in certain regions as well as the concentration of CDM projects amongst certain sectors in developing countries have resulted in the issue of whether CDM projects contribute to sustainable development in developing countries. This article examines the impact of CDM projects on sustainable development in South Africa by examining a sample of working CDM projects there and evaluating their impact on environmental, economic and social sustainable development. Based on observations during the study, CDM policy changes are reviewed, and options to enhance the sustainable development implications of CDM projects are explained.

Keywords: Climate Change; Clean Development Mechanism; Certified Emission Reductions; Greenhouse Gas Emissions; Sustainable Development

INTRODUCTION

In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was born with the goal of reducing the concentration of greenhouse gases in the atmosphere. South Africa became a signatory to the UNFCCC in August 1997 (UNFCCC, 2004). According to a sustainable development study in Southern Africa, the level of carbon emissions per unit of economic output in South Africa was nearly three times the average set by the Organisation for Economic Co-operation and Development (OECD) (Goldblatt & Davies, 2002).

The UNFCCC allows for flexibility in that the convention allows the possibility of additional responsibilities and commitments in the face changing technology and political considerations (SAGDEA, 2003). In December 1997 a legally binding agreement known as the Kyoto Protocol was signed by a host of industrial countries, who collectively agreed to reduce greenhouse gas emissions by 5.2% in comparison to the emission levels in 1990 (Kyoto, 2010). In terms of the Kyoto agreement the 37 most industrialised countries of the 146 nations ratifying the agreement have agreed to reduce their GHG emissions below 1990 levels during an initial commitment period of 2008 through 2012 (Weyant et al, 1999).

The Kyoto Protocol offers industrialised countries a means of meeting their targets by way of three market-based mechanisms. The Kyoto mechanisms are emissions trading- known as "the carbon market"; Clean Development Mechanism (CDM) and Joint Implementation (JI) (UNFCCC, 2014). As South Africa signed the Convention as a non-annexure 1 country the obligations under the protocol are less onerous than developing countries and include a commitment to be involved in all climate change negotiations (SAGDEA, 2003).

South Africa signed the protocol in 2002, and even though it has no commitment to cap emissions it is involved in CDM (clean development mechanism) projects (DEAT, 2010). A CDM project is one form of carbon trading that aims to reduce greenhouse gases, through international cooperation of an emitter in a developed country and a project owner in a developing country. The emitter in the developed country supplies the capital to a project

owner in a developing country to the value of the carbon credit generated by the project owner in the developing country which is then utilised by the emitter in the developed country (DEAT, 2010).

A CDM thus effectively enables a developing nation to participate in the Kyoto Protocol by selling carbon credits which are called "certified emission reductions" (CERs) and measured in tons of carbon dioxide equivalent to parties with emission commitments. The birth of CDM was on 11 December 1997 when CDM was signed into being as Article 12 of the Kyoto Protocol (Lecocq & Ambrosi, 2004). The CDM executive board, however, was only formally established at a meeting of the conference of parties (COP) in Marrakesh in 2001 (Matsuo, 2004).

CARBON CREDITS AND CDM

An alternative Kyoto protocol mechanism to the CDM approach is the *cap-and-trade* approach which has its origins in the United Nations Framework Convention on Climate Change (UNFCCC) that was established with the goal of reducing the concentration of greenhouse gases in the atmosphere, to which South Africa became a signatory in August 1997 (UNFCCC, 2004). In a cap-and-trade scheme, a governmental organisation typically issues *a license to emit greenhouse gases* to major industries with the entity then being in position to trade these permits with another entity who might make 'equivalent' changes more cost effectively (Gilbertson & Reyes, 2009).

This is the approach underlying most emission trading schemes with the underlying theory that the available supply of permits will be slowly reduced, so that the market retains its value while at the same time forcing a decrease in the overall level of greenhouse gas emissions (Gilbertson & Reyes 2009). Cap and trade schemes have been reported as effective in reducing greenhouse gas emissions and improving environmental sustainability, a sample study of 2101 European firms subject to the EU ETS revealed that it led to reductions in emissions in both phases (Abrell *et al.*, 2011). Trade schemes implemented in air pollution programmes in the United States also reported a strong positive effect on reducing emissions (Tietenburg, 2003). The performance of cap-and-trade schemes on sustainable development was assessed using a simulation model at the University of Saskatchewan, where it was revealed that it decreased carbon dioxide emissions and increased environmental and economic sustainability (Belcher *et al*., 2003).

It should be noted that the CERs associated with CDM's are subject to a process of verification by a UN accrediting body before issuance (Boyd *et al.*, 2009). In this regard the project design document (PDD) is critical, as this document is involved directly in the validation and registration of a CDM project activity and is reviewed by the designated operational entity (DOE) during the validation process to ensure the project meets all the requirements for validation (CDM, 2014).

CARBON EMISSIONS TAX

An alternative instrument to Kyoto protocol mechanisms is that of *carbon taxation*, which has been defined as an instrument of environmental cost internalisation that effectively amounts to an excise tax on the producers of raw fossil fuels based on the relative carbon content of those fuels (OECD, 1997). The primary purpose of a carbon tax is thus to address the problem of global warming caused by increasing concentrations of greenhouse gases, which include carbon (Pearson & Smith, 1991).

South Africa implemented a carbon excise tax on the 1st of September 2010 for motor vehicles at a rate of R75 for every gram of carbon dioxide per kilometre it emits over the 120g/km (Shirley, 2010). Studies examining the impact of a carbon tax on greenhouse gas emission have shown that a carbon tax may positively contribute toward environmentally sustainable development. In a study estimating the impact of carbon tax on greenhouse gas emissions in Nepal using an energy system model, it was confirmed that the introduction of carbon tax would result in an estimated reduction of 12% under certain conditions (Shakya *et al.*, 2012). A study estimating the effect of policy instruments such as carbon tax in Austria on the passenger motor vehicles confirmed that policy measures may demonstrate an effective reduction in GHG emissions (Kloess & Muller, 2011).

SUSTAINABLE DEVELOPMENT

Linked to the implementation of clean development mechanisms in South Africa is the concept of sustainable development. Various definitions of the term "sustainable development" have been derived over the last few decades with the more common definition being "that which is required to harmonise the fulfilment of human needs with the protection of the natural environment so that these needs can be met not only in the present, but also in the indefinite future" (Mohammed, 2011).

Sustainable development comprises multiple elements categorised into three dimensions, namely environmental, economic and social, which in essence is the "triple bottom line", which has been defined as the *balance* within the concept of sustainability (Cronje &Chenga, 2009; Anon, 2006; Newport *et al*., 2003):

- The *economic dimension* of sustainability is important as critical issues such as costs associated with environmental pollution; constraints on economic growth and the destruction of non-renewable resources are addressed by this area of sustainable development.
- Concerning *social sustainability*, it is suggested that the social dimension of sustainable development encompasses the transformation and perpetual improvement of the livelihoods of human beings within a specific social context.
- In terms of *environmental sustainability,* clean air and water, reduced toxic emissions and reducing household waste as well as conserving natural resources are among the important environmental policy objectives that most OECD governments have been pursuing over the past thirty years.

CDM PROJECTS IN SOUTH AFRICA

In order for South Africa to participate in CDM projects, a Designated National Authority or "DNA" had to be established and the regulations establishing the DNA for CDM in South Africa were gazetted on 22 July 2005 (Department of Energy, 2014). From a South African perspective, the CDM offers the opportunity to attract capital for projects that assist in the shift to a more prosperous but less carbon intensive economy (Department of Energy, 2014a).

All CDM projects in South Africa go through a 9 step project cycles as follows:

- Project Identification and Design: This is the identification of CDM opportunity with quantifications of baseline estimates of GHG reductions
- Host country approval: The DNA of the host country must approve the CDM project before it is submitted for registration to the CDM Executive Board.
- Third-party validation of the Project Design Document: In South Africa this step is carried out by a Designated Operational Entity (DOE).
- Registration: This is the formal validation of the CDM project, and it is registered by the CDM Executive Board.
- Financial structuring: In this phase, the finances are secured in the form of debt or equity and the investors will pay for the certified credits on delivery.
- Implementation and operation: In this phase the CDM project is built and becomes operational.
- Monitoring Project performance: In this phase to ongoing performance targets set in the PDD are measured by the project developer on an ongoing basis.
- Third-party verification of project performance: In this phase, the DOE verifies the project performance against the validated design and baseline objectives to approve certification;
- Certification and issuance: CERs are certified by the DOE and issued by the CDM Executive Board based on verified project performance against project design and baseline objectives (Department of Energy, 2014b).

In 2014, there were 347 CDM projects submitted to the Designated National Authority (DNA) in South Africa with 12 being issued CER's (Department of Energy, 2014a). CDM include various project types such as

hydro-electricity, gas fired power generation, industrial energy efficiency, improved public transport and cleaner coal power generation technology (PACE, 2014).

In terms of the assessment of CDM projects and their related effect on sustainable development experts are beginning to systematise sustainable development contributions of CDM projects, with various studies examining the project design document (PDD) in an attempt to elucidate the effect of each projects stated contribution to sustainable development (Boyd *et al.*, 2009). In South Africa, a total of 138 PDD's have been submitted to the DNA (Department ofEnergy, 2014a).

Given the uneven distribution of CDM projects across countries and regions and the fact that a few technologies and sectors have dominated in the early stages of CDM (Boyd et al, 2009), the question to be asked is whether CDM has fallen short in contributing to sustainable development in South Africa?

PROBLEM STATEMENT AND OBJECTIVES

Following from the above the question may be asked as to what is the total impact of CDM projects on sustainable development in South Africa. In light of that the primary research question could be formulated as follows:

Is the CDM an appropriate market-based instrument to reduce greenhouse gas emissions and contribute to sustainable development within South Africa?

The research is based on an analytical literature study utilising a three-step approach of determining whether CDM projects contribute adequately to sustainable development in South Africa. Firstly an overview of CDM projects globally and their impact on environmental and economic sustainable development is completed. Secondly the evenness of distribution of CDM projects by region and type in South Africa is examined. Thirdly the study evaluates the sustainable development contribution 10 working CDM projects according sustainable development criteria.

CDM STATUS AND SUSTAINABLE DEVELOPMENT ASPECTS

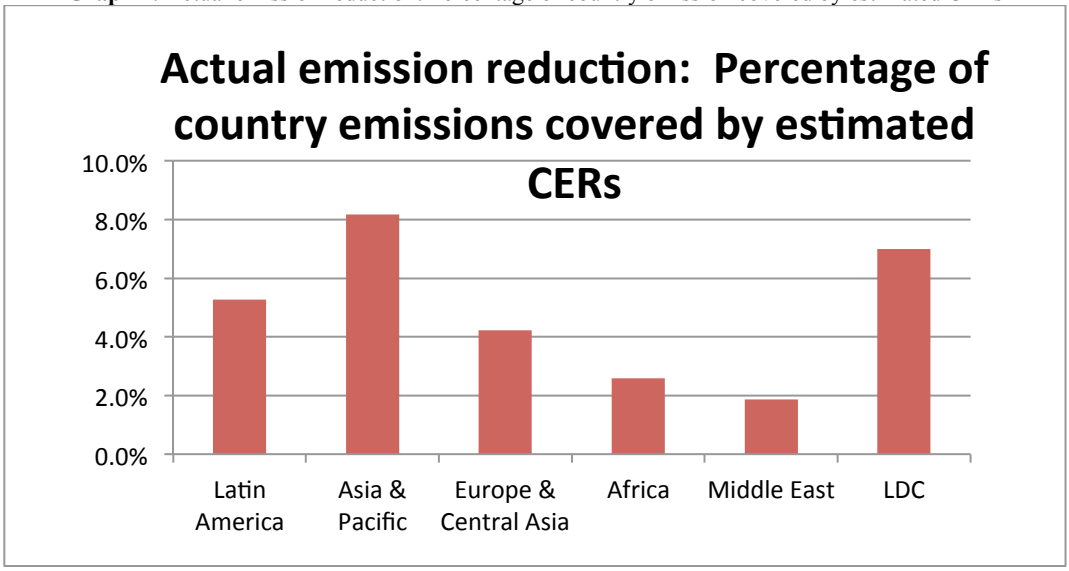
According to the United Nations Environmental Programme (UNEP) approximately 7516 CDM projects are now registered around the world and a further 15 are in the registration process with 2587 CDM projects having CERs issued (UNEP, 2014). CDM contributions to sustainable development have been summarised under environmental and economic sustainable development headings respectively.

Environmental Sustainable Development

Academic findings regarding the effectiveness of CDM in reducing greenhouse gases is mixed, Rai (2009:75) confirms that despite the CDM's theoretical potential to leverage market mechanisms to incentivise investments in low-carbon technologies in the developing world, its real impact on emissions reductions has been limited while Matsuo (2004:1) confirms that it is widely agreed that the CDM is a useful instrument that encourages and reinforces the reduction of greenhouse gas emissions (GHGs), and also that it should be further promoted as a way to fill the gap in energy and GHG efficiency between industrialised and developing countries.

Graph 1 below measures the actual carbon dioxide emission reduction in terms of certified emission reductions issued by CDM projects around the world.

Graph 1. Actual emission reduction: Percentage of country emission covered by estimated CERs



Source: (UNEP, 2014b)

The graph above measures the effectives of CDM in reducing carbon dioxide emissions by comparing certified emission reduction certificates issued by region as a percentage of actual carbon dioxide emissions in that region. The graph also provides a high-level overview of CDM effectiveness in South Africa, since South Africa will fall into the African region. Out of a total of 6 world regions, Africa is placed fifth overall in terms of overall CDM effectiveness.

CDM appears to be most effective in the Asian and Pacific region and the least effective in the Middle East region in lowering carbon dioxide emissions. From a South African perspective, 3.3% of carbon dioxide emissions have been covered from CERs arising from 71 CDM projects in South Africa (UNEP, 2014b). The graph statistically confirms the effectiveness of carbon dioxide reductions as a result of the implementation of CDM in different regions of the world including South Africa.

Economic Sustainable Development

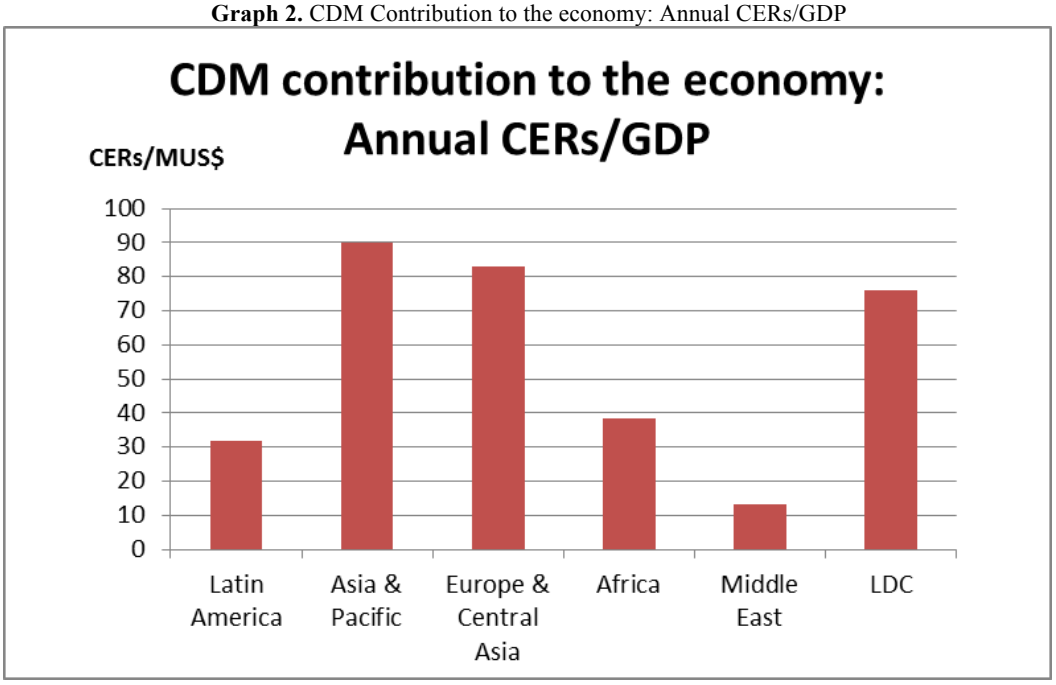
Before determining the impact of CDM on economic sustainable development in South Africa, a review of academic studies examining the impact of CDM on economic sustainable development from a global perspective is summarised below:

- A study examining the impact of CDM on macroeconomic factors confirmed that CDM is an important flexibility mechanism to achieve the Kyoto targets at low cost (Anger *et al.*, 2007).
- A study in India on the impact of CDM on rural poverty confirmed that CDM is unlikely to have benefits on rural poverty in India (Sirohi, 2007).
- A further study conducted on 16 registered CDM projects on whether such projects contribute to sustainable development confirmed that CDM projects are far from delivering their claims to promoting sustainable development (Sutter & Parreno, 2007).

The mixed results from the studies above confirm that it is not automatic that South Africa will receive any sustainable development benefits via implementation of CDM.

Graph 2 below measures the CDM contribution from an economic perspective by dividing the annual CER value against the GDP for the respective region.

Graph 2. CDM Contribution to the economy: Annual CERs/GDP



Source: (UNEP, 2014b)

The graph above is a measure of economic sustainability since it measures the CDM contribution to an economy in terms of the certified emission reduction value relative to regional GDP. The graph also provides a high-level overview of CDM effectiveness in terms of economic sustainability in South Africa, since South Africa will fall into the African region

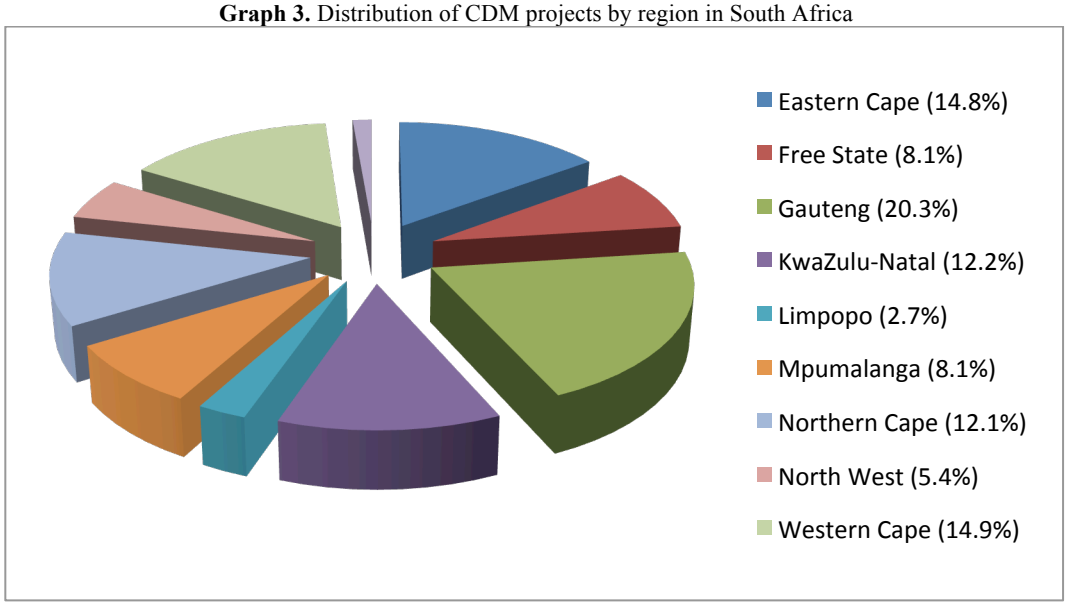
Out of a total of six world regions, Africa is placed fourth in terms of economic sustainability. CDM appears to be most economically sustainable in the Asian and Pacific region and least sustainable in the Middle East region. From a South African perspective, the annual CER value relative to GDP is 34% which appears slightly lower than the Africa figure of approximately 38% (UNEP, 2014b). The graph statistically confirms the positive economic sustainability effects as a result of the implementation of CDM in different regions of the world including South Africa.

CDM PROJECT DISTRIBUTION IN SOUTH AFRICA

According to the UNEP, there are currently 71 CDM projects that are either registered or at validation phase in South Africa, with these projects being located in different parts of South Africa and having benefit to different industries (UNEP, 2014a). Where the distribution of CDM projects has been extremely uneven across regions, it may be questionable whether CDM is actually contributing to sustainable development (Boyd *et al.*, 2009)

Graph 3 below summarises the distribution of CDM projects by region in South Africa.

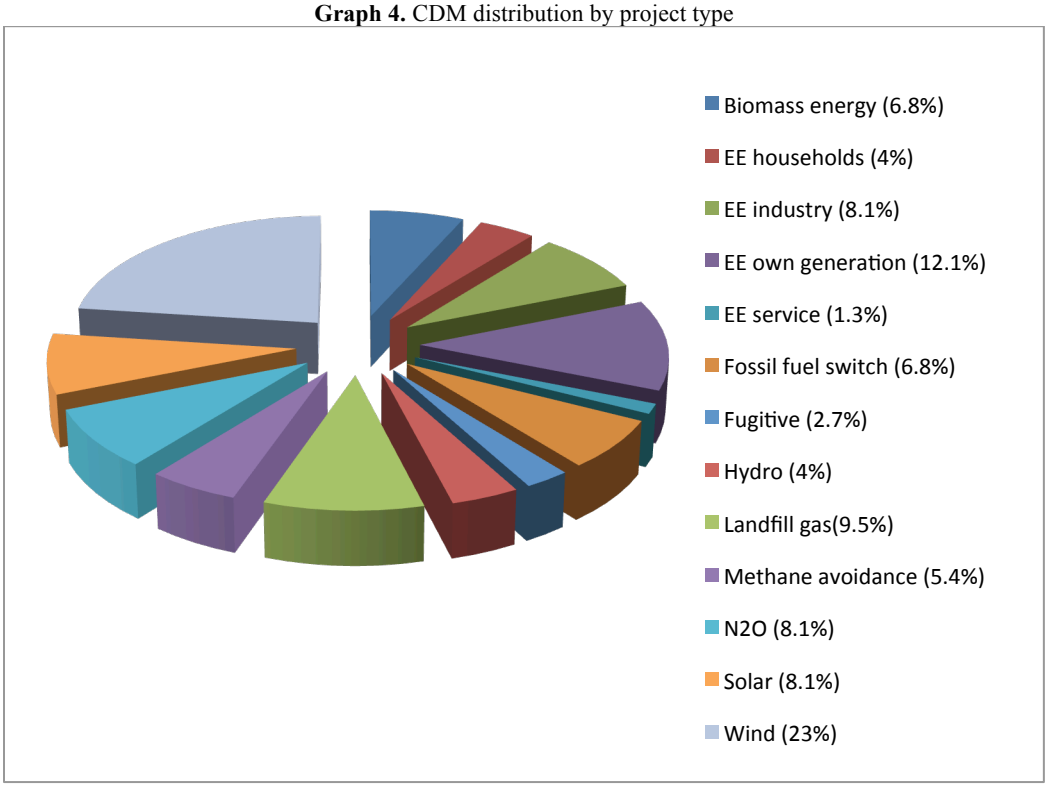
Graph 3. Distribution of CDM projects by region in South Africa



Source: (UNEP, 2014a)

Graph 3 above shows Gauteng to be the dominant region for CDM projects followed by the Eastern Cape and then the Western Cape. The three regions in total constitute 50% of all CDM projects in South Africa. The lowest numbers of CDM projects are found in the Free State, Limpopo and Mpumalanga. These three only constitute 18.9% of the total number of CDM projects in South Africa. Since there are 9 provinces in South Africa, and a material disparity between the lowest and highest CDM regions in the country (SA, 2014; UNEP, 2014a), one may conclude that there is an uneven distributional spread of CDM projects across South Africa.

Graph 4. CDM distribution by project type



Source: (UNEP, 2014a)

There are currently thirteen different CDM project types or technologies in South Africa. The most dominant by far of all technologies is wind technology and electrical energy generation. These two project types constitute approximately 35.1% of the total CDM projects in South Africa with the least number of CDM projects being in electrical energy services. Given that there are thirteen different project technologies with two project types constituting 35% of all CDM projects, it also appears that the project type distribution is uneven (UNEP 2014a).

CDM EVALUATION IN SOUTH AFRICA

Assessing the contribution of CDM projects to sustainable development in a region may be performed in a number of different ways, a systematic approach that has been applied by a number of studies in recent years has been to examine the supporting project design documents (PDDs) in determining the sustainable development contribution of a project. Both Sirohi (2007) who examined 65 projects in India and Sutter and Parreno (2007) have examined PDDs in attempting to determine the impact of projects on sustainable development (Boyd *et al*., 2007).

In order to better measure the contribution of South African CDM projects to sustainable development a review of a random sample of 10 cases in South Africa that capture (a) diversity of CDM projects such as fuel switch, landfill and wind power as well as (b) regions (refer to Table 1 below). The supporting PDDs are then reviewed and then subjectively evaluated according qualitative measures of direct and indirect benefits based on sustainable development criteria, such as health, greenhouse gas reductions, employment and technology transfer.

The aim of the review is to provide a high-level insight in the sustainable development benefits at the project level. Given that many of the projects are in the beginning stages of their project life, the review has to be considered preliminary, but it is hoped that there will be a deeper evaluation of the projects at a future stage in the project life.

In this study "direct benefits" are those that arise directly from the project such as a project employment whereas indirect benefits are benefits that occur when there is an improvement in environmental and social conditions such as the use of renewable energy which will indirectly reduce air pollution and increase environmental sustainability. When the benefits of a project appeared to be negligible, these are classified as negligible benefit.

Table 1. CDM Contribution to Sustainable Development in South Africa

Project	Project Summary	Environment	Economic	Health	Employment	Tech Transfer	Other social
Kuyasa low-cost urban housing energy upgrade project, Khayelitsha	This project activity is aimed as an intervention in an existing low-income housing development with households in Kuyasa, Khayelitsha, as well as in future housing developments (100 ha) in this area	aa	NB	a	a	NB	a
Lawley Fuel Switch Project	The project entails the conversion from coal to natural gas of the thermal fuel used in clay brick baking kilns at Lawley Brick Factory, an existing brick factory wholly owned by Corobrik (Pty) Ltd, South Africa. The fuel switch project is developed, financed and implemented by Corobrik.	aa	a	NB	NB	a	NB
Rosslyn Brewery Fuel-Switching Project	The project activity primarily aims at reducing GHG emissions through fuel switching. The project consists of investment to replace the use of coal by natural gas, funded through the sale of carbon Credits in the context of the Clean Development Mechanism (CDM) of the Kyoto Protocol.	aa	NB	NB	NB	NB	NB
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	The project, when originally registered, consisted of an enhanced collection of landfill gas at two landfill sites of the municipality of Durban, the use of the recovered gas to produce electricity and flaring of the excess gas. The electricity produced is fed into the South African grid system. In its first crediting period, the project was implemented on the Mariannhill and La Mercy landfill sites.	aa	NB	NB	NB	a	NB

(Table 1 continued)

Project	Project Summary	Environment	Economic	Health	Employment	Tech Transfer	Other social
Omnia Fertilizer Limited Nitrous Oxide (N2O) Reduction Project	Nitric acid (HNO3) produced at Omnia's nitric acid plant is used as a feedstock in another section of the plant to produce ammonium nitrate (NH4NO3) which is in turn used for fertilizers.	aa	NB	NB	a	NB	a
Tugela Mill Fuel Switching Project	Currently, thermal energy produced for use at the Tugela Pulp and Paper Mill is supplied by coal- fired Boilers.	aa	a	NB	NB	NB	NB
Coega IDZ Windfarm	The project will see Electrawinds Africa and Indian Ocean Islands (Pty) Ltd install 25 wind turbines: one of 1.8 MW and 24 of 3 MW, making a total of 73.8 MW.	aa	a	NB	a	a	NB
Rheboksfontein Wind Energy Facility	Moyeng Energy (Pty) Ltd is developing the Rheboksfontein Wind Energy Facility (from now on the "Project") in Western Cape, South Africa. The project will comprise the installation of 35 Vestas V112 wind turbines, each turbine of 3MW with a total installed capacity of 105 MW and is expected to generate 360,500 MWh/year.	aa	NB	NB	a	a	NB
Grahamstown Invasive Biomass Power Project	The purpose of the project activity, is to utilize the invasive biomass for the generation of clean electricity. The electricity generated by the project activity will be supplied to the national electricity grid.	aa	a	NB	a	a	NB
De Aar Grid Connected 10 MW Solar Park, South Africa	The aim of the project is to supply solar-generated electricity to the grid of the Republic of South Africa.	aa	NB	NB	aa	a	NB

Source: CDM, (2014a); CDM, (2014b); CDM, (2014c); CDM, (2014d); CDM, (2014e); CDM, (2014f); CDM, (2014g); CDM, (2014h); CDM, (2014i); CDM, (2014j)

Key:

aa - direct sustainable development benefit noted
a - indirect sustainable development benefit noted

NB – negligible sustainable development impact noted

Per an analysis of the CDM PDDs, South Africa has developed a standard checklist approach to the issue of sustainable development. A review of the project design documents reveals that most of the CDM projects are focused on environmentally sustainable development. All the CDM projects under review reflected clear targets for GHG emission reductions as well as the technology to be applied in reducing greenhouse gases. These benefits resulted in an immediate and direct benefit in terms of environmental sustainable development.

With reference to Table 1 above in terms of pure economic sustainable development criteria, only 40% of the sample evidenced increase economic output or suitable investment return. Note this criterion did not consider the future sale of CERs which would result in increased foreign direct investment (FDI) as the CERs were not a certain outcome in the future. A possible reason for low focus on economic sustainable development criteria is the concentration on GHG reduction and the future sale of CERs to ensure FDI in South Africa. Linked to economically sustainable development is employment generation. Approximately 60% of CDM projects in the sample addressed employment generation. Most CDM projects did not directly address employment generation as a priority of the project, however since most of the projects involve infrastructure development, employment generation would be a by-product of such increases in infrastructure. Once again, a possible reason for the low direct focus on employment generation is the concentration on GHG reduction and generation of future CERs.

Table 1 above confirms approximately 60% of CDM projects which provide technology transfer or improvements as a result of implementation of the project. The technology benefits were primarily as a result of installation or creation of new machines or equipment which would assist in the reduction of greenhouse gases. Approximately 10% of the CDM projects sampled showed health benefits either to employees or society at large. Most of the health benefits occur indirectly as a result of reduction in carbon dioxide emissions, however only one CDM project made specific mention of the actual health benefits to accrue as a result of implementation of the project. Other social benefits include benefits such as housing and education. Only one CDM project in the sample addressed this benefit in their PDD (CDM, 2014a).

The overall analysis of CDM's impact on sustainable development reveals that South African projects are focused on GHG reductions to the detriment of welfare and economic considerations.

Employment opportunities are by-products of investments in GHG-reducing technologies and any health benefits only arise as a by-product of carbon dioxide emission reductions. In order to attain a an equal distribution of sustainable development objective, it is proposed that certain policies may have to be considered in initiating CDM projects for the future.

Two possible CDM policy futures that may be particularly relevant to the South African context may be summarised as follows:

- Implementation of a points system which allocates points based on development aspects of CDM projects where all projects would have to attain a minimum level of points in order for sustainable development benefits to be accepted.
- CER value adjustment to be made where CDM projects favour high CERs but low sustainable development or distributional benefits. This would then force project designers to focus on a more equivalent distribution of sustainability benefits on inception of the project (Boyd et al., 2009)

With the regard to the first policy future, the points system may well work in South Africa provided the weighting of points be fair and agreeable to all stakeholders in the relevant project. The minimum level of points may come under greater scrutiny and debate as it will set the minimum standard of sustainability benefits to be attained by any CDM project. Provided these two issues can be resolved, the points system might hold the key to achieving a more balanced development outcome for CDM projects.

The second policy may have far reaching implications since it might create a market distortion of CERs by artificially altering their value. Its advantage is that it directly impacts the final CER value which can be sold to the developed country thus forcing the host country company to ensure strong sustainability development benefits arise

from project implementation. Provided the adjustment does not lead to a significant market distortion of the CER price, the second policy could also be implemented in South Africa.

LIMITATIONS AND FUTURE RESEARCH

The contribution of CDM projects to sustainable development in South Africa was assessed solely through a review of PDDs of the relevant projects and no other information. This may be considered a limitation as not all the information may be included in the project document or some views in the project report may be over or understated. Due to the length of project life cycles no meaningful subsequent performance evaluation could be done to determine how accurate the baseline targets in the PDD were. A future research opportunity might thus lie in performing a CDM review in future years to evaluate whether PDD targets are being met.

CONCLUSION

The issue of whether CDM projects are contributing to sustainable development in the global context was examined in the first part of this study. The results and data show that CDM projects contribute significantly to GHG reduction and that the values of CER's are material in relation to regional GDP. In a global context, it might be concluded that there is a material contribution by CDM to both environmental and economic sustainable development.

In South Africa, CDM projects are gaining momentum at a rapid pace, the evidence of this is in the number CDM applications to the Designated National Authority in South Africa. The potential for a material contribution to sustainable development in South Africa via CDM is thus significant, and CDM policy should be harmonised to achieve an equitable distribution of sustainable development benefits. The analysis current distribution of CDM projects in South Africa both by region and type indicate that the CDM project distribution is uneven. This is a preliminary indicator that CDM projects may not be contributing to sustainable development as many people might have expected.

Further testing on the actual contribution of CDM to sustainable development in South Africa per a PDD review also indicates that CDM are heavily skewed toward GHG reduction with little priority given to health, education and employment generation. Most of the sustainable development benefits in terms of technological transfer, economic growth and health are indirect in nature and arise as the by-product of the reduction in greenhouse gases. In order for CDM to achieve a greater contribution to sustainable development in South Africa, CDM policy has to increase its focus on promoting sustainable development criteria as a whole, and not solely on GHG reductions. The two policy alternatives highlighted in this paper are seen as viable in the South African context provided the necessary safeguards be in place to prevent any possible unfairness and abuse arising from the implementation of the policy.

AUTHOR INFORMATION

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