CDM STATUS REVIEW

DESIGNATED NATIONAL AUTHORITY FOR THE CLEAN DEVELOPMENT MECHANISM

SOUTH AFRICA

2009

energy
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Energy
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Executive summary

The Clean Development Mechanism (CDM) plays an important role in South Africa's efforts in combating climate change. The Designated National Authority (DNA), South Africa's custodian for the CDM, has commissioned this report to review the development of the CDM in South Africa and to provide insights into the successes and challenges of the CDM in the country.

The timing of this review is particularly pertinent when one considers that in December 2009 world leaders will be meeting in Copenhagen, Denmark, at the United Nations Climate Change Conference to discuss the future of the CDM and to agree on an ambitious and effective worldwide response to climate change for the second commitment period of the Kyoto Protocol.

The information gathered and presented in this report provides relevant information regarding the status and future potential of the CDM in South Africa and highlights the steps taken by the country in combating the effects of climate change and the significant CDM opportunities created through these measures.

To date there are 14 active South African CDM projects registered by the Executive Board. There are a further 14 projects that are at an advanced stage of development, either in the CDM validation process or about to enter this process. This is out of the 1,652 projects that have been registered globally and confirms that South Africa has lagged behind in developing the CDM as a national initiative.

Despite the relatively small number of registered projects, there is a rapidly growing project pipeline in South Africa with 128 projects having been submitted to the DNA in various different stages of development. Only 91 of the 128 projects have been included in the analysis section of this report for a variety of reasons, including reasons of confidentiality and because some were only submitted during the course of the analysis. These additional projects will be added to the DNA's database and will be included in subsequent updates of the information in this report. Of the 91 projects that were analysed, 5 projects are no longer active, 58 are in the in Project Idea Note (PIN) phase and 28 are in the Post-PIN phase. There are almost certainly additional projects in development in the country that have not been formally brought to the attention of the DNA which further increases the true size of the project pipeline.

From the 28 South African projects that have passed the PIN phase it is projected that, over the total crediting periods of the projects, there will be at a total saving of 82.8 million tonnes of carbon dioxide equivalent ($mtCO_2e$). This equates to an average saving of approximately 5.1$mtCO_2e$ per year.

When compared to the total annual greenhouse gas emissions in South Africa, estimated to be 447$mtCO_2e$ in 2000 and certain to have grown since then, the annual reductions due to the CDM account for only 1% of the annual emissions from the country. Although this indicates that CDM has had a small impact on total emissions it does suggest that enormous opportunities for further reductions do exist in the country and can be supported by the revenue generated from the CDM.

Projects from the chemicals sector will contribute 35.4$mtCO_2e$ of the total expected post-PIN emission reductions, followed by the energy industries with about 17.9$mtCO_2e$. This is contrasted with the analysis of total emission reductions for projects that are in the PIN phase where there are no projects that have the chemicals sector as their primary sector, whilst projects in the energy industries have possible total emission reductions in excess of 300$mtCO_2e$.

The initial dominance of the chemicals sector probably reflects the weight of the nitrous oxide reduction projects which are essentially process changes in the chemicals industry. As these opportunities are taken up, the next series of projects appear to be focusing more on energy – either cleaner energy production or cleaner fuels. The small number of energy demand projects in the light of the enormous scope for energy efficiency in South Africa, increasing electricity prices and the significant policy attention being given to this area is surprising although this may indicate a lack of awareness of the CDM or that the lengthy time frames and costs associated to the CDM act as a deterrent to smaller projects with short lead times. The early stage of programmatic CDM projects probably also accounts for the limited number of demand side energy projects.

As might be expected the industrial centres of the country (Gauteng, the Western Province and KwaZulu-Natal) have been at the forefront of developing CDM projects.

This is changing, with the spread of projects in the PIN phase including more projects located in the less industrially developed provinces such as the Eastern Cape, Mpumalanga, North West and Limpopo.

On the basis of reported costs from project owners and developers the average CDM project in the post-PIN phase will cost R2 million to develop. Clearly, significant resources are required to develop projects and a key component of expanding the CDM in South Africa is to find ways of reducing these transaction costs.

CDM projects do lead to new investments and the underlying project activities that were established by CDM projects required an average capital investment of R57 million. In total the CDM has leveraged R1.4 billion of capital investment in cleaner technology in South Africa for projects at an advanced development stage. On the revenue side these projects are expected to, on average, generate R421 million of CDM revenue over their lifetime. Total CDM related revenue from all post-PIN projects is projected to be in the region of R10 billion, with all this revenue being in the form of foreign exchange, representing an important benefit for the country.

Job creation to date, as a result of the CDM, has been disappointing with only 2 projects in the post-PIN phase projecting the creation of jobs in the range between 15 and 25. At the PIN stage, the picture is brighter, with a reported 17,000 jobs scheduled to be created if all the projects are implemented. These figures should, however, be viewed with caution as it is likely that they include over-estimates of actual permanent jobs to be created and it does appear that the employment potential of the CDM is relatively limited given the nature of the projects under consideration in the country.

In addition to job creation there are other benefits that are expected to arise from the post-PIN projects under development. These include the setup and financing of community based trusts by project proponents, aimed at improving community health and welfare, in lieu of direct project benefits.

With respect to environmental impacts, several projects will improve the quality of the groundwater and air in the vicinity of the project which will indirectly improve the health and living standards of the surrounding communities.

There are also several projects both in the post-PIN and PIN stages, where the project itself is aimed at the development of low income communities as opposed to projects where the sustainable development benefit is purely a by-product of the project. It is expected that significant sustainable development benefits will flow from these projects. These include projects for the installation of solar water heaters and insulation in low cost housing developments and the supply of low energy usage cookers.

In conclusion the CDM in South Africa is very much a work in progress and is still far from perfect, suffering from a range of constraints such as high transaction costs, imperfect information and regulatory constraints.

There are also gaps which have been identified in the market relating specifically to the low number of energy efficiency and programmatic CDM projects being developed and the lack of replication of those projects which should be easy to replicate, which seems to confirm constraints in the CDM development process.

Outside of specific project-related and domestic issues there appear to be loud and consistent complaints from project developers about the international regulatory process of the CDM itself. In particular there are concerns about the performance of the Designated Operational Entities (DOE), (further exacerbated by there no longer being a South African DOE) and the high levels of bureaucracy and transaction costs involved in the project development process.

Despite these constraints, the CDM has also demonstrated much success in South Africa, as a GHG reduction mechanism and also as a mechanism to facilitate projects which provide support to important elements of government policy. Further potential exists in the greater use of programmatic CDM (to allow smaller projects to benefit from CDM revenue), fuel switching (South Africa remains a coal intensive energy user), energy efficiency and renewable energy projects.

In the context of the successes, challenges and opportunities presented above, the DNA is in a position to further support the development of the CDM market in South Africa. These areas of support include ensuring better DOE availability and performance, provision of a database of expertise for all potential stakeholders to access, working with the Executive Board to reduce complexity in the registration process and the associated transaction costs, providing support for sector-wide and programmatic CDM, further and continued promotion of the CDM, providing a level of certainty as to the future of the CDM, and, importantly, the integration of the CDM into government programmes.

A revolution in humanity's use of fossil fuel-based energy would be necessary sooner or later to sustain and to extend modern standards of living. It will be required sooner if we are to hold the risks of climate change to acceptable levels. The costs that we bear in making an early adjustment will bring forward, and reduce for future times, the costs of the inevitable eventual adjustment away from fossil fuels.

Garnaut Report on Climate Change

February, 2008

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1 Foreword

Climate change is one of the foremost challenges facing the world in the 21st century and its impact on the Sub-Saharan region and South Africa, in particular, is potentially devastating. In direct response to this threat the Kyoto Protocol was set up by the United Nations Framework Convention on Climate Change (UNFCCC) with its main aim being the setting of binding targets for developed countries so as to reduce the global emissions of greenhouse gasses (GHG). The Kyoto Protocol recognises that through higher levels of industrialised activity, developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere and because of this a heavier burden should be placed on them in finding a solution as opposed to less developed countries with lower levels of industrialised activity.

The Clean Development Mechanism (CDM) is one of the tools created under the Kyoto Protocol and together with other governmental policies, regulation and direct interventions, it forms an important component in combating this climate change challenge. CDM has further economic, social and environmental benefits that will accrue to the country if well executed.As part of the participation criteria for the CDM each host country had to establish a Designated National Authority (DNA), whose primary objectives are to assess whether potential CDM projects assist South Africa in achieving its sustainable development goals and to issue formal host country approval where this is the case. Furthermore, as the custodian of the CDM in South Africa, the DNA has been tasked with creating an environment, conducive to facilitating and growing the development of the CDM in South Africa. This report forms part of this

process as it provides detail on the current status of the CDM and provides a view to the future as more projects in the pipeline are developed.

The pace of CDM project development to date has been slow and only recently are we seeing a significant improvement in the scale of the mechanism with a rapidly growing pipeline of over 1281 projects having been submitted to the DNA. The impact of these projects on our energy intensive country, although relatively small, is still impressive and provides an encouraging view of the future as more projects are developed and reach their full potential.

Some of the highlights identified in this report include, the potential for a saving in excess of 480mtCO_2 if all the emission reductions of the pipeline are taken into account and a capital investment already in excess of R1.4 billion in clean technologies for advanced stage projects. Furthermore individual projects that deserve highlighting for the sustainable benefits that derived from them include the Kuyasa project where solar water heaters, insulated ceilings, and energy efficient lighting have been installed in a low cost housing development and the Rea Vaya bus rapid transit system, which is a project that aims to establish a sustainable mass urban transport system based on a Bus Rapid Transit (BRT) system to ensure high ridership levels.

The report highlights opportunities for further development of projects particularly in the areas of energy efficiency, fuel switching, renewable energy and greater use of programmatic CDM. The report has identified areas where DNA intervention can improve the CDM process, including improving the levels of Designated Operating Authority support, providing certainty as to the future of CDM in South Africa and the integration of the CDM into government programmes.

Ms Nelisiwe Magubane
Director General
Department of Energy

[1] This pipeline includes the additional projects submitted to the DNA, but which were not included in the analysis.

2 Introduction

The Clean Development Mechanism is an important component of the global response to climate change mitigation. It is also a mechanism that has the potential to combine greenhouse gas mitigation with support for sustainable development and increased technology transfer and investment in host countries. The Designated National Authority, South Africa's custodian for the CDM, has commissioned this report to review the development of the CDM in South Africa and to provide insights into the successes and challenges of the CDM in the country.

The timing of this review is particularly pertinent when one consider that in December 2009 world leaders will be meeting in Copenhagen, Denmark, at the United Nations Climate Change Conference to discuss the future of the CDM and to agree on an ambitious and effective worldwide response to climate change for the second commitment period of the Kyoto Protocol.

The development of the CDM market in South Africa has lagged behind some other industrialised developing countries with only 14 projects in the country having been registered against the greater than 1,600 projects registered in the rest of the world. The Designated National Authority has recognised the comparatively slow growth of the CDM in the country and has commissioned this report to both better understand obstacles to the CDM and to demonstrate to project proponents the potential for project development in South Africa and the real successes that have already been achieved.

This report has been laid out in three sections, firstly an overview on the steps taken to combat climate change with specific reference to the CDM at a global level, secondly a general discussion of the investment context related to climate change mitigation and the CDM in South Africa and finally a more detailed review of the CDM in South Africa through the analysis of the CDM projects that have been submitted to the DNA for inclusion in the CDM process.

Section One provides a brief overview of climate change and the Kyoto Protocol broadly detailing how the CDM works, sources of investment finance, a look at greenhouse gases, a view of the CDM post 2012 and an overview of the CDM project life cycle.

Section Two provides general information on South Africa's response to climate change and the development of the CDM process within the country. The report profiles South Africa as an investment destination and provides an overview of the policies, regulations and mitigation incentives that have been put in place to aid the fight against global warming and to assist in growing the CDM.

In **Section Three** an analysis is provided of the CDM market in South Africa with specific reference to the number and type of projects, the volume and types of GHG's reduced, the location of projects, the economic implications of CDM projects and the sustainable development benefits accruing from the projects.

In order to achieve these aims a database has been set up incorporating all the CDM projects that have been submitted to the DNA, whether informally as a Project Information Note (PIN) or formally as a Project Design Document (PDD) as a precursor to entry into the UNFCCC process.

The initial inputs for the database were taken from the documentation submitted to the DNA. Following on from this a questionnaire was developed to complete the gaps remaining from the documentation and to gain some qualitative insights into the CDM process. These questionnaires were e-mailed to project developers and in some instances followed up with telephone conversations.

Site visits were undertaken to most projects that had either been registered or passed the validation stage. These site visits have been written up into the case studies that are included in the report and which provide a project level view of some of the challenges and successes of current CDM project development in South Africa.

Finally the report provides recommendations and insights into the opportunities that are available to take the CDM forward in South Africa so that the market can reach its full potential and meaningfully assist the country in combating the effects of climate change.

3 Combating Climate Change

3.1 Climate Change[2]

During the mid to late 1980's there was growing scientific evidence that human beings were having a significant effect on climate change and that this would have a significant effect on global climate patterns. In response, the United Nations Environment Programme (UNEP) together with the World Meteorological Organisation (WMO) set up the Intergovernmental Panel on Climate Change (IPCC). The first IPCC Assessment Report in 1990 generated sufficient concern to instigate the creation of the United Nations Framework Convention on Climate Change (UNFCCC), which was opened for signature at the Rio Earth Summit in 1992 and came into force in 1994.

The publication of the second IPCC Assessment report in 1995 demonstrated that the actions outlined in the UNFCCC were insufficient and triggered the negotiation of the Kyoto Protocol (the Kyoto Protocol is further discussed in section 3.2), which was finalised in 1997 as a first step towards a more ambitious international response to the global climate change threat.

Although the Kyoto Protocol was a major advance it remains an incomplete international response to the threats posed by climate change. A particular limitation is that the legally binding provisions of the Kyoto Protocol cover less than 40% of the world's GHG emissions, due to the fact that the world's biggest emitter of GHG (the USA) was not a signatory to the Protocol and that the largest projected growth in GHG emissions is from seven countries (China, India, Brazil, Mexico, South Korea, Saudi Arabia and South Africa) that are not legally bound to any reductions of emissions.

The fourth IPCC Assessment Report released in 2007 resulted in a significant increase in public, media and political pressure on the international community to address the global challenge of climate change. The report highlighted that:

- The observed and predicted future trends of a climate change were unequivocal and almost certainly caused by human activity;
- The impacts and risks of climate change are more severe than previously thought;

- Existing technology, together with new developments in the pipeline, can solve the problem at a cost that is affordable (between 1% and 3% of global GDP by 2100).

In 2007 a new round of negotiations to strengthen the climate regime after 2012 was launched. A key step in these negotiations is the conference of the parties to the UNFCCC meeting in Copenhagen in 2009. The conference is expected to provide the basis for a continuation and expansion of the global response to climate change. Two outcomes in particular are expected. The first is continued and deepened quantified emission reductions by developed countries, including bringing the USA into the Protocol. The second expected outcome is to set a framework for mitigation actions by developing countries supported and enabled by technology, finance and capacity-building, in a way which must be measurable, reportable and verifiable.

3.2 The Kyoto Protocol: The Development of a Carbon Market

The Kyoto Protocol, which was set up by the United Nations Framework Convention on Climate Change (UNFCCC) has as its main aim the setting of binding targets for industrialised countries so as to reduce the global emissions of GHG. The reductions amount to an average of five per cent against 1990 levels of GHG emissions, over the five-year period 2008-2012.

The Kyoto Protocol recognised that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, as opposed to less developed countries where there has been significantly less industrial activity. Under this principal of "common but differentiated responsibilities" a heavier burden has been placed on developed nations.

Under the Kyoto Protocol three mechanisms were developed to assist developed countries in meeting their GHG emissions targets:

- A system for countries to trade their allowed emissions on a recognised international market;

[2] Edited extracts from The National Climate Change Response Policy Discussion Document For The 2009 National Climate Change Response Policy Development Summit, 3-6 March 2009

- The Joint Implementation of emission reduction projects between developed countries;
- The Clean Development Mechanism (CDM) to encourage joint projects between developed and developing countries with the dual aims of reducing emissions and contributing to sustainable development in developing countries.

These mechanisms together give countries and private sector companies the opportunity to reduce emissions anywhere in the world and to count these reductions towards their own targets. The Kyoto mechanisms, as well as similar carbon trading mechanisms within countries and regions, such as the European Union Emissions Trading Scheme, have led to the creation and dramatic growth of a global carbon market. Despite the turmoil in the financial world, 2008 saw a doubling of the global carbon market, to an estimated value of more than US$126 billion, according to the latest State and Trends of the Carbon Market Report 2009, prepared by the World Bank[3].

3.2.1 How the CDM works

The CDM is a carbon emissions trading mechanism between developed and developing countries. Carbon trading, also called cap and trade, is a mechanism that provides economic incentives for reducing the level of GHG emitted into the atmosphere. Under the Kyoto Protocol signatories agreed on limits or caps on the amount of GHG that could be emitted by individual developed countries. Countries are issued credits which represent their right to emit a specific amount of GHG in a given period of time. The levels of credits issued to a specific country are based on a predetermined baseline and the total amounts of credits issued to entities in a country are not allowed to exceed the cap for the country itself.

Entities, such as manufacturing firms or energy utilities, that need to exceed their allowance either face penalties or are required to buy credits from other firms that have not exceeded their allowance. In addition to buying allowances within developed countries, the CDM allows these entities to purchase credits from greenhouse gas reduction projects in developing countries. Such projects, and the associated creation of tradable greenhouse gas reduction certificates, are referred to as Clean Development Mechanism projects. The certificates under the CDM are referred to as Certified Emission Reductions (CERs) and each represents one ton of CO_2 reduced.

The International Panel on Climate Change has identified six key greenhouse gases (GHGs) which are emitted into the atmosphere by human activities. Each of these GHGs has a different heat trapping property, with CO_2 trapping the least heat. To compare them they are indexed according to their Global Warming Potential (GWP). The symbol most often used is $mtCO_2e$ or million metric tons of carbon dioxide equivalents.

[3] *World Bank: State and Trends of the Carbon Market*, May 2009

Symbol	Name	tCO_2e	Most Common Sources
CO_2	Carbon Dioxide	1	Burning of fossil fuels (oil, coal, gas), forest clearing, cement production
CH_4	Methane	21	Landfills, production and distribution of natural gas & petroleum, fermentation from the digestive system of livestock, rice cultivation, burning of fossil fuels
N_2O	Nitrous Oxide	310	Burning of fossil fuels production of fertilisers, nylon production, manure
HFC's	Hydrofluorocarbons	140 – 11,400	Refrigeration gases, aluminium smelting, semi-conductor manufacturing
PFC's	Perfluorocarbons	6,500 – 9,200	Aluminium production, semiconductor industry
SF_6	Sulfur Hexaflouride	23900	Electrical transmissions & distribution systems, magnesium production

Figure 1: Greenhouse Gases

A CDM project can reduce any of these gases which are then converted to their equivalent CO_2 value. The table above highlights the most common sources of the various gases and shows their relationship in terms of tCO_2e.

The two main criteria that CDM projects must meet are additionality and sustainable development:

Additionality

The additionality criterion of the CDM requires that the project will result in emission reductions that are additional to those that would have occurred in the ordinary course of business. The additionality argument can be based on a variety of criteria including financial and environmental and are an important part of the CDM project registration process.

Sustainable Development

In addition to demonstrating that the project is additional, CDM projects need to demonstrate that they support sustainable development objectives of the host country. There are no international rules for what qualifies as sustainable development and these are left up to the sovereign decision of the host country. South Africa has developed its own framework for such an evaluation which is elaborated on below.

In general most countries, as in South Africa, view sustainable development along three dimensions:

- **Social criteria**. Whether the project improves the quality of life, alleviates poverty, and improves equity;
- **Economic criteria.** Whether the project provides financial returns to local entities, results in positive impact on balance of payments, and transfers new technology;
- **Environmental criteria.** Whether the project reduces GHG emissions and the use of fossil fuels, conserves local resources, reduces pressure on the local environments, provides health and other environmental benefits, and meets energy and environmental policies.

The CDM is a growing international financial mechanism. By 2008 the value of transactions from CDM projects in developing countries was worth US$6.5 billion[4] with an average price of US$ 16.8 per tCO_2e. The growth in the market has not been linear and the market size in 2008 was lower than the previous year. In 2008 about 389 million tCO_2e's were transacted on the primary market, which was 30% lower than the 2007 volumes. According to the World Bank the market decline was probably due to regulatory delays in registration and issuance as well as the international financial crisis which made project financing extremely difficult to obtain. In addition, the market was probably constrained by uncertainty about the continuation of the CDM following the end of the first commitment period of the Kyoto Protocol at the end of 2012.

In contrast to the slowdown in 2008 of the primary market, the secondary market for Certified Emission Reductions (CER) continued to grow exponentially, with more than one billion CERs transferred during the year with an estimated value of US$26.3 billion. This was more than a 350% increase in both volumes and values over the previous year and demonstrates that the carbon market is maturing rapidly towards a liquid 'commodity' market. Further evidence of this is that a market for options on CERs started to emerge in the second half of 2008, with hedging, profit-taking, raising cash and arbitrage as the main drivers of this market segment.

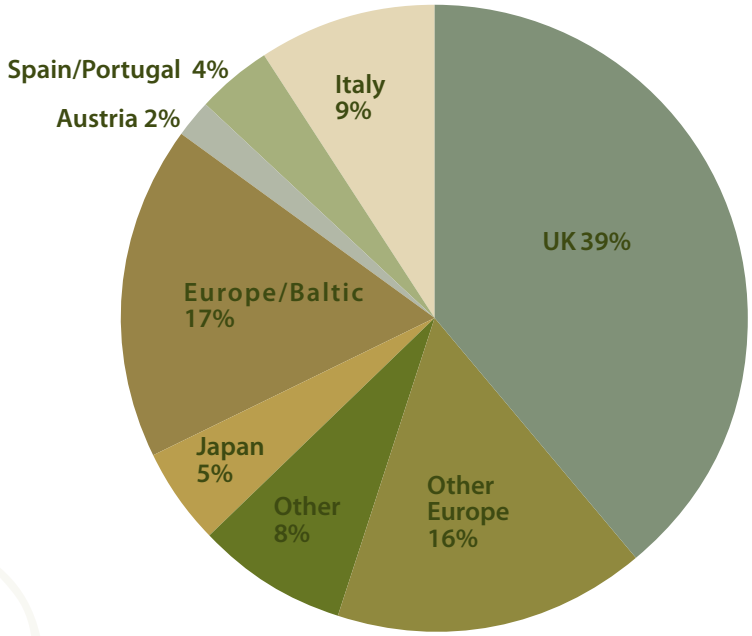
All CDM projects must go through a "project cycle". Although many of these steps are the same as for any other investment project there are some steps that are unique to the CDM process. The detailed steps in the project cycle can be viewed at http://www.dme.gov.za/dna/dna_image3.stm.

Buyers of Carbon

European buyers dominate the CDM market for compliance purposes with a combined market share of over 80%. Private sector companies have been the most active buyers, responsible for about 90% of volumes contracted. The market share of European governments remained stable at about 10% of volumes transacted from 2007 to 2008.

Financial institutions and investors are also important in the market. They made up a greater proportion of the market in 2007 but have gradually returned to the primary market in late 2008, although at a much lower level than before the financial meltdown.

[4] *World Bank: State and Trends of the Carbon Market*, May 2009



Graph 1: Primary CDM buyers
(Source: World Bank: State and Trends of the Carbon Market 2009)

3.2.2 Sources of Finance and Investment Leverage

CDM projects require upfront investments to fund the development of the physical project as well as the CDM component. There are a variety of different sources from which this funding can be obtained including loan funding, equity, grants and upfront payment for future carbon emission reductions[5]:

- Loan or debt finance refers to funds lent to CDM project owners by financiers. This finance can be obtained through public markets (bonds) or private placements (bank loans and institutional debt);
- Equity refers to funds received from company shareholders. Equity may be sourced from internal sources (current shareholders) or external investors through private or public placements;
- Grants are obtained from institutions and governments where the development of the CDM project contributes to the donors' objectives;
- Upfront payment for CER purchases. Carbon buyers may through their purchase agreements provide upfront payment for a portion of the CERs to be generated by the project. To compensate for increased risk, upfront payments are generally discounted.

The existence of CERs is important to stakeholders as it improves the overall profitability of the project and where upfront payments are received it may reduce debt and equity requirements.

[5] "The Clean Development Mechanism: A Guide For Potential Participants" In *South Africa September 2002 - Future Energy Solutions*

Sales of CERs represent significant inflows to developing countries. As, or more important, however, are the associated underlying capital investments that are typically undertaken for the project. CDM projects therefore effectively leverage significant amounts of investment, from both domestic and foreign sources, in greenhouse gas reducing projects in developing countries. These investments have attendant benefits of technology transfer, skills development and employment creation.

3.2.3 The CDM after 2012

The first commitment period of the Kyoto Protocol ends at the end of 2012. There remains some uncertainty about the level of reduction commitments that developed countries will agree to for the next commitment period. There is also not final agreement that the CDM will be retained as a carbon trading mechanism for the second commitment period. Both these factors introduce uncertainty around the CDM which has affected the pace and nature of project development.

There are however, strong indications of a viable carbon market after 2012 and the continued existence of the CDM. These signals include statements by the European Union that they will unilaterally retain certain GHG reduction commitments until 2020 at least. They have also indicated that they will retain the use of the CDM for compliance purposes. There are also good policy signals that the developed world is committed to continued binding reduction commitments. Recent statements by the G8 group of developed countries, as well as the passing of internal carbon reduction and emissions trading legislation in the USA lend further support to a post-2012 CDM market. There are also a number of financial institutions and utilities in the European Union who are willing to purchase CERs generated from 2013 onwards, demonstrating the real belief by these large institutions that the market will continue.

Probably more important than whether the CDM will continue is in what form. A number of bureaucratic and other concerns have been identified during the implementation of projects during the first commitment period. It is hoped that these will be considered and addressed to streamline and improve the efficiency of the project development process.

It is also expected that the second commitment period will see an expansion of projects that include broad sector-wide actions, such as changes in national transport or housing delivery practices. Such projects could draw on existing procedures in the CDM which allow the integration of many dispersed activities into a single project, so-called Programmatic CDM. It is also possible that more extensive revisions to the mechanism could allow sectoral projects, based on policy changes or incentives, that may allow developing countries to receive credits, and hence financial support, for broad greenhouse gas reducing policies or programmes. ■

4 Investment Context

4.1 South Africa as an Investment Destination[6]

South Africa is one of the most sophisticated and promising emerging markets in the world. The unique combination of a well-developed first-world economic infrastructure, and a rapidly emerging market economy, has given rise to an entrepreneurial and dynamic investment environment with many global competitive advantages and opportunities.

South Africa is home to 6% of Africa's population, and accounts for approximately 25% of the continent's Gross Domestic Product (GDP). It also boasts 45% of Africa's mineral production, and 50% of the continent's purchasing power.

South Africa's financial systems are robust and well regulated with seventy-seven banks operating in the country. Global confidence in South Africa's banks is further evidenced by the World Economic Forum's Global Competitiveness Report 2008/09 which ranked the country's banks as the 15th most secure, out of 134 countries reviewed. In addition, the Johannesburg Securities Exchange Ltd. (JSE) rates among the top 20 stock exchanges in the world by market capitalisation.

South Africa boasts the most modern and extensive infrastructure in Africa with a road network in excess of 750,000 km's, an extensive rail network and the largest port authority in Southern Africa. More than 50 airlines move through South Africa's 10 principal airports. The South African telecommunications market is the largest in Africa, both in terms of customers and revenues. South Africa is also the largest internet market in Africa, with estimated 3.5m internet users, resulting in a penetration rate of approximately 8%.

A number of industrial support measures have been implemented to enhance the competitiveness of South Africa's industrial base. These include placing more emphasis on supply-side measures than those on the demand-side, such as tariffs and expensive export support programmes. To this end, government has set in place incentives for value-added manufacturing projects, support for industrial innovation, improved

[6] Extracts from http://www.thedti.gov.za/investing/whyinvestinsa.htm

access to finance, the creation of an enabling environment for SMME development, Industrial Development Zones (IDZs), and competition and consumer protection measures.

The costs of doing business in South Africa compare favourably to other emerging world markets. The Economist Intelligence Unit has rated South Africa as highly cost effective. The country boasts labour costs significantly lower than those of other key emerging markets and a favourable corporate tax rate.

South Africa possesses a large resource base of skilled, semi-skilled and unskilled labour. The South African government has introduced wide-ranging legislation to promote training and skills development and to fast-track the building of world-class skill and competence.

4.2 South Africa's Response to Climate Change [7]

South Africa has recognised that there has been a significant impact on climate change due to the development pathways taken by industrialised countries in the past. At the same time, South Africa acknowledges that the solution to the climate change crisis requires concerted action on a global scale and that all countries, including developing countries, share responsibility for the future.

In this context, South Africa has committed itself to working towards the achievement of a global agreement on climate change that ensures a balance between climate action and sustainable development, prioritises both adaptation and mitigation and that has high levels of ambition in order to avoid dangerous and irreversible climate change.

Government is committed to ensuring on-going and increased support for new and ambitious research and development initiatives in the field of carbon-friendly technologies – with the focus on the renewable energy and transport sectors. To this end the Department of Science and Technology (DST) has produced a Climate Change Research and Development Strategy and has also completed a Climate

[7] Department of Environmental Affairs and Tourism, 2009: South African Discussion Document for the 2009 National Climate Change Response Policy, DEAT, Pretoria.

Change Technology Needs Assessment that has been submitted to the UNFCCC and that provides a high level assessment of technology transfer requirements in relation to both mitigation and adaptation.

In an attempt to shift South Africa's economy away from its energy-intensive structure, energy efficiency and a cleaner fuel mix are significant short-term mitigation actions. However, in the long run, the challenge is to structurally change the energy-intensity of the economy. Industrial policy needs to be rewritten to favour those sectors that used less energy per unit of economic output. South Africa's GDP has already shifted significantly from mining through manufacturing to services. Associated with this shift is a decrease in energy intensity, yet industrial policy still tends to define competitive advantage around energy-intensive sectors. The proposed measures will tend to create an environment in the country which is supportive of greenhouse gas reducing projects and investment and which will therefore be increasingly conducive to the establishment of CDM projects.

4.3 A Supportive Policy Framework for the CDM in South Africa

The National Environmental Management Act (Act No. 107 of 1998) is the overarching environmental legislation in South Africa. The Act is primarily concerned with the establishment of principles, institutions and procedures for the effective management of South Africa's natural resources and biological diversity. Regulations to the Act that have a direct influence on the CDM in South Africa include the establishment of the Designated National Authority (DNA) for Clean Development Mechanism projects and the revised Environmental Impact Assessment (EIA) Regulations passed in 2006 (Regulation No. 385 of April 2006).

4.3.1 Energy policy and regulation

Many CDM projects will fall within the energy sector or will have some relationship with energy supply or use. The country's energy sector has comprehensive policy and legislation that is increasingly supportive of renewable energy generation and of energy efficiency. The Electricity Regulation Act (Act No. 4 of 2006) provides the basis for the regulation of the electricity supply industry, including the issuing of licenses for generation, transmission and distribution. The stated objects of the Act include:

- Achieving the efficient, effective, sustainable and orderly development and operation of the electricity supply infrastructure in South Africa;
- Promoting the use of diverse energy sources and energy efficiency.

The National Energy Act (Act No. 34 of 2008) gives legislative effect to those aspects of the Energy White Paper that have yet to receive proper regulatory backing, as well as to make legal provision for the maintenance of national energy security. This Act makes reference to the need for the promotion of a diversification of energy supplies, including the development of renewable energy technologies and specific roles in facilitating the development of appropriate measures and incentives.

The National Energy Regulator Act (Act No. 40 of 2004) established the National Energy Regulator of South Africa (NERSA), which has responsibility for overseeing the electricity, piped gas and petroleum industries.

In addition to supply side measures the Energy Efficiency Strategy[8] of the Republic of South Africa consists of three phases (each approximately 3 years in duration) for the period 2005 – 2015 each with their own actions and targets. There are also 4 sector programmes: industry and mining; commerce and public buildings; residential; and transport. The goals of the strategy are to improve national health; job creation; alleviate energy poverty; reduce environmental pollution; reduce CO_2 emissions; improve industrial competitiveness; enhance energy security and reduce the need for additional generation capacity. In achieving these goals the strategy will highlight opportunities for renewable energy and energy efficiency interventions with their corresponding opportunities for the development of CDM projects.

Other important initiatives include work being done to set "Green Building" standards, as well as plans to retrofit existing buildings and industrial facilities with energy efficient and clean technologies. The transport sector is yet another key "business unusual" growth sector and policies and measures are being put in place to substantially reduce GHG emissions from this sector. These measures include the various national, provincial and local initiatives around modal shift in passenger transport, the regeneration of the rail network, and the work being done to reduce vehicle emissions.

'Green' Levy on Electricity

Initial provision for the funding of energy research, renewable energy, and to a lesser extent, energy efficiency, was made through a levy on electricity sales announced in the 2008 Budget Speech. The levy, effective from 1 July 2009, amounts to a 2c/kWh charge on the sale of electricity produced from non-renewable sources, with renewable energy and co-generation based power exempt from the tax. The levy is to be collected directly from the electricity generator at source.

As an incentive to promote energy efficiency, it was also indicated in the budget speech that households and industries that are able to reduce their electricity consumption by 10%, would effectively not experience a net increase in their monthly costs, as the extra tax paid would be offset by reduced electricity costs. The levy should, nevertheless, be seen as a sign of things to come, as the National Treasury argue in their 2008 Medium Term Budget Policy Statement (MTBPS[9]): "The electricity levy should be seen as the first step towards the introduction of a more comprehensive emissions based carbon tax". The introduction of a national carbon tax could have a significant impact on certain industries in South Africa, particularly energy and carbon intensive industries and would further stimulate the uptake of greenhouse gas reducing projects eligible for the CDM.

[8] Department of Minerals and Energy, 2005: Energy Efficiency Strategy of the Republic of South Africa, March 2005.

[9] National Treasury, 2008: Medium Term Budget Policy Statement - 2008, National Treasury, Pretoria.

Current South African policy promoting the diversification of energy supply encourages measures such as fuel switching, particularly to cleaner fuels, as well as the renewable energy sector. Supply side measures further extend the policy environment to one that is very conducive to CDM projects, especially to those directed at energy efficiency and electricity use reduction.

4.3.2 Climate Change Mitigation Incentives in South Africa

In addition to the broader trends in the policy environment supporting the CDM there are some specific measures targeted at renewable energy projects, energy efficiency and at supporting CDM projects directly.

Renewable Energy Feed-in Tariff (2009)

At the end of 2007, the National Energy Regulator of South Africa (NERSA) commissioned the development of a Renewable Energy Feed-in Tariff (REFIT) for South Africa, under its authority to regulate electricity tariffs in the country and in support of the government's 10,000 GWh renewable energy target for 2013. The feed-in tariff requires the Renewable Energy Purchasing Agency (REPA) to purchase renewable energy from qualifying generators at predetermined prices, guaranteed for a period of 20 years. The REFIT acts as an incentive to investors by reducing financial risk and providing market certainty. The REFIT which was launched in March 2009 promotes competitiveness between renewable energy and conventional energies.

The REFIT presents further opportunities for CDM as the pricing model does not take CDM into account and therefore any CDM revenue would be in addition to the tariffs being received thereby increasing the financial viability of these projects for potential investors.

The REFIT only applies to power generation from generators connected to the national grid and therefore excludes off-grid power generation. All renewable energy power generators under the REFIT will require a generation licence issued by NERSA. The initial roll-out of the REFIT supports wind, small-scale hydro, landfill gas, and concentrating solar power, with the clear intention of bringing more technologies on-line in the near future. The Regulator has stated that other technologies, such as solar PV, will be reviewed and brought on after six months. Biomass pulp and paper and sugar bagasse were excluded from the initial REFIT, because of the inclusion of these technologies in the Pilot National Cogeneration Programme (PNCP) implemented by Eskom within the same period, although these are also expected to be brought in at a later stage.

Pilot National Cogeneration Programme

The Pilot National Cogeneration Programme (PNCP) is a programme led by NERSA and Eskom with the objective of stimulating the development of cogeneration technologies in South Africa and in so doing contribute towards meeting the need for new generation capacity and promoting the uptake of energy efficiency and environmentally beneficial technologies. All of the projects developed under the PNCP

will be suitable for the development of CDM projects thereby further increasing their attractiveness to investors. As with the REFIT, the PNCP does not preclude investors from registering projects as CDM projects and thereby gaining financial support via the sales of carbon credits.

Renewable Energy Finance and Subsidy Office

The Department of Energy has established the Renewable Energy Finance and Subsidy Office (REFSO), whose mandate includes the management of renewable energy subsidies and the offering of advice to developers and other stakeholders on renewable energy finance and subsidies. REFSO has links with several national and international finance institutions that offer financial assistance to private sector companies that wish to establish renewable energy production capacity. These institutions offer a wide range of products which can support companies who are in the process of developing CDM projects. The REFSO will facilitate interactions with these institutions but cannot guarantee financing from these sources. The REFSO has its own limited funds from the National Treasury for the provision of direct subsidies to project developers. See http://www.dme.gov.za/energy/refso.htm for more information.

Tax incentives

Treasury has recently begun to put budgetary measures in place that encourage both energy conservation as well as dis-incentivise the use of environmentally "unfriendly" energy. In the 2009 budget speech the Minister of Finance announced an adjustment to excise duties on motor vehicles by introducing an additional excise duty that takes account of the amount of carbon emitted by different vehicles; a charge of about R3 a light bulb on incandescent bulbs; and also proposed that investments by companies in energy efficient equipment should qualify for an additional allowance of up to 15%.

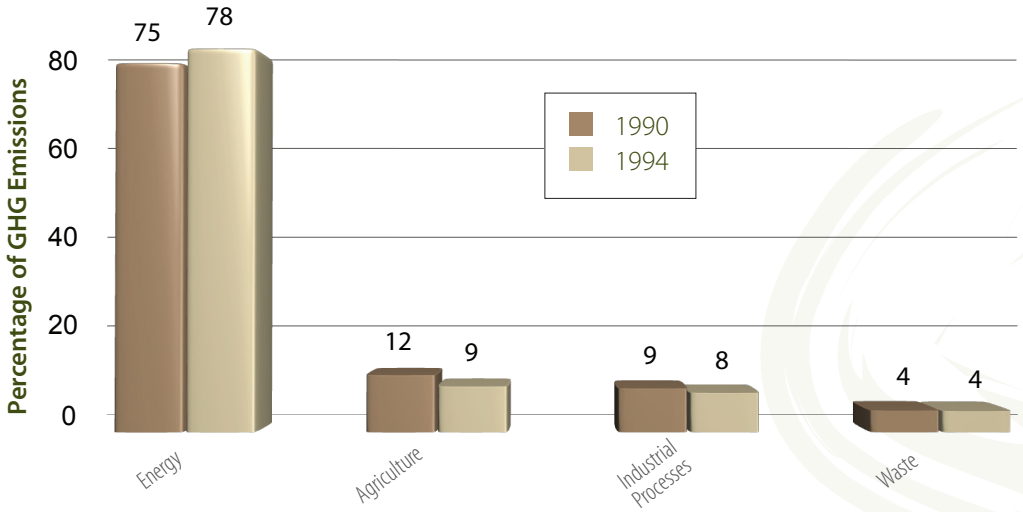
The draft 2009 Taxation Laws Amendment Bills, published for public comment, contains two incentives in support of the environment and the CDM. The main proposal of relevance to the CDM is that the sale of certified emission reductions will be exempt from income tax. This provides a significant additional incentive to the CDM in South Africa.

A secondly proposed tax incentive is that businesses will obtain notional deductions for income tax purposes for energy efficiency savings from certified baselines based on energy efficiency certificates issued by the National Energy Efficiency Agency.

All of the measures mentioned above will have an impact on the CDM as they either incentivise energy conservation, energy efficiency and the use of environmentally friendly energy or penalise inefficient energy practices and the use of environmentally unfriendly energy. In effect, these measures are the beginnings of the pricing of carbon within the South African economy and will act as further stimulus for CDM as entities search for projects that either maximise the incentives on offer or minimise the penalties that may be charged.

4.3.3 Greenhouse Gas Mitigation Potential in South Africa

A national GHG inventory for the base year 2000 is currently being prepared for South Africa. Pending the conclusion of this work, the most recent official national inventory was prepared for the country's national communication to the UNFCCC for the years 1990 and 1994. The total GHG emissions for 1990 were 347.3 $mtCO_2e$ and 379.8 $mtCO_2e$ for 1994. The total emissions for each sector, calculated as $mtCO_2e$, show that the energy sector contributed 75% of the total emissions in 1990, and 78% in 1994; agriculture contributed 11.6% of the total emissions in 1990, and 9.3% in 1994; industrial processes contributed 8.9% in 1990, and 8.0% in 1994; and, waste contributed 4.4% in 1990, and 4.3% to the total emissions in 1994 (See the figure below)[10].



GHG Emissions by Major Sector (1990 & 1994)

These emissions make South Africa the 19th largest emitter of GHGs in the world, and the 8th largest developing country. The country is also very energy intensive and energy inefficient due to its historically cheap electricity supply from abundant coal. The coal-based power generation gives South Africa the 13th most carbon intensive energy generation sector globally and the 15th most energy intensive economy in the world[11].

The converse of this carbon intensity is that there is significant potential for GHG mitigation in the economy and hence many opportunities for CDM project development. A number of studies are available that highlight these opportunities for potential CDM investors including the National Strategy Study on the CDM

[10] World Bank, 2001: South African National Strategy Study on the Clean Development Mechanism, Final Report, prepared by Goldblatt *et al* for the South African Department of Environmental Affairs and Tourism & The World Bank.

[11] All comparative figures are from the Climate Analysis Indicators Tool (CAIT) of the World Resources Institute, as of August 2009. See http://cait.wri.org/cait.php.

(World Bank, 2001), the CDM Investor Guide to South Africa (UNIDO, 2003)[12], and The CDM Guidebook (EDRC, 2002)[13]. These studies have identified a range of mitigation opportunities that could be eligible for the CDM. These include large scale power generation options, such as moves to cleaner coal options, the significant introduction of renewable energy generation from such sources as wind, hydro or solar, and switching from coal to natural gas. At the other end of the chain opportunities identified include distributed demand side options such as solar water heating and other residential energy efficiency interventions at the household scale. Other options identified in these studies include:

- In the land-use and agriculture sector, enhanced livestock productivity through herd optimisation and improved feed; reduced burning of agricultural residues; better manure management, reduced fire frequency and afforestation;
- The high dependency on private cars and minibus taxis for public transport mean that in the transport sector, emissions could be reduced by introduction or more public transport such as Bus Rapid Transport options, switching to buses using alternative fuels (such as compressed natural gas), promoting better transport infrastructure and techniques to improve emission control and fuel efficiency;
- Industrial and mining sector mitigation options such as converting industrial boilers from heavy fuel oils or diesel to biomass from forestry waste and biogas, industrial scale energy efficiency projects such as energy and materials savings, co-generation, energy cascading and steam recovery, and use of more-efficient motors and other electrical devices; further recycling of materials; and using fuels with a lower carbon content, such as switching to gas from coal;
- Coal mining GHG reduction projects such as higher extraction ratios underground and ash filling, extraction of remnant pillars and the removal of emitted methane;
- Residential and commercial demand side options such as the replacement of incandescent lights with compact fluorescent lights, more efficient wood/coal stoves, solar water heaters, more thermally efficient buildings, and the conversion to gas as an energy source.

The list above is far from comprehensive but it sufficient to demonstrate that many GHG reduction project opportunities exist throughout the economy from the household scale all the way to massive power generation projects. There is significant background research on these opportunities and therefore a range of potential CDM project opportunities available to be developed.

[12] United Nations Industrial Development Organisation, 2003: The CDM Investor Guide to South Africa, UNIDO.

[13] *Energy for Development Research Centre, 2002: The Clean Development Mechanism of the Kyoto Protocol – A Guidebook for Project Developers in Southern Africa*, edited by R. Spalding Fecher, Elan Press, 2002.

4.4 The Designated National Authority

To allow the operation of the CDM in South Africa, the South African government was required to set up a Designated National Authority (DNA). The DNA's main role is to regulate CDM Activities according to the United Nations Framework Convention on Climate Change and Kyoto Protocol requirements and to promote CDM activities in South Africa.

The DNA was established by the Minister of Environmental Affairs and Tourism in 2004 in accordance with Section 25 of the National Environmental Management Act. The DNA has been hosted by the Department of Minerals and Energy since its inception.

The primary role of the DNA is to evaluate potential CDM projects based on the degree to which the projects contribute towards sustainable development. If projects meet the DNA's criteria, and are also in compliance with the required domestic legislation and CDM rules and procedures, then the DNA will issue projects with a Letter of Approval. The Letter of Approval is required before the project can be registered as a CDM project with the Executive Board of the CDM.

In addition to this regulatory function the DNA also supports the development of the CDM in South Africa. The DNA is available to provide assistance to project developers and/or project owners on such issues as navigating regulatory requirements, providing contact details in government and so forth. The DNA also helps in promoting the CDM in South Africa by demonstrating the attractiveness of South Africa as an investment location for CDM projects.

4.4.1 DNA Project Approval Procedures

The DNA has established a formal project approval procedure for the CDM. The procedure provides a structured process for discussion between the project developer and the DNA and commits the DNA to specific time-frames for making decisions. The procedure also introduces transparency into the CDM approval process, as the core documentation of all CDM projects requesting a Letter of Approval is made available on the DNA's web-site for a 30 day period.

The project developer or owner has two points of entry into the process:

- **Voluntary screening:** This is done via the submission of a brief Project Identification Note (PIN) and application form to the DNA. This stage is voluntary but 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. When submitting the PIN the project developer can request a letter of no objection or assistance in / comments on the development of the project. This step is not binding on the DNA or the project developer. The project developer can revise the project design and the DNA is not bound to issue a Letter of Approval even if a Letter of No Objection has been provided.

DIRECTORATE
DESIGNATED NATIONAL AUTHORITY (DNA) FOR CDM

PURPOSE:

- To regulate Clean Development Mechanism (CDM) Activities according to United Nations Framework Convention on Climate Change and Kyoto Protocol and
- To promote CDM activities in South Africa

FUNCTION:

1. Regulate and Monitor CDM activities in South Africa
2. Promote and Build capacity on CDM activities in South Africa

SUBDIRECTORATE
PROJECT EVALUATION & MONITORING

PURPOSE:

To review and monitor CDM activities in South Africa

FUNCTIONS:

1. Approve project eligibility for CDM under the auspices of the National CDM DNA Steering Committee.
2. Provide an administrative support function for the National CDM DNA Steering Committee.
3. Develop and maintain processes, guidelines and criteria for the DNA project evaluation and monitoring functions.
4. Provide assistance to CDM project developers, Designated Operational Entities and other CDM stakeholders.
5. Provide CDM project development advisory services
6. Ensure effective communication and liaison between relevant stakeholders.
7. Maintain CDM project database/records.

SUBDIRECTORATE
CDM PROMOTION & CAPACITY BUILDING

PURPOSE:

Promote and facilitate development of CDM activities in South Africa

FUNCTIONS:

1. Manage and implement CDM capacity building and awareness raising activities.
2. Provide an administrative support function to CDM Promotions Committee.
3. Conduct research on CDM trends and developments.
4. Ensure effective communication and liaison between relevant stakeholders.
5. Maintain CDM databases.
6. Provide CDM information repository
7. Participate in CDM forums and negotiations
8. Develop CDM information material

Figure 3: Functional Structure of the DNA

SA CDM Timeline

1997	2002	2004		2005	2008		2009
SA Joins UNFCCC – 08/07	SA signs Kyoto Protocol – 31/07/02	DNA established [16]	1st SA CDM PIN – Kuyasa	1st SA Project registered with EB – Kuyasa	1st Programmatic Project in validation – New Energies Commercial Solar Water Heating submitted 15 April	1st Credits issued – Lawley Fuel Switch issuance mid 2008	Currently 14 Registered projects

- **Mandatory submission**: All projects will require the submission of a more detailed description of the project via a Project Design Document and application form to receive a Letter of Approval from the DNA. If the project is approved the developer will be given a formal Letter of Approval signed by the Director General of the Department of Energy. This will allow the project to be submitted for registration at the CDM Executive Board.

Details of the project approval procedure can be viewed at:
http://www.dme.gov.za/dna/dna_approvalprocess.stm

4.4.2 Sustainable Development Evaluation of Projects

In accordance with the procedures for the CDM agreed at Marrakech in 2001 participants in CDM projects will have to provide "written approval of the voluntary participation from the DNA of each party involved, including confirmation by the host party that the project activity assists it in achieving sustainable development" . The DNA is responsible for putting this procedure in place and for assessing whether the project assists the country in achieving sustainable development.

Sustainable development is defined in the National Environmental Management Act (NEMA) as "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" (see box on next page for details).

This definition is in line with the international viewpoint that sustainable development encompasses three dimensions, being the economic, social and environmental dimensions. Within these dimensions the South African DNA has identified a series of questions against which the CDM project's commitment to sustainable development is measured, as follows:

- **Economic**: How does the project contribute to national economic development?
- **Social**: How does the project contribute to social development in South Africa?
- **Environmental**: Does the project conform to the National Environmental Management Act principles of sustainable development?

National Environmental Management Act principles of sustainable development

The National Environmental Management Act established a number of principles of sustainable development. These principles are used by the DNA in evaluating the environmental dimension of sustainable development. The NEMA principles are:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be avoided, are minimised and remedied;
- That pollution and degradation of the environment are avoided, or where they cannot be altogether avoided, are minimised and remedied;
- That the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided are minimised and remedied;
- That waste is avoided, or where it cannot be altogether avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner;
- That the use and exploitation of non-renewable resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
- That the development, use and exploitation of renewable resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
- That a risk averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions;
- That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.

The DNA has established a set of sustainable development criteria and indicators that assists in ensuring that consistent and evidence based decisions are made on whether projects can be deemed to be supporting sustainable development in South Africa or not. These criteria can be viewed at http://www.dme.gov.za/dna/dna_susdev.stm. ■

5 A Review of the CDM in South Africa

In reviewing the status of the CDM in South Africa an analysis has been undertaken on all the projects that have been submitted to the DNA with specific reference to the number and type of projects, the volume of GHGs and specific gases that are being reduced, sectoral splits of projects, location of projects, economic and investment implications of CDM projects and the sustainable development benefits accruing from the projects.

5.1 Approach to analysis of the CDM in South Africa

The data and analysis in the following sections is based on the consolidated project database which provides the first quantitative review of the CDM market in South Africa. It should be noted that although every project that had been brought to the attention of the DNA at the time of the survey has been included in the database it cannot be seen as completely comprehensive. This is because there are certainly CDM projects in development or under consideration in the country that have not yet been brought to the DNA as either early stage PINs or late stage PDDs for formal approval[14]. The scale of the CDM pipeline presented therefore should be seen as a minimum level of project activity which is likely to be exceeded in reality.

The information has been provided at a relatively consolidated level and reference to individual projects has been avoided, except where express permission has been gained from the project developer. This is to protect the confidentially of project proponents as outlined in the DNA's approval procedures.

Terms used in this Section

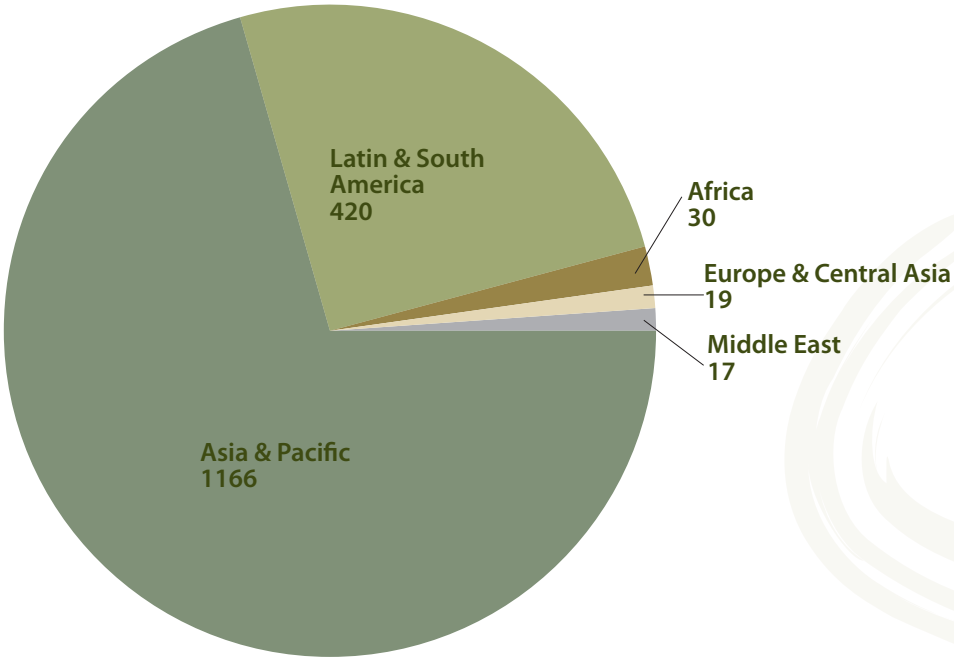
The analysis in the following section is based on the following division of project activities:

- **Project Idea Note (PIN)** – this refers to the first stage of a CDM project where the project is being conceptualised. The submission of a PIN to the DNA is voluntary and some projects will skip this step and interact with the DNA for the first time when submitting a Project Design Document.
- **Project Design Document (PDD)** – this document is part of the formal process for the registration of a CDM project and must be submitted to the DNA for approval. The document provides detail as to the project that is being developed.
- **Post-PIN** – Although this is not formal CDM terminology we have included it to refer to all projects that have formally entered, or are about to enter, into the CDM process (i.e. after the PIN phase) and encompass the following phases in the CDM process: validation, verification, approval of PDD, registration and issuance of credits.

[14] In addition, the DNA received additional PINs during the course of the survey which could not be included in the quantitative analysis.

5.2 Number of Projects

Africa and South Africa have lagged in the CDM process internationally as of the 1,652[15] projects that have been registered globally only 30 originate in Africa. Of the total registered projects worldwide, 71% originate in the Asia and Pacific region and 25% in Latin & South America. China (568), India (428) and Brazil (158) are the countries with the most registered projects.

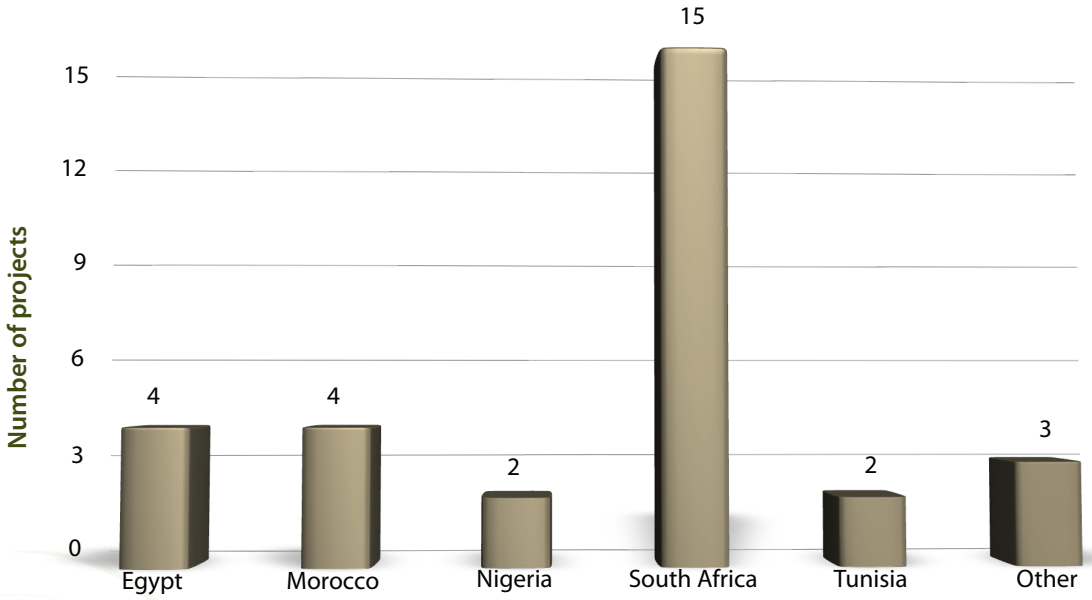


Graph 1: Number of Worldwide Registered CDM Projects [16]
(Source: CDM Pipeline Overview 1 June 2009)

Within Africa, South Africa accounts for half of the registered projects followed by Egypt and Morocco with four each. The Egyptian projects are each of a different type being landfill gas, wind power, energy efficiency and Nitrous Oxide reduction. There are a further three Egyptian wind power projects at the validation stage. Of the four Moroccan projects two are wind power, one solar power and one landfill gas.

[15] Capacity Development for the Clean Development Mechanism – CDM Pipeline Overview, 1 June 2009

[16] The 15 South African projects includes one inactive project that has not been included in the remainder of the analysis in this report



Graph 2: Number of Registered CDM Projects in Africa – per Country
(Source: CDM Pipeline Overview 1 June 2009)

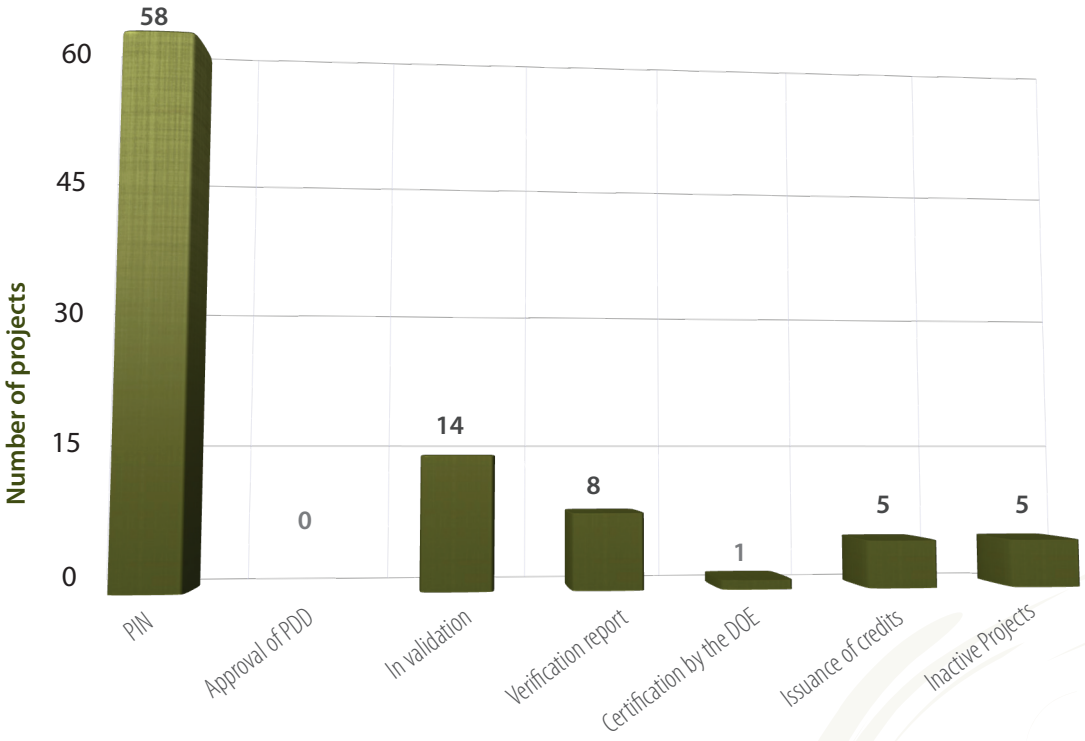
5.2.1 South African Project Pipeline

There are currently 15 South Africa CDM projects registered by the Executive Board. This includes one project that, although registered, is now inactive. There are another 14 projects that are at an advanced stage of development, either in the CDM validation process or about to enter this process.

Despite the relatively small number of registered projects, there is a rapidly growing project pipeline in South Africa. Overall, 91 projects that had been submitted to the DNA have been included in the analysis[18]. Of these projects 58 are in the in Project Idea Note (PIN) phase and 28 are in the post-PIN phase. As noted, there are additional projects in development in the country that have either not been formally brought to the attention of the DNA or the DNA has been requested by the project developers to not release any information about the projects for confidentiality purposes. These two issues will, for obvious reasons, increase the true size of the project pipeline.

The graph shows that in addition to the 14 active registered projects there are an additional 14 projects (post-PIN project) that are in validation and have formally entered into the CDM approval process.

[17]The DNA has been informed by the project proponents that five of these are no longer active and have therefore not been included in the analysis below. In addition, as mentioned above, the DNA has received 37 additional projects during the course of this analysis which could not be included. These will be added to the DNA's database and will be included in subsequent updates of the information in this report.



***Graph 3:** Number of Projects per CDM Project Development Phase*

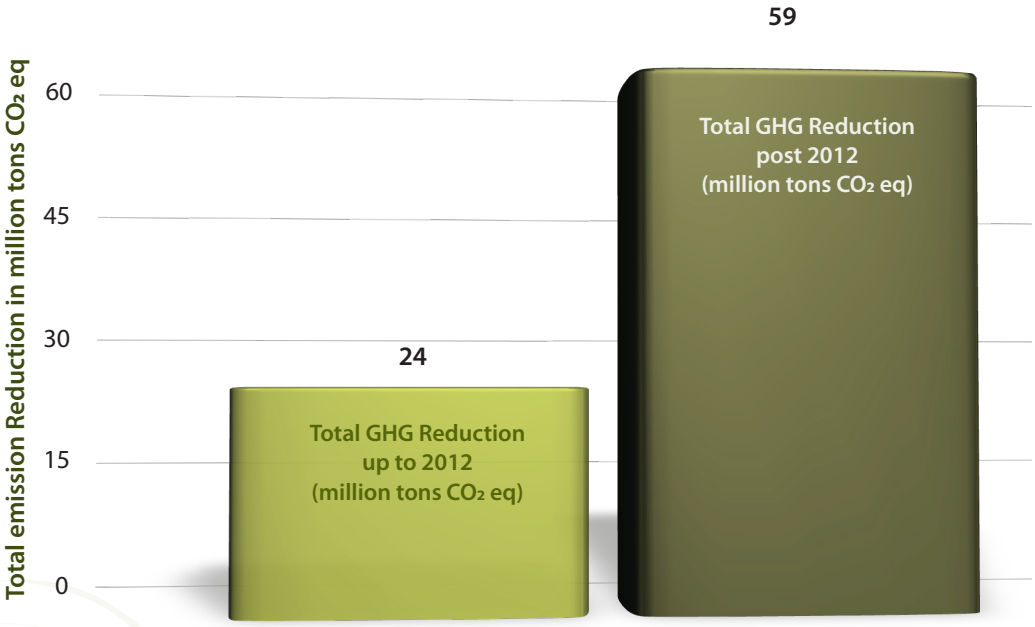
5.3 Emission Reductions from the CDM in South Africa

From all the South African projects that have passed the PIN phase it is projected that there will be at a total saving of 82.8 $mtCO_2e$ over the total crediting periods of the projects, of this 24.3 $mtCO_2e$ are expected to be saved pre-2012. These projects will on average save approximately 5.1$mtCO_2e$ per year.

Total annual greenhouse gas emissions in South Africa were about 447 $mtCO_2e$ in 2000[18] (although they are almost certain to have increased since then). The reductions due to the CDM therefore account for about 1% of the total emissions from the country. If the potential emission reductions from the full project pipeline is taken into account, the contribution to emissions reduction is in excess of 480$mtCO_2e$, which is roughly equivalent to one year of South Africa's total greenhouse gas emissions.

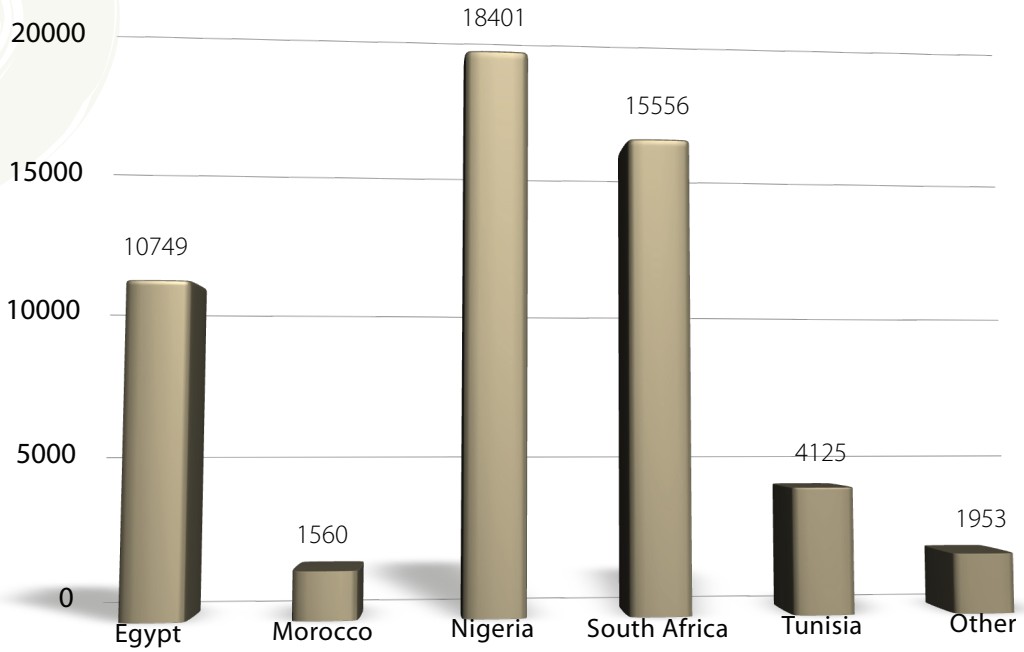
On the negative side, the small percentage contribution to national emission reductions from advanced stage CDM projects shows that the CDM has not yet led to a substantial change in the country's emissions profile. On the positive side, however, is the implication that there are still significant emission reductions that can be made in the economy and that can be supported by carbon finance from the CDM.

[18] DEAT, 2009: The National Climate Change Response Policy, Discussion Document for the 2009 National Climate Change Response Policy development Summit.



Graph 4: Total CO_2 Emission Reductions for All Post-PIN Phase Projects

When South Africa's total emission reductions are compared against the region it can be seen that, despite having the largest number of projects of any African country, South Africa lies second, behind Nigeria, in emissions reduced. This is due to the fact that although Nigeria only has two registered projects both these projects are very large oil field gas flaring projects.

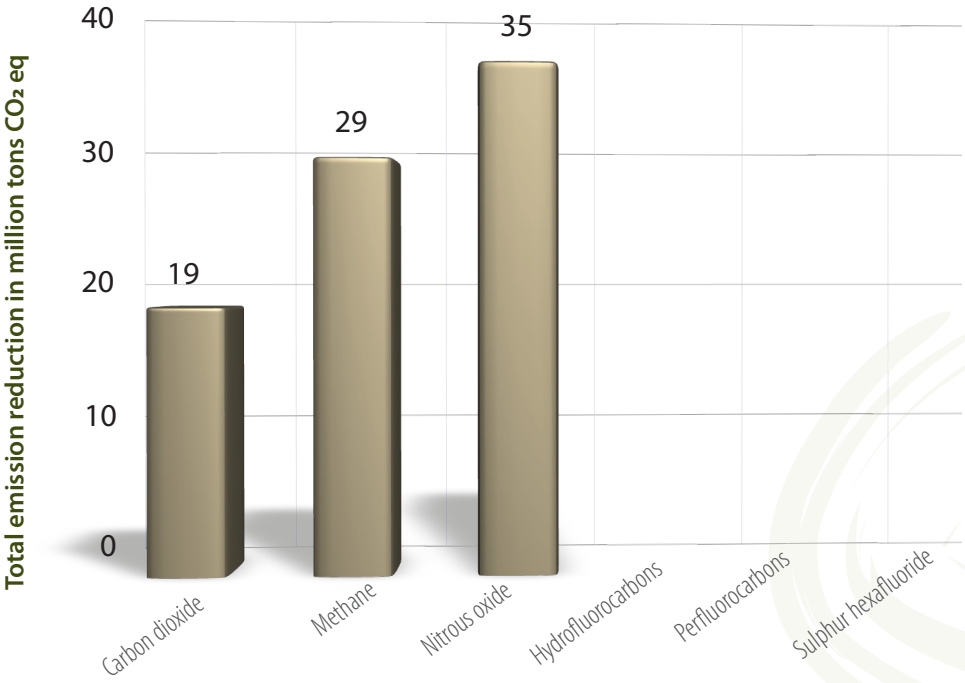


Graph 5: Volume of 2012 CER's for CDM Projects in Africa – per Country

Source: CDM Pipeline Overview 1 June 2009

5.3.1 Which greenhouse gases are being reduced

An analysis of projects at the advanced development stage shows that the primary gas with the largest emission savings from CDM projects is nitrous oxide (35.4 $mtCO_2e$) followed by methane (28.8 $mtCO_2e$) and carbon dioxide (18.5 $mtCO_2e$). A breakdown of emission reductions by type of gas is shown below:



Graph 6: Total Emission Reductions per GHG for CDM Projects in the Post-PIN Phase – Over Project Lifetime

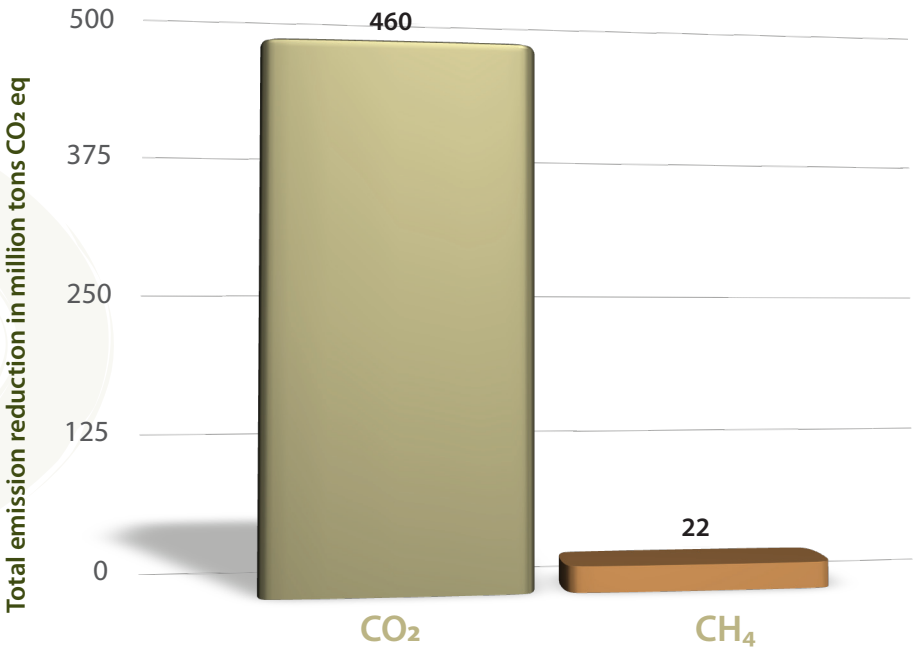
The high levels of nitrous oxide (N_2O) are from four projects all from large industrial concerns who have installed catalytic converters for the decomposition of nitrous oxide. Nitrous oxide has a global warming potential 310 times that of carbon dioxide and therefore N_2O projects typically produce large amounts of emission reductions in CO_2 equivalents. It does not appear that there are any further N_2O projects under development – probably because there are no further industrial processes in the country amenable to this type of project.

The second largest set of reductions are from methane projects. There are a variety of such projects under development – these are predominantly from landfill gas projects, but also include the recovery of biomass waste for use as a fuel source and the flaring of methane from livestock waste products. Again, the high global warming potential of methane, 21 times that of carbon dioxide, means that these projects are attractive to developers since large volumes of emission reductions can be made. Methane

projects are also attractive since they offer the opportunity to use the methane, which is an energy-rich gas, for productive energy use purposes. These can include electricity generation at a small scale or direct use of the gas for heating.

Fourteen projects have carbon dioxide as the primary greenhouse gas being emitted. These include a wide variety of projects types including fuel switching, hydro-electric power and the installation of solar water heaters. Any project in South Africa that reduces or displaces electricity use from the grid will be primarily a carbon dioxide reducing project as the South African grid is dominated by coal-fired power production.

When looking at the graph for total GHG emissions from projects in the PIN stage it is evident as mentioned above that there are no longer N_2O projects in the pipeline to be developed and that CO_2 projects dominate with over 96% of all emissions identified from PIN stage projects. This would seem to indicate that the majority of future projects will be either cleaner or renewable energy generation projects, or energy efficiency projects that will look to displace the burning of coal and other fossil fuels to generate electricity or as direct heating sources.

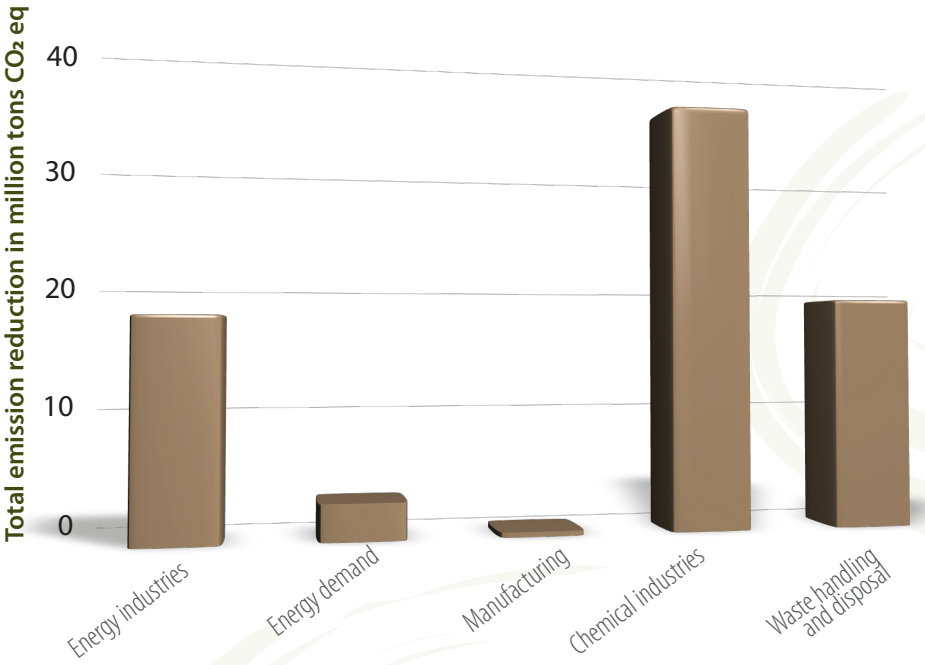


Graph 7: Total Emission Reductions per GHG for CDM Projects in the PIN Phase – Over Project Lifetime

It is interesting to note that there are no hydrofluorocarbon, perfluorocarbon or sulpherhexafluoride projects in South Africa. This is due to the nature of the industries and manufacturing processes that give rise to these gases and the fact that none of these industries are operating in South Africa.

5.4 In which sectors are projects occurring?

Given the UNFCCC categories it is evident that projects can often be categorised in more than one way – for example, an energy efficiency project in a refinery would fall into both the energy demand category and the chemicals sector category. For this reason, projects have been allocated primary and secondary sectors to allow a better picture to be presented of where projects are occurring and what types of projects are occurring. This allocation is relatively subjective due to the varying definitions of economic category in use and therefore the picture presented needs to be seen as indicative.



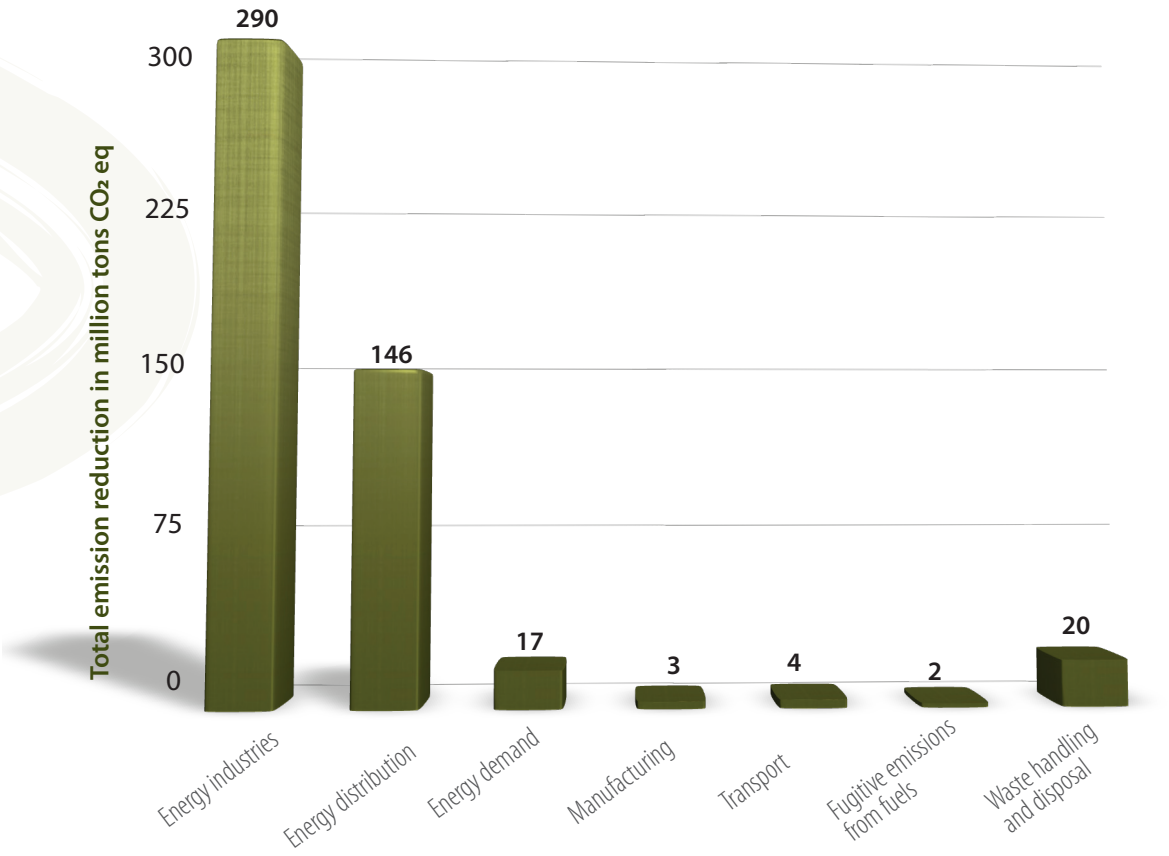
***Graph 8:** Total Emission Reductions per Primary Sector for CDM Projects in the Post-PIN Phase*

Primary sector

For the sectors selected as the primary sector the total expected emission reductions from projects in the post-PIN stage are predominantly from the chemicals sector with 35.4mtCO_2e followed by the energy industries with about 17.9mtCO_2e. This is contrasted with the analysis of total emission reductions for projects that are in the PIN phase where there are no projects with the primary sector being the chemicals sector, whilst projects in the energy industries have total emissions in excess of 290mtCO_2e. When the full project pipeline is considered most CDM opportunities have been identified in the Energy Industries sectors with 29 PIN's and 12 post-PIN projects.

The initial dominance of the chemicals sector probably reflects the weight of the nitrous oxide reduction projects which are essentially process changes in the chemicals industry. As these opportunities are taken up, the next series of projects appear to be focusing more on energy – either cleaner energy production or cleaner fuels. Although the energy distribution sector appears to be important when considered from an expected emission reduction perspective this reflects a single project concerned with energy management through distribution networks and could be considered an energy demand project as well. The project is also at an early stage of development and therefore the projected emissions need to be viewed cautiously.

It is surprising that energy demand reductions are so low given the enormous scope for energy efficiency in South Africa, increasing electricity prices and the significant policy attention being given to this area. It is possible that many energy efficiency projects that are being undertaken in the country are not aware of the CDM potential for the projects or are being implemented in a time-frame that is too quick to allow for the extensive time-frames of the CDM.



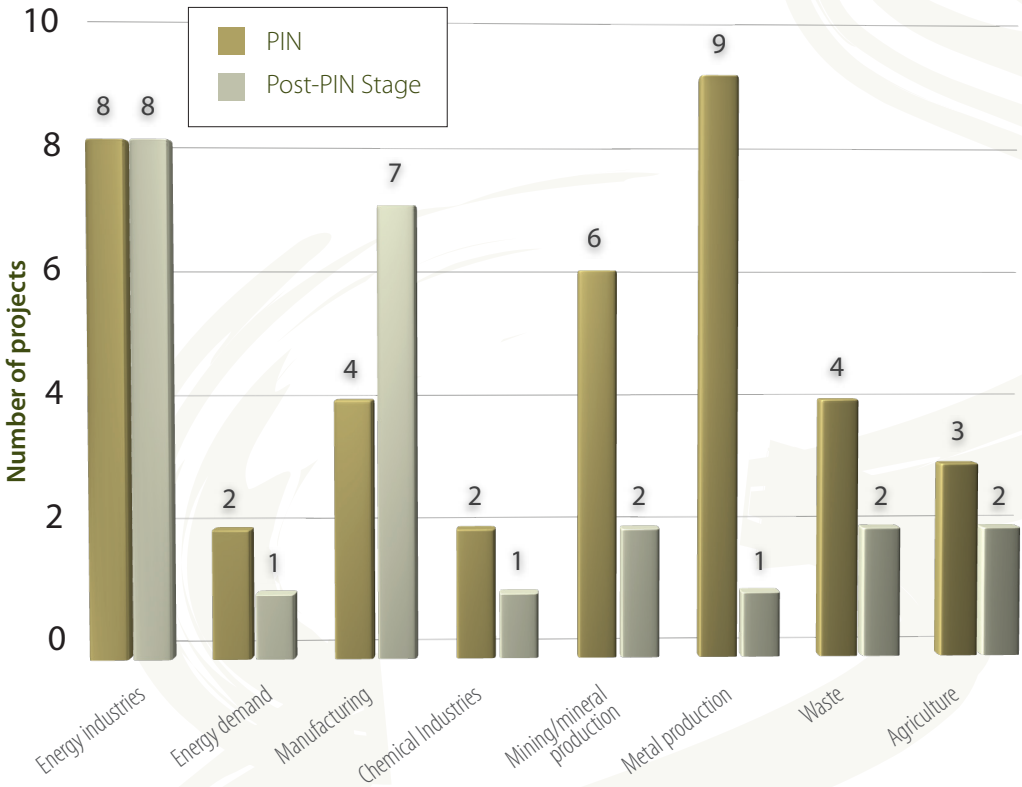
***Graph 9:** Total Emission Reductions per Primary Sector for CDM Projects in the PIN Phase*

Secondary sector

For the sectors that have been selected as the secondary sector (only 62 projects have selected a secondary sector; 24 post-PIN and 38 PIN) the majority of projects originate in the energy industries sector with an even split of 8 projects in the PIN phase and 8 projects in the post-PIN phase. In the post-PIN phase a further 7 projects (4 in the PIN Phase) have identified the manufacturing sector as the originating secondary sector. In the PIN phase 9 projects (1 in the post-PIN phase) have identified metal production and 6 projects (2 in the post-PIN phase) have selected mining / mineral production as being their originating secondary sector.

When viewing the secondary sector by volume of emissions a very similar picture is painted with the energy manufacturing and mining/ mineral sectors being identified as the sectors with the largest volume of emissions, with the exception of where no secondary sector has been identified.

Energy demand once again features very low on the list of secondary sectors identified for CDM projects.



***Graph 10:** Total Number of CDM Projects per Secondary Sector*

5.4.1 Project Methodologies

The most common methodology used in post-PIN stage projects (5 instances) is AMS 1-D: Grid Connected Renewable Energy Generation. This has been used for two hydro-electric power stations and for the production of energy through the use of biofuels.

There are a number of further instances in post-PIN stage projects where a methodology has been used for three projects. These include ACM 001: Landfill Gas Activities and ACM 002: Grid connected electricity generation from renewable sources. A full list of the methodologies used is tabled below:

Although the information available for the PIN stage projects is not complete due to a number of projects not having identified the methodology to be used at this stage it is interesting to note that there are two methodologies which gain prominence: ACM 002 Grid connected electricity generation for renewable sources (no biomass) and AMS-1.C Thermal energy use for the user.

ACM 002 projects include the establishment of wind, concentrated solar and hydro-electric power generation. AMS-1.C projects include solar water heating and fuel switching.

Methodology	Description	No. of Post-PIN Projects	No. of PINs
ACM0001	Landfill gas project activities	3	2
ACM0002	Grid-connected electricity generation for renewable sources (no biomass)	3	7
AM0008	Industrial fuel switching from coal and petroleum fuels to natural gas without extension of capacity and lifetime of the facility	1	N/A
AM0010	Landfill gas electricity (CERs from electricity)	2	N/A
AM0011	Landfill gas recovery with electricity generation (no CERs from electricity)	1	N/A
AM0014	Natural gas-based package cogeneration	1	N/A
AM0028	Catalytic N_2O destruction in the tail gas of nitric acid or caprolactam production plants	1	N/A
AM0034	Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants	3	N/A
AM0036	Fuel switch from fossil fuels to biomass residues in boilers for heat generation	1	N/A
AM0038	Improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn	1	1
AM0049	Gas based energy generation in an industrial facility	1	1
AM0064	Methodology for mine methane capture and destruction in underground, hard rock, precious and base metal mines	1	1
AMS-I.C.	Thermal Energy for the user	3	6
AMS-II.C.	Demand–Side Energy Efficiency Programmes for Specific Technologies	1	4
AMS-I.D.	Grid connected renewable electricity generation	5	2
AMS-II.D	Energy efficiency and fuel switching measures for industrial facilities	1	N/A
AMS-II.E.	Energy Efficiency and Fuel Switching Measures for Buildings	1	1
AMS-III.B.	Switching fossil fuels	1	1
AMS-III.D.	Methane recovery in agricultural and agro industrial activities	1	N/A

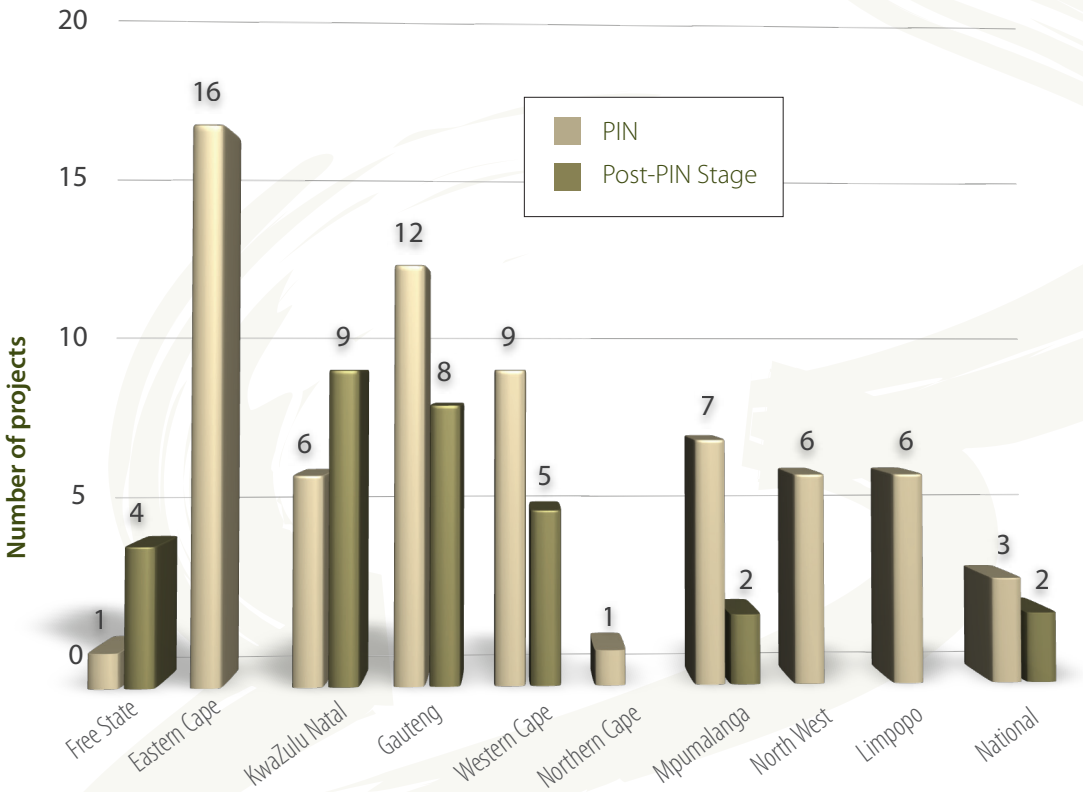
***Table 1:** Projects per Methodology*

5.5 Location of Projects

Most projects at an advanced, post-PIN, stage of development are located in the industrial centres of the country – in Gauteng, the Western Province and KwaZulu-Natal. This reflects the fact that the CDM leaders have been major industrial concerns, the large municipalities and large landfill site owners. The spread of projects appears to be changing, however, with many PIN-stage projects being located in the less industrially developed provinces such as the Eastern Cape, Mpumalanga, North West and Limpopo.

This trend is encouraging and probably reflects a diversification of the CDM into a broader range of sectors, including the agriculture sectors and more peripherally based industrial sectors such as pulp and paper and mining. No projects have yet reached the post-PIN stage in the Eastern Cape, Northern Cape, North West provinces but it is likely that this will start happening soon.

There are two projects in the post-PIN phase that are located across more than one province. The first is a solar water heating project with a national rollout and the second an N_2O project with sites in the Free State and Mpumalanga. These projects have been shown as national projects in the graph. It is expected that as the programmatic CDM becomes a more recognised and utilised type of CDM project an increasing number of projects will have a national footprint.



***Graph 11:** Total Number of CDM Projects per Province*

5.6 The Economics of the CDM in South Africa

The CDM is both an environmental mechanism and a financial one and it is important to understand the economics of undertaking CDM projects as well as the overall economic and financial impact of the CDM on the country. These are looked at below, firstly by a brief consideration of the costs of developing projects, and then by a review of the capital investment created in South Africa due to the CDM and the expected financial inflows due to the sales of CERs.

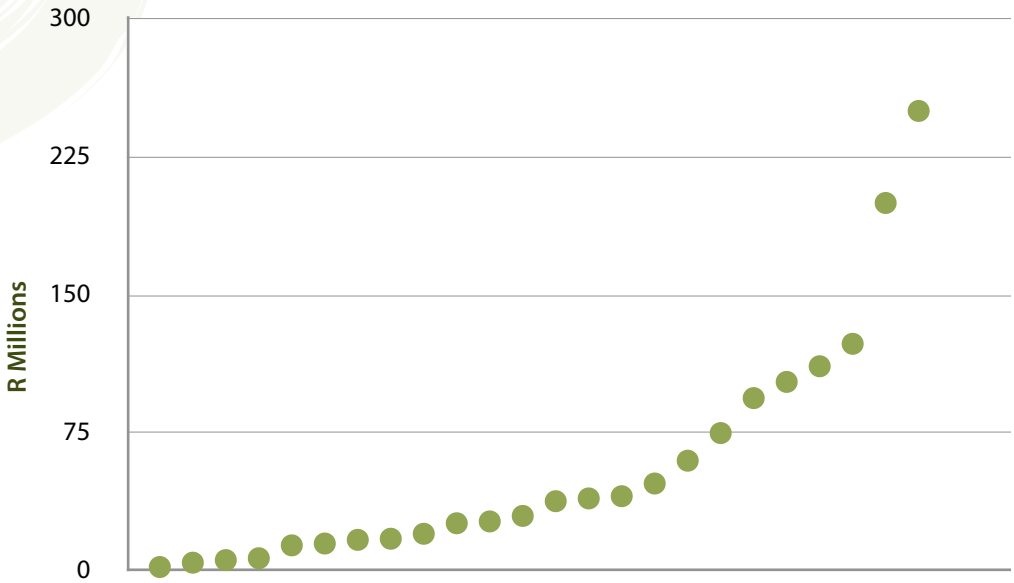
5.6.1 Development costs

On the basis of reported costs from project owners and developers the average CDM project that has reached the post-PIN phase will have cost R2 million to develop (i.e. the transactions costs of the project, not the actual project capital investment). The most expensive project to date cost R4.5 million for a nitrous oxide project and the least expensive project was R400,000 for a small scale energy demand project.

Clearly, significant resources are required to develop projects and a key component of expanding the CDM in South Africa is to find ways of reducing these transaction costs. Anecdotal evidence from the case studies suggests that the most important area to be addressed is the international rules and procedures around the CDM and the performance of DOEs. Current procedures appear to be cumbersome, poorly managed and often confusing or unnecessarily complicated.

5.6.2 Investment leveraged

CDM projects are always based on some underlying project activity. In most cases this activity requires some form of capital investment. Data collected in the review shows that the average capital investment per project on post-PIN projects was R57 million with a range from R2.4 million for a fuel switching project to about R250 million for a hydro-electric project. The distribution of investment costs is shown below.

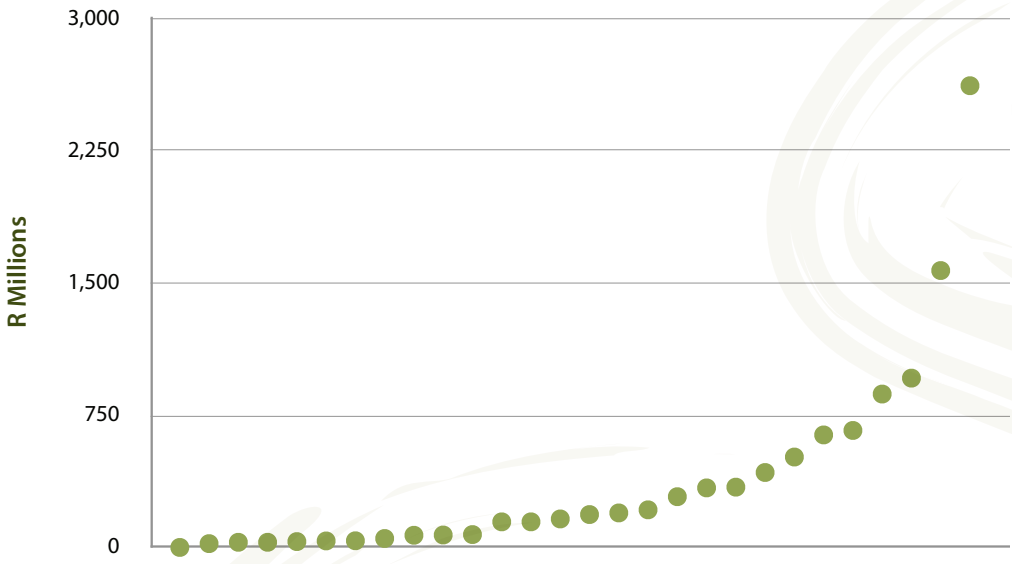


***Graph 12:** Capital Investment Costs for Post-PIN projects*

In total the CDM has leveraged capital investment in cleaner technology in South Africa of R1.4 billion already for projects at an advanced development stage. This provides an important boost to direct investment in the South African economy.

5.6.3 Value of CER sales

The capital investment above is facilitated by the expected revenue from the sales of CERs from projects. Projects in the post-PIN phase where the capital investment costs are known will on average generate R421 million over their lifetime with total revenue of R10.1 billion being generated. The projects earning the most revenue for the country are nitrous oxide projects with the highest being in excess of R2 billion. The project with the lowest revenue earned is R22 million, against a capital investment of R2 million. All this revenue is in the form of foreign exchange which represents an important benefit for the country.



***Graph 13:** Total Projected CER Revenue Generated from Post-PIN CDM Projects*

5.6.4 Types of Buyers

Where projects have entered into agreements for the sale of CERs there have been a wide variety of buyers including the project developers themselves, funds, financial institutions, government owned institutions and utilities. The agreements to sell have been signed predominantly with entities from European countries (Denmark, Germany, Netherlands, Spain, Switzerland and the United Kingdom) with Japan being the only non-European country having contracted to purchase CERs.

To date South African projects have completed the sale of 701,000 CERs to a combination of entities from Switzerland, the Netherlands and the United Kingdom.

5.7 The CDM and Sustainable Development

The CDM has the dual objective of reducing greenhouse gases and also contributing to sustainable development in the host country. In many respects the sustainable development impacts of the mechanism are tied in with the economic impacts, in that the CDM contributes to sustainable development through the in-flow of foreign exchange to the country and the leveraging of investment in the economy.

The CDM also supports sustainable development through facilitating the development and transfer of clean technology and associated skills. For example, the CDM has led to the introduction of new technology for power generation from landfill gas that had previously not been employed in South Africa. Similarly, the introduction of new nitrous oxide catalysts, the re-establishment of small hydro-power development expertise and the increase and improvement of domestic manufacturing of low-cost solar water heaters have all been due to the CDM.

In addition to these elements of the project there are more visible elements such as job creation and improvements to the local environment that may occur through the CDM. The sections below provide some evaluation of these impacts.

5.7.1 Employment

The employment impacts of the CDM to date have been limited and it appears as if the majority of CDM projects implemented to date have been capital intensive or else have been integrated into existing manufacturing concerns where the new investment has been managed by existing staff.

Of the 28 Projects that are at the post-PIN stage or beyond, two projects have created between 15 and 25 permanent jobs each and four have resulted in between 5 and 15 new jobs each being created. The remaining projects have resulted in about 3 jobs on average being created per project. In addition to these employment figures a significant number of temporary jobs have been created during the construction stage of projects. Looking at the information provided by 14 projects, post-PIN projects were expecting, on average, to create 47 temporary jobs of varying lengths.

The Kuyasa project, discussed in more detail as a case study, is a successful CDM project through which houses in the area have been retrofitted with solar water heaters, insulated ceilings, and energy efficient lighting. As part of the monitoring of the project each effected household has to report back to the developer on a monthly basis regarding the status of the products that were installed. This monitoring is paid for by the developer and in effect has lead to the creation of 12 full time equivalent posts over the 22 year life span of the project.

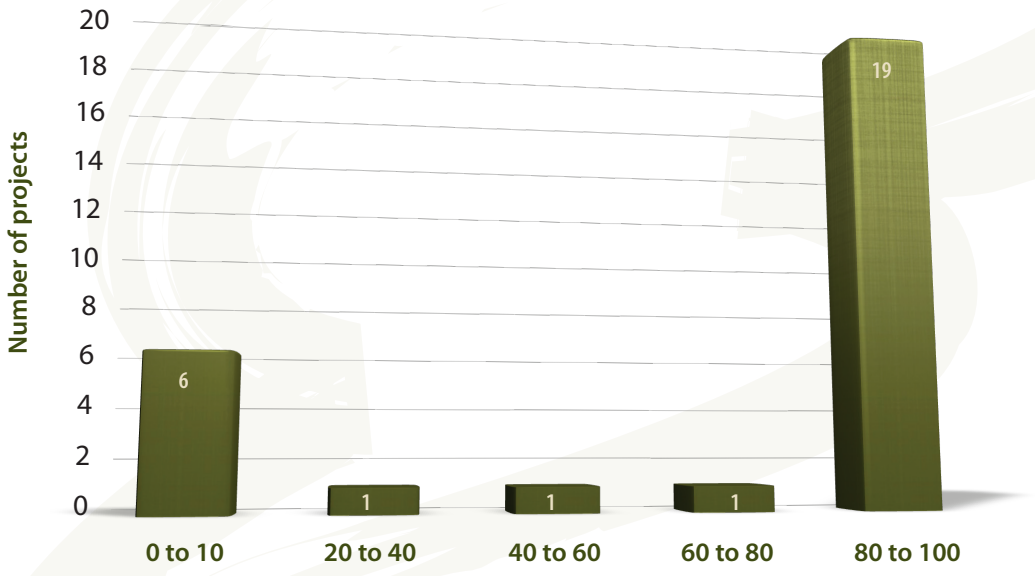
There are some projects which have reduced the likely loss of jobs in the future as opposed to creating new job opportunities, these include a fuel switching project which will ensure that the underlying company will remain financially viable in the long term due to the addition of carbon revenue.

At the PIN stage the picture is more positive with a reported 17,000 jobs scheduled to be created if all the projects are implemented. This figure needs to be viewed with caution however, since the total includes an estimated 10,000 jobs that will be created through the establishment of community funds from the revenues generated by a fuel switching project and over 5,000 jobs created through similar ancillary benefits from a landfill gas project. It is highly likely that these are over-estimates of actual permanent jobs to be created and the employment potential of the CDM appears to be relatively limited given the nature of the projects under consideration in the country.

The employment potential of the CDM may be improved if the mechanism moves towards large scale sector-wide or programmatic projects as discussed below. However, the early stages of the mechanism do not seem to be particularly conducive to labour intensive projects.

5.7.2 Transfer of Technology

Although the CDM does not have an explicit technology transfer mandate, it does contribute to the transfer of technology through financing the development of emission reduction projects that make use of technologies that are not currently in use in South Africa. Technology transfer is more common for larger projects and projects with foreign participants and usually involves the transfer of both knowledge and equipment. From the above graph it can be seen that the vast majority of projects are making use of foreign technologies for the development of the projects. 19 out of the 28 projects



***Graph 14:** Percentage of Foreign Technology used in Post-PIN Projects*

claim to have a foreign content in excess of 90% and only 6 projects have less than 10% foreign content. This is indicative of how South Africa is still in the early stages of CDM development and that without the CDM there has not been the incentive to develop the associated technologies. Examples of the foreign technologies being employed in South African projects include ammonia chillers, gas boilers, solar water heaters, specialised gas engines (such as landfill gas engines), catalytic technology and steam turbines.

Although projects rely significantly on imported technology, not all this technology is new to the country. However, there is anecdotal evidence that much of the technology is either new, or is being used in new and broadened applications.

5.7.3 Other Sustainable Development Benefits

In addition to the social benefits discussed above, there are other benefits that are expected to arise from the post-PIN projects under development. These include the setup and financing of community based trusts by project proponents, aimed at improving community health and welfare, in lieu of direct project benefits.

With respect to environmental impacts, several projects will improve the quality of the groundwater and air in the vicinity of the project which will indirectly improve the health and living standards of the surrounding communities.

There are also several projects both in the post-PIN and PIN stages which promise to provide significant sustainable development benefits to South Africa. These are predominantly projects where the project itself is aimed at the low income communities as opposed to projects where the sustainable development benefit is purely a by-product of the project. Some of the projects have been highlighted below together with the significant benefits that will be derived from them.

- The **Rea Vaya bus rapid transit system** is a project that aims to establish a sustainable mass urban transport system based on a Bus Rapid Transit (BRT) system to ensure high ridership levels. The Rea Vaya BRT system will improve social wellbeing as a result of less time lost in traffic congestion, fewer accidents per passenger transported, less respiratory diseases due to less particle matter pollution and less noise pollution. This will also create more construction job opportunities for unskilled workers of the surrounding communities and improved livelihoods.
- **CDM Solar Cooker Project** – the proposed project would be largest solar cooker and fuel efficient stove project of its kind anywhere in Africa providing an opportunity for solar cookers to become as commonplace a part of energy choices in Africa as they are in India or China. This project aims to significantly reduce the economic, environmental and health risks for an initial 15,000 households and their surroundings.

- **Fuel Efficient Biomass Stoves** – the proposed project will offer fuel efficient stoves to schools and other institutions. By improving the financial situation of schools, resources can be allocated elsewhere to offer higher quality education programmes.
- **Heat Retention Cookers in South Africa** - The programme aims to reduce cash expenditure on cooking, by introducing an affordable device known as the Wonderbag. This is an insulated container which is designed to hold a hot cook-pot safely for several hours, so that food can be cooked through heat retention. Approximately 1,400 people will be trained to distribute and manufacture the products.
- **Kuyasa CDM and the National Sustainable Housing Facility** – the Kuyasa CDM project (also highlighted as a case study) is providing insulation, solar water heating and compact fluorescent light-bulbs to low income houses in Khayelitsha, Cape Town. The project significantly reduces household energy costs and provides a better quality of life for residents. The project experience is also contributing to a proposed national facility that will support a national rollout of the technologies and lessons learnt at the Kuyasa project including solar water heaters and insulation.
- **Cosmo City** is a PIN phase project for the installation of solar water heaters in a housing development. The project will result in the creation of jobs for the installation, operation and maintenance of the solar water heaters. The project will lead to the training and skills development of those employed directly in the project construction and operations. ■

6 Conclusions and recommendations

The review of the status of the CDM in South Africa presented in this report is primarily intended as a descriptive overview, showing the current status of implementation of the mechanism. At the same time, through a review of this nature, a number of insights have been gained into the successes, challenges and possible future directions of the CDM in the country. Potential areas in which the DNA could support the growth of the CDM have also be identified. Some of these lessons are summarised below.

6.1 Challenges and Missing Elements

Although the CDM is the start of an emergent 'carbon market' in South Africa this market is still very far from perfect and suffers from a range of constraints such as high transaction costs, imperfect information and regulatory constraints. In some respects the market has operated as expected – for example, the cheaper and more substantial emission reduction opportunities such as nitrous oxide projects were identified and developed early on.

In other respects, however, there are clear market failures or gaps. These are highlighted below:

- **Few energy efficiency projects:** there have been very few energy efficiency projects implemented through the CDM despite numerous studies showing large, low cost reductions possible through energy efficiency and despite a very positive government policy context. Reasons for this possibly include the fact that many energy efficiency projects could fall into the programmatic CDM category which is still difficult (see below). Other reasons could include the fact that the energy supply crisis has led to many energy efficiency projects that are prioritised being conducted very rapidly which has failed to allow the lead time needed for the CDM registration process. There are also some large projects, such as the distribution of Compact Fluorescent Lightbulbs (CFLs) that, with proper planning, could have been conducted as CDM projects but were not.
- **Limited programmatic CDM:** The use of the programmatic CDM for such projects as solar water heating, CFL roll-out, and energy efficiency in buildings, is still in its infancy. This reflects the fact that this approach is new globally. However, South Africa, with early experience of similar project approaches, such as the Kuyasa project, could be at the forefront of such project types.
- **Limited replication of projects:** There are certain types of projects, such as landfill gas, fuel switching and other projects, that appear to offer significant replication potential in the country as they have been successfully registered and commissioned in South African circumstances. The fact that they have not been replicated to their full potential seems to point to other constraining factors outside of the CDM itself.

Outside of specific project related and domestic issues there appear to be loud and consistent complaints from project developers about the international regulatory process of the CDM itself. In particular there are concerns about:

- **Designated Operational Entity performance:** The performance of DOEs appears to be have been erratic at best, and highly frustrating and unprofessional at worst. Project developer experience suggests that over-stretched DOEs, language and time barriers due to the lack of a local DOE[19], and the cumbersome validation process with limited recourse by the project proponent to the Executive Board caused significant frustrations, time delays and costs to projects.
- **CDM bureaucracy and transaction costs:** In addition to the DOE performance, project developers noted the excessive transaction costs and delays caused by the bureaucracy of the CDM. This includes poorly written and inconsistent or ambiguous documentation, rapidly changing rules and requirements that affect projects in the middle of their development process, overly complex and unclear procedures and so forth.

6.2 CDM Potential

Although the challenges above have been noted, the CDM has already demonstrated much success – both simply as a GHG reduction mechanism but also as a mechanism facilitating projects which provide support to important elements of government policy. Some of these projects with high development potential have been noted above. Further potential exists in the following areas, amongst others:

- **Greater use of programmatic CDM:** A programmatic CDM is a programme consisting of a number of small projects which when viewed as individual projects are too small to participate in the traditional CDM structures due to the high level of transaction costs and complexity of the registration and monitoring processes. When these small projects are combined they have enough emission reduction and carbon revenue earning potential to exist as a CDM project. Examples of such projects would include the installation of solar water heaters and compact fluorescent light bulbs at a residential level. There appears to be real potential for the use of the programmatic CDM in such areas as:
  - Expansion of low income energy access and energy efficiency projects similar to the Kuyasa project;
  - Supporting household energy efficiency interventions such as CFL distribution on a mass scale, or middle and upper income SWH projects;
  - National solid waste management projects addressing methane emissions from numerous small municipal landfills.

[19] A local DOE, PriceWaterhouseCoopers, was accredited by the Executive Board but then withdrew its accreditation.

- **Fuel Switching:** South Africa still remains a coal intensive energy producer and there are significant fuel switching opportunities in the country where industrial boilers and turbines can be adapted to using either biomass or natural gas as an alternative. Similar projects are already being developed in South Africa and there are significant opportunities for replication.
- **Energy Efficiency:** As discussed above, there are numerous firms that are embarking on energy efficiency improvements in their operations. It would be a missed opportunity if such improvements did not benefit from carbon finance under the CDM. These improvements could include both large process changes as well as simple housekeeping measures.
- **Renewable energy projects:** The Renewable Energy Feed-in-Tariff is likely to see a large increase in renewable energy project development. These projects should not be precluded from utilising the CDM as further support for the establishment of a viable renewable energy industry in the country and there is likely to be significant CDM potential in this area. This would include related areas of new power generation, such as co-generation and co-firing of biomass.

6.3 DNA Support

In the context of the successes, challenges and opportunities presented above, there are some possible areas in which the DNA could further support the appropriate and meaningful expansion of the CDM in South Africa. Some possible areas are outlined below, which, following the publication of this review, will be considered and discussed by the DNA.

- **Ensuring better DOE support:** the DNA could assist project developers in securing better support from DOEs by such mechanisms as encouraging the establishment of a local DOE or local branches of DOEs. Furthermore the DNA could assist project developers in addressing poor performance from DOEs to help project developers receive more professional and rapid service from DOEs.

- **Database of expertise:** Many project developers noted the importance of good technical support in the CDM development process and the complex nature of the process. The DNA could possibly manage a database of available expertise, without favour to any particular firm, to ensure that project developers can access and compare service providers for project support.

- **Reducing transaction costs:** In general the DNA could work with the Executive Board and with the South African delegation to Members of the Protocol meetings to seek ways to reduce complexity and transaction costs in the CDM process. This would include making representations around improvements in document and methodology clarity, as well as reducing bureaucracy and delays in other areas of the validation and registration process.

- **Supporting sector-wide and programmatic CDM:** the DNA could support such projects through working with the Executive Board to ensure that the rules and approaches for programmatic CDM are clear and unambiguous; through establishing its own clear guidelines to such issues as overlapping programmatic projects; and trough working with the public sector to develop sector-wide projects.

- **Continued promotions of the CDM:** the DNA could expand its promotional work within South Africa in both the private and public sectors through the showcasing of the increasing number of successful CDM projects and through targeting clear areas of replication and other potential.

- **Provide level of certainty as to the future of the CDM:** the DNA is well placed to keep abreast of international developments and can help to provide long term certainty to the market in South Africa on the continuation of the CDM post-2012. This includes the distribution of information on progress in the international negotiations as well as information dissemination on other positive signals such as the fact that some large funds and utilities are already purchasing CERs for the post-2012 period.

- **Integration of the CDM into government programmes:** the DNA, with the Department of Energy as a whole, could help facilitate better integration of the CDM into government service delivery strategies and programmes such as the Energy Efficiency Accord, low-income housing delivery, public transport programmes, solid waste management and so forth. ■

7 Case studies

7.1 Bethlehem Hydro Project

Interview with Anton-Louis Olivier, Bethlehem Hydro

The Bethlehem project is a small hydroelectric scheme comprising two generation facilities with a joint capacity of 7MW. One facility is a 4MW run-of-river site located on the As River and the other is a 3MW site adjacent to the existing wall of the Sol Plaatje dam. Both sites are within the boundaries of the Dihlabeng Local Municipality in the Free State Province and will be connected the national grid via a 5km 11KV transmission line for Sol Plaatje and a 16km 22KV line for Merino. The lifespan of the project is in excess of 20 years, with a predicted base load power production of 38 GWh.

Hydropower opportunities are relatively limited in South Africa, but the scheme benefits from the outflow from the Lesotho Highlands Water Scheme, which enters South Africa near the project. This flow is not seasonally variable, as there is a steady and controlled release of water from the dams in Lesotho. There are also sufficient height differences in the area to create a suitable head of water.

The scheme is owned by Bethlehem Hydro (Pty) Ltd which will be one of the few independent power producers in South Africa. The company will generate revenue through a long term power purchase agreement (PPA) with the local municipality and by selling its reduction in greenhouse gas emissions as Certified Emission Reductions (CERs). It is likely that the project will also now try to secure a revised PPA to take advantage of the renewable energy feed-in-tariffs recently announced by the National Energy Regulator of South Africa. There have been no new and independent small hydro power plants in South Africa since the early 1980's and this project demonstrates the value of the CDM in helping to revitalise renewable energy in South Africa.

History

The initial project developer, NuPlanet, was first alerted to the opportunity to develop a small-scale hydropower plant in 1999. The company undertook an initial pre-feasibility study largely at their own risk. Although the project appeared to be sound, for some time NuPlanet had insufficient funding to take the project to the next stage. Fortunately the project was able to secure a grant from the Dutch government under the Netherlands Activities Implemented Jointly (AIJ) pilot programme. The AIJ was a precursor to the CDM with similar objectives. This funding allowed the project developers to undertake the necessary feasibility studies. It also ensured that the project took into account carbon finance opportunities from the very beginning.

Project Development and Obstacles

After the hurdle of raising sufficient finance for the feasibility study the main obstacles encountered by the developers were addressing a variety of regulatory requirements. In addition to the technical and commercial factors, the feasibility assessments for the project, contracted to Ninham Shand Consulting Engineers, had to take account of:

- environmental impacts;
- water use restraints;
- securing land lease agreements;
- power generation licence requirements;
- securing a power purchase agreement.

There was added difficulty for all these requirements since at the time of project development much of the relevant legislation was relatively new, and certainly untested with regards to small independent power producers. The main implication for the developer was project delays – for example, approval of the environmental impact assessment scoping study took nine months while the approval of the water use licence was only issued after three years.

After obtaining the necessary regulatory approvals and securing finance for construction of the project, Bethlehem Hydro, approached Ninham Shand to provide the necessary consulting services for the implementation of the project. Ninham Shand in turn obtained the services of sub-consultants for the key project components.

During the final design and construction stages final energy output at both power stations has increased compared to the initial feasibility study, due to such factors as design improvements and better hydrological records. According to the project manager, the small scale of the project and hands-on management have allowed many detailed design improvements and cost savings to be made as the project progressed. There has also been exceptional commitment to the project from all partners who have worked together as a very successful team, sharing risk and learning together on the project.

CDM Process

Aside from the local regulatory hurdles, the project has experienced some hurdles in the CDM process itself. These have largely been in the validation process which has been protracted and expensive. According to the project developer the local CDM requirements, primarily DNA approval, have been well managed and have not led to project delays. However, poor performance by the Designated Operational Entity has led to unnecessary delays in securing project registration. This was compounded by changes in the CDM regulations during the CDM development process. For example, after finalisation of the Project Design Document new reporting formats or methodology changes required revision of the PDD causing extensive delays.

Financial viability of Project Activity and Sale of credits

At the feasibility stage evaluation the project was only marginally viable. Nevertheless, the project managed to secure debt financing from the Development Bank of Southern Africa (DBSA) who were able to understand the carbon revenue component of the project. It was clear that without the income from carbon revenue, the project would not have sufficient cash flow to meet the minimum debt service coverage ratio requirements of the DBSA. The DBSA therefore included the existence of a sales agreement for the emission reductions as a suspensive condition for its loan. The CERs from the project were sold to the Statkraft Group, a leading European conventional and renewable energy company, and this sales agreement fulfilled the DBSA's requirements. These credits were sold for the full 21 years of the registered CDM crediting period. The credits were sold directly to the purchaser with no intermediaries involved. The purchase is on the basis of a combination of a fixed credit price and a percentage of prevailing market price.

Due to delays in the project validation it is not yet registered and may be commissioned and start producing power prior to registration. The expected commissioning date is July 2009. The registration delay will lead to a loss of carbon revenue for the project and demonstrates the real financial impacts of delays in the CDM process.

New regulations in South Africa, including the renewable energy feed-in-tariffs and recent announcements for tax reductions on income from CERs, will contribute to increased viability of the project. Even without such regulations, the steadily increasing electricity price in the country, against a fixed cost of producing power from the plants, will ensure an increasingly financially beneficial project.

Replication and Future Projects

The project is a relatively conventional small hydro project and has demonstrated the viability of such projects in South Africa as well as the viability of the independent power producer model in the country. In this sense it opens the way for other small scale renewable energy projects. There are also some specific plans to extend the scheme to other sites in the same river system, to benefit from the regular and controlled hydrological regime in the area. These projects, due to barriers to small hydro generation in the country are also likely to be eligible under the CDM.

Sustainable Development Impact

The project has contributed to local economic development in the area. The project will create some 40 skilled and 100 to 160 unskilled job opportunities during the construction phase, which lasted for 30 months. Three full-time permanent jobs will be created once the project is operational.

At the same time the project has certain environmental impacts given that it involves construction along a watercourse. The main impact identified during the EIA was the flooding of a wetland identified in a natural basin at the As River Site. After discussion with the environmental authorities the developer has agreed to implement off-site mitigation in the form of restoring a wetland of greater or equivalent environmental value to the wetland that will be lost by the development of power station. Design changes during construction also reduced this impact leaving the wetland largely undisturbed.

In recognition of the project's contribution to sustainable energy it has received accolades from various quarters including the Development Bank of Southern Africa CEO's Award for the "Green Project of the Year in 2006" and the South African National Energy Association "Project of the Year in 2008".

7.2 African Explosives Limited (Plant 9 and Plant 11)

Interview with Paul Eagar, Alan Pikor and Hendrik Burger

African Explosives is a leading supplier of explosive materials to global markets, with the production of nitric acid being one of its producing activities.

One of the by-products during the process is N_2O which has been identified under the Kyoto protocol as a greenhouse gas whose levels need to be reduced by 2012. In order to bring about the reduction of N_2O, the CDM project activity will include new N_2O reduction technology in the form of a new catalyst for the ammonia oxidation reactors on the nitric acid plants 9 and 11 where both plants correspond to a different PDD document with their own corresponding CDM registration.

The project modification is based on changing the catalyst used in the current reactor to a secondary catalyst which leads to lower N_2O emissions thereby affecting the containment basket where packing for the catalyst bed otherwise known as Raschig rings are located.

The opportunity for the project was identified in 2004. Currently there is a team of individuals dedicated to making the project succeed in every way possible, not stopping when any hurdles or obstacles are encountered along the way.

Plant 9 which has been in operation since 1968 is the smaller of the two plants and is labelled as a swing 'plant'. It is currently experiencing a lower reduction efficacy in N_2O than the no. 11 plant. A 'swing plant' is an operating plant whose downtime is affected by demand for its product which in this case is nitric acid.

The project expects to generate credits amounting to over 57,000 for plant 9 and 264,000 for plant 11 per year providing the production of nitric acid stays relatively constant. This catalyst is sourced from an international suppler that has experience dealing with similar N_2O reduction projects in South Africa.

Sale of credits

No credits have been sold as of yet. However there have been preliminary discussions with Citibank who will be in charge of selling the credits on behalf of African Explosives.

Financial viability of Project activity

There are high overheads with this project and at the same time high risks in the form of potentially lower productivity from the modified reactors as well as possible shut-downs as a result of the modifications, leading to a loss in production time and volume. One of the contributors to the high costs involved includes the lease fee to the catalyst provider. This means that initially with the sale of credits, the plant barely breaks even with the CDM activities in place.

The environmental benefits from reducing the greenhouse gas are significant but at the end of the day the feeling was that the manufacturers are gaining very little financially from the project whereas the other parties involved are making large financial gains from it. However should the project become profitable at some stage, the project owners would consider the set-up of a further CDM project on site as mentioned in the PDD.

Constraints

The project makes use of DNV as their DOE (with a local presence) who are currently carrying out the second round of verification for the project. Even with this local presence there were still time delays in the validation and verification reports.

A major constraint from a financial point of view besides the capital expenditure required is the amount of downtime that the plant experiences due to the required modifications. As the main reactor is where these changes take place, production is stopped during modifications.

From a technical and legal point of view, there are no guarantees from the manufacturers of the catalyst, that there will indeed be a reduction in N_2O. Therefore this can be seen as a major risk to the success of the project if the expected reductions are not achieved.

One of the main recommendations made was for CDM to be made a more financially viable and beneficial endeavour for the project owner in order to encourage a larger number of South African industries to invest in CDM Projects of their own.

Replication

African Explosives can be noted as one of the first nitric acid producers to introduce the new N_2O abatement technology onto their plant. This can be attributed mainly to the fact that currently there is no law in South Africa regulating N_2O levels and no expectations of any law of this nature being imposed in the near future. Therefore revenue from CER's generated can act as an incentive for other nitric acid plant owners in setting up similar N_2O abatement projects which will then allow for the high project costs to be alleviated.

Post 2012

There is some confidence in post 2012 CDM activities based on the requirement for a 'vehicle' to resolve environmental issues such as climate change which is happening at an alarming rate. However at the same time there is no guarantee that there will be a future for CDM Projects and the carbon credit market before the Copenhagen conference on Climate Change later this year.

Before investments in the SA CDM environment can be made, there needs to be a solid guarantee in the future of CDM Projects so that developers and investors can be sure that when they invest in these projects there will be a market for carbon credits by the time the project gains issuance of credits.

DNA Performance

The DNA's performance came with very high praise as they were seen to be highly pro-active when it came to their role in the CDM process. Apart from this, any deadlines laid out at the start of the project requiring DNA assistance and authorisation were met.

7.3 Kuyasa CDM Project

Interview with Carl Wesselink, Kuyasa CDM

The Kuyasa Project is a low cost housing and poverty alleviation project in Kuyasa, Khayelitsha. This project is a successful CDM project through which houses in the area have been retrofitted with solar water heaters, insulated ceilings, and energy efficient lighting. Kuyasa was the first South African Clean Development Mechanism (CDM) project to be registered and was the first Gold Standard Project in the world. The project has generated substantial interest locally and internationally as a pilot for the energy-efficient adaptation of low-cost housing.

Khayelitsha is a large, mainly informal settlement about 30km from the centre of Cape Town with a complex social, economic and political history, and with the majority of its inhabitants trapped in chronic poverty. The low cost housing units in Kuyasa were built under the once-off Reconstruction and Development Programme national housing subsidy. Each $30m_2$ housing unit is electrified through a pre-paid meter but has no internal wiring for plugs and lights, no ceilings and no water heaters. Lighting is provided by incandescent bulbs. The lack of ceiling insulation means that basic thermal comfort is not met – with houses being overheated in summer and very cold in winter. No provision for hot water was made during housing construction and the energy profile of the households is characterised by multiple fuel use (including paraffin and wood) for space and water heating which is expensive and often dangerous. Some households in the area use as much as 25% of their income on energy services.

When completed the project will have retrofitted 2,310 houses with solar water heaters, ceilings and ceiling insulation, electrical wiring and compact fluorescent light bulbs (CFLs) which together significantly improve the comfort of residents, reduce energy costs by about R300 per household per year in winter, and reduce the negative health impacts and fire and accident risks of indoor fuel burning. The greenhouse gas reductions due to reduced fossil fuel use are significant and initial estimates are that approximately 2.8 tonnes of CO_2 per household per year will be avoided as a result of the project[20].

History and Project Development Obstacles

The Kuyasa project was initially developed by the nongovernmental organisation (NGO) SouthSouthNorth (SSN) with the City of Cape Town's Environmental Resource Management Department and Urban Renewal Programme. Ten pilot houses were adapted in 2002, providing the practical data for an efficiency measuring system. Although successfully registered as the country's first CDM project and providing significant poverty alleviation benefits the project failed to progress to its intended scale. This was due to the fact that the CDM component of the project did not cover the full capital costs of the interventions and there was an inability from the City of Cape Town to provide the required implementation funds.

The project subsequently received capital grants from the national Department of Environment and Tourism's (DEAT) Social Responsibility Programme and the Provincial Government's Department of Housing. In addition, the South African Export Development Fund (SAEDF), a joint public/private sector investment fund, has underwritten the additional finance required for successful completion of the project and has also played a crucial role in establishing the necessary management and financial structures for the project. The combination of these interventions enabled the retrofitting of the full complement of houses to be started in August 2008 and significant progress has now been made over the last year[21].

The SAEDF has been appointed as the project-implementing agency. The SAEDF, under the guidance of a Project Advisory Committee, will be responsible for all aspects of implementation, including the setting up of a community-based energy services company. The community-based model will see the creation of a sustainable community owned energy services business. This business will create ongoing permanent employment and provide for the maintenance and monitoring of the installations for at least 7 years (the initial period over which the Certified Emission Reduction Certificate's will be claimed) as well as for any extension of that period up to a maximum of 21 years (see diagram of proposed operating structure below).

[20] World Clean Energy Awards, 2007: http://www.cleanenergyawards.com/top-navigation/nominees-projects/nominee-detail/project/28/?cHash=b43ddd97da

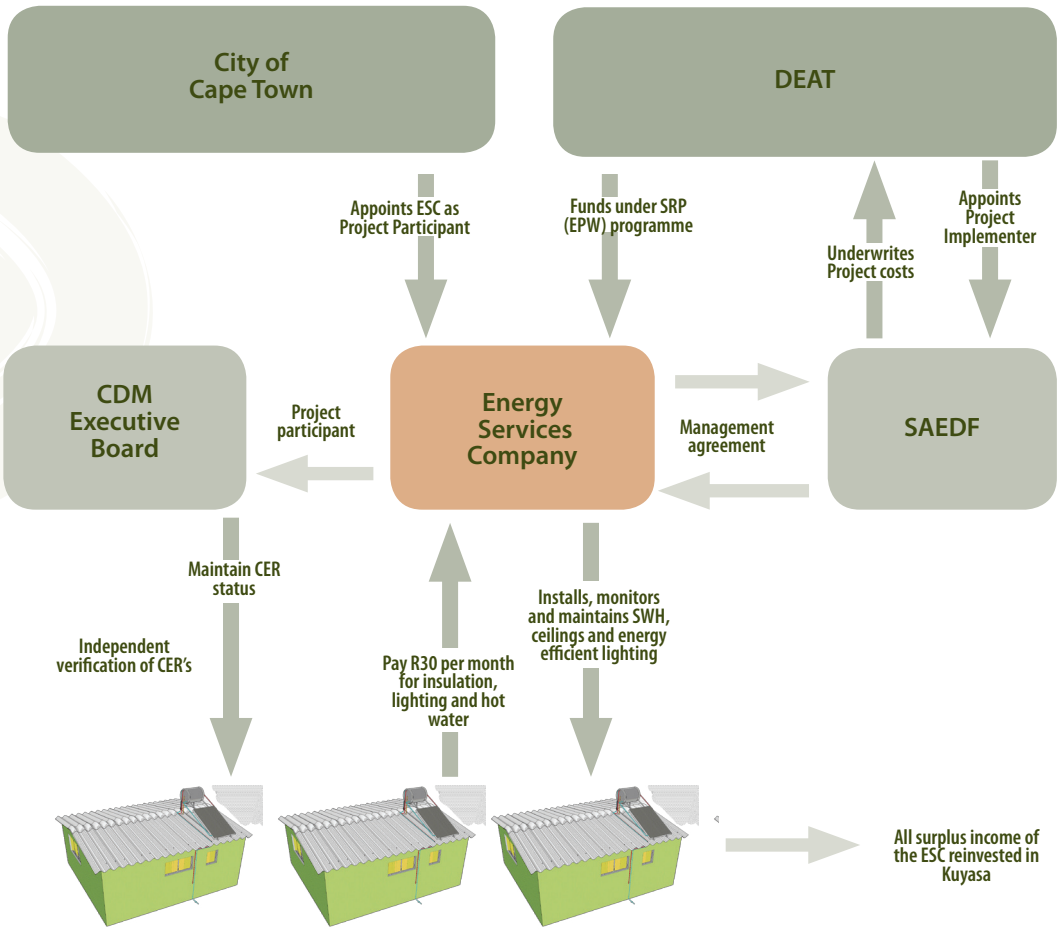
[21] Kuyasa CDM Project Website: http://www.kuyasacdm.co.za/

Income from the sale of Carbon Emission Reduction certificates as well as contributions from beneficiaries will finance the operations of the Energy Services Company – providing long-term opportunities for locally-based small and micro enterprises. The Company will be accountable to Kuyasa residents and will use its surplus income to support future community development initiatives[22].

CDM Process

The CDM process was managed by SouthSouthNorth and was ground breaking in a number of ways. The project was explicitly designed as a poverty alleviation activity to be supported by carbon finance and was the first Gold Standard CDM project registered.

The greenhouse gas reduction interventions constitute three project activities which fall under three different simplified small-scale CDM Project Activity categories. The project also successfully argued for the notion of suppressed demand, whereby anticipated future levels of household energy use that will result from advances in the provision of energy services and improved access to energy services is taken into account.



[22] World Clean Energy Awards, 2007: http://www.cleanenergyawards.com/top-navigation/nominees-projects/nominee-detail/project/28/?cHash=b43ddd97da

According to SouthSouthNorth the project can also be seen as a de facto Programme of Activities as it has aggregated the highly dispersed and small scale types of emissions reduction opportunities which Programmatic CDM is designed at facilitating[23]. The project therefore is of international importance and has helped to pave the way for the development of formalised Programmatic CDM.

Replication and Future Projects

The project remains financially viable only with the provision of public subsidies of various kinds. However, the project, is beginning to demonstrate that large scale solar water heating implementation in low-cost housing is financially sustainable if a suitable financial package can be developed which combines:

- A small monthly payment for hot water supply from households;
- Demand side management finance, such as the Eskom solar water heater subsidy;
- Carbon finance through the CDM;
- Suitable low-cost technologies which are suited to local conditions;
- The use of local labour and community level structures to manage ongoing maintenance.

A large scale programme of this nature would have numerous social, environmental and economic benefits. These would include reducing the burden of respiratory disease, improved hygiene and comfort, and cost savings at the household level. In addition the programme would create substantial employment, training and entrepreneurial opportunities in communities where this was needed most. The energy savings would not only reduce greenhouse gas emissions but also reduce peak demand for electricity, thus deferring the need for new power capacity.

The Kuyasa project has received significant international recognitions and acclaim. However, the real measure of the project's success will be whether it can serve as the start of a much larger scale programme which demonstrates that the CDM can be used to support a country-scale poverty alleviation development intervention.

[23] SouthSouthNorth, no date: Kuyasa Low Cost Housing Energy Upgrade Project, Khayelitsha, South Africa

7.4 Lawley fuel-switching Project

Interview with John Anthony (Technical Manager)

The Lawley fuel-switching project is one of the leading CDM projects in the country and has been the first project in Sub-Saharan Africa to have credits issued. The project is based at Lawley, a brick factory owned by Corobrik, one of the biggest suppliers of bricks in South Africa, which currently produces about 100 million bricks a year.

The basis of the project is a fuel switch from coal, which is currently fired in the furnaces, to Sasol gas supplied via a 5km pipeline. The conversion required was relatively straightforward with minimal shut-down time making it a smooth transition for the plant.

The project was started in 2004 as a result of the company's strong commitment to sustainable environmental practices on its plant. The project was registered during March 2006 and the first set of credits was issued as of June 2008. In addition to being the first project in the country to be issued with credits the project had already achieved another first as no company globally had registered a fuel-switching project prior to Corobrik. This path-breaking has proved to be highly successful for the firm which has so far been issued with 35,000 CERs from the years 2005-2006. These have been sold upfront to Statkraft, a European utility. The credits from the years 2007-2008 still need to be issued.

Financial viability of Project activity/s

With the sale of credits included, the project activity became financially viable. However, the financial gain from the credits sold was relatively small in comparison with the expenditure on the project development and the capital outlay, as well as the time and expertise dedicated by the staff at Corobrik. The non-financial benefits of the

project are substantial and also contributed to Corobrik deciding to move forwards with the project. These benefits include:

- Improved air quality experienced by neighbouring communities as a result of the switch from coal to natural gas;
- Better working environment with worker's exposure to ash reduced to almost nil
- Producing a low carbon foot print clay brick;
- Reduction in the use of vehicles previously used to transport and move coal;
- Potential of spontaneous or accidental combustion being significantly lower than coal;
- Access to carbon footprint information relevant to architects or other parties involved in the construction sector.

The conversion also carries with it various advantages including improved product yields as well as better processing rates.[24] Not only has the plant met South African Bureau of Standards (SABS) approval for the required safety measures installed on the plant, but the plant has also been designed according to EU standards which are more stringent in some respects.

Another significant factor is that the use of natural gas means that the process has a higher degree of automation than the pre-existing process. This has led to a reduction in the number of staff required to run the section of the plant. However, even though there are less people required to operate the particular section of the plant affected, no job losses were incurred as those operators were all transferred to another section of the plant.

The nature of the required technical and process changes at the factory was such that it was not very disruptive to ongoing production at the site. The project owner therefore experienced little downtime and costs from decreased production.

The replicability of the project, especially in South Africa and the brick making industry can be considered high as the project is relatively easy to implement but at the same time brings with it many ancillary benefits as well as revenue from the sale of the carbon credits. Similar projects would also be attractive to companies relying on exports to developed countries who may be faced with purchasers who favour a non-coal-based and less greenhouse gas intensive product.

Constraints

The main project constraints related to the CDM regulatory processes. The first verification process to take place was unsuccessful. For the second round of verification, an alternative Designated Operational Entity was contracted and Lawley was successful in obtaining its first verification. According to the company the verification process was slow and laborious, largely as a result of the time taken to communicate with the DOE.

[24] 25 Degrees in Africa Volume 4: First-hand knowledge: Case study. 2009

The main constraint identified during the project cycle was the level of bureaucracy attached with the process. During the first verification, there was no visit to the plant by the DOE. However for the second verification round there is a planned visit.

The locally-based CDM consultant used by Corobrik was said to be very helpful in setting up the project. The project owner noted that the role of the consultant was crucial in steering them through the regulatory procedures of the CDM and that without such support it was unlikely that they would have achieved the successful validation of the project and the subsequent verification and issuance of credits. In comparison with the difficulties experienced with the international CDM process, the project owner indicated that the local DNA approval process was uneventful and did not pose an obstacle to the project.

Other projects in the future

Corobrik has a firm belief in the importance of making resources available for energy-efficient projects to happen as well as technologies involved in reduced greenhouse gas emissions.[25] As a result of Corobrik's confidence in the CDM process gained from the Lawley project, the company is in the process of gaining CDM status for the Driefontein plant, another Corobrik manufacturing plant where 54 million bricks are produced a year.[26] The project similarly involves a fuel-switch to natural gas.

In terms of the post 2012 debate, according to the project owner, South African project owners should have faith in the continuation of the CDM and become more open-minded towards investing in CDM projects in the future.

7.5 Bisasar Road, Marrianhill and La Mercy

Interview with Marc Wright (Design Engineer)

Bisasar Road landfill situated in Durban is a fully operational landfill site responsible for collecting around 3,500 tons of solid waste per day with a landfill lifespan till 2013 expected. The Marrianhill landfill site is proposed to operate until 2024, currently receiving between 550 – 700 tons of waste daily. In 2002, Marrianhill was nominated as a Nature Conservancy site, making it the only landfill site in South Africa to be awarded this status. La Mercy, a relatively old site now closed and rehabilitated processed about 350 tons of waste per day.

The project involves the collection of landfill gas from the 3 landfill sites in Durban in Kwazulu-Natal. By 2012 the project proposes to supply electricity to an increasing number of houses in the surrounding municipality.

[25] Corobrik Staff Newsletter, April 2009. Brikforce, 2009

[26] African Energy Journal. CDM pioneers

Originally there was a single CDM project based on the same activities happening at three landfill sites owned by the eThekwini municipality however, the project is now split up into two separate projects as follows:

- **Components One:** Marrianhill and La Mercy
- **Component Two:** Bisasar Road

This split was decided on in conjunction with the World Bank in order to enable the first component of the project to move ahead rapidly due to unforeseen delays on the second component. Although this did allow for the first component to be registered this also meant the separate registration of two CDM projects with the corresponding increases in the level of time and effort required.

Registration for Component Two was recently obtained in March 2009 while Component One registration occurred in December 2006. The CO_2e reductions experienced by Bisasar Road on a yearly basis amount to 350,000 tonnes resulting in 6.5MW of electricity being generated where for Component One the annual CO_2e emission reductions obtained are 70,000 tons eq. with an electricity generation of 1MW. translating into a total electricity supply from both components for about 3,750 small households.

eThekwini Landfill Project was initially a pilot project where the World Bank first introduced the idea of a CDM Project at the landfill to the municipality. This introduction took place during November 2001, making eThekwini one of the first CDM projects to be initiated in South Africa.

The project split, as mentioned earlier, allowed for the process to go ahead, thereby avoiding delays in getting Component One verification. For Component Two the nature of the delays included:

- Necessary clarification of the methodology;
- New calculations required for the revised methodology;
- A delay due to stakeholder's requests during the EIA approval process to have the project stopped.

Project Revenue

Electricity generation is an important part of the landfill gas recovery project's income. The electricity generated is supplied to eThekwini Municipality with the possible future sale to Eskom under the new feed-in tariff. At the moment only CERs from Mariannhill and La Mercy have been sold to the World Bank.

The project development led to much higher overheads than expected with the project receiving financing from various sources including the local municipality, the Department of Trade and Industry, the French Development Bank as well as the Department of Minerals and Energy. Currently Component One of the project is not financially feasible and is running at a loss. This is largely due to the fact that voluntary emission reductions are being sold as opposed to CER's. However at the CER price negotiated, Component Two of the project will be able to experience a profit.

Replication

In terms of replication around South Africa, an increasing number of landfill projects are being initiated. Landfill projects not only result in the sale of CER's but also the sale of electricity to nearby users. Such projects also lead to a certain degree of odour control on the landfill, one of the major problems that landfills experience with residents in the area.

Constraints

The main technical obstacle encountered involved over-estimates of the amount of gas collected at Bisasar while using vertical collection wells as opposed to horizontal wells. Currently, the landfill project is seeing the installation of new horizontal wells at Bisasar and Mariannhill which should enable a higher collection of gas to be achieved.

During verification, problems were experienced with the project DOE, making it difficult to get clear direction regarding the problems around the project and appropriate improvements in its activities. It was also apparent from the long response times that the DOE had a backlog in project verifications and validations. This translated into delays in the various project stages in each of the components. Little recourse is possible around DOE performance as the only communication with the Executive Board is through the DOE.

This project is known as a 'City Project' in the sense that a variety of Municipal departments are involved from all sectors with no external project partners. The lack of available and skilled resources in the municipal departments led to further delays in the project.

One of the recommendations made in terms of the institutional barriers surrounding the CDM process was that in order to cut down the time lag between steps in the project cycle, some should be made parallel to others as opposed being sequential in order to streamline the process. An example of this is the EIA step, which was a very lengthy process and resulted in considerable delays. The EIA's were started in 2003 and the final Record of Decisions, after various appeals and further amendments, were completed in 2006.

Sustainable Development criteria

Any visitors to the landfill or residents surrounding the landfill can see the nurseries being built on the perimeter of the entire landfill site as part of the City Park's project scheme which aims to rehabilitate some of the used landfill cells and at the same time making sure the surroundings of the landfill are as aesthetically pleasing as possible to those living in the immediate vicinity of the landfill.

There was limited job creation through the employment of skilled operators required for the maintenance and continuous operation of the generators. A selected group of young adults from the surrounding area are currently receiving training at a university level as a form of skills development while a portion of the revenue from the credits sold will go towards setting up funds for surrounding communities living in the vicinity of the landfill.

There are currently other projects in the pipeline at the Bisasar landfill site where research is being done on aerobic and anaerobic digestion and electricity generation which, if it proves to be successful, will lead to the implementation of another CDM Project.

The project has been awarded the 'Honorary Energy Globe Award' Project at the Prague Energy Globe Awards which took place earlier in 2009. The award was for the projects contribution and performance towards helping to sustain the environment.

7.6 Mondi Richards Bay

Interview with Hendrik Louw (Mondi Energy and Climate Change)

The Mondi Richards Bay mill was commissioned in 1984, with the first commercial pulp being produced in October 1984. The operation occupies a 385 ha site and produces two key products: Baycel, a premier grade bleached hardwood pulp made from 100-percent eucalyptus fibre, and ProVantage Baywhite, a white top kraft linerboard. Both products are produced using wood from certified sustainable forests. In 2005, the Richards Bay mill underwent a major expansion project that increased its capacity to more than 720 000 tonnes per annum from 2005. The modernisation of the Richards Bay operation enabled the mill to significantly reduce its impact on every aspect of the environment, from air quality to water consumption through to solid waste reduction. The SilvaCel wood chip plant, also located in Richards Bay, produces more than one million tons of eucalyptus and wattle wood chips each year.

There are currently two CDM projects under development at the Richards Bay Mill, a biomass project and a gas turbine project.

Mondi Richards Bay Biomass Project

The project activity encompasses the collection of biomass waste from plantations and nearby chipping facilities for use in a co-fired boiler, replacing coal. In the past Mondi SilvaCel and other timber processors (chippers) in the area of Richards Bay transported their biomass waste to the local municipal landfill site. With the introduction of this project the biomass waste is collected at the facilities, transported to the Richards Bay operation where it is processed before being fired in a co-fired boiler. Previously coal was the primary fuel source for the boiler. Other potential sources of biomass waste from surrounding plantations (stumps, off-cuts and branches) typically left in the plantations to decay are transported to the Richards Bay operation and cleaned to ensure compliance to the necessary quality requirements before being fired in the co-fired boiler.

The boiler has the capacity to use 300 tonnes of waste biomass per day, although it is currently utilised below capacity due the quality requirements that the waste biomass has to adhere to in order to be fired in the co-fired boiler.

The project has been registered and Mondi are preparing to issue their first credits in 2009. Credits from this issuance will not be sold on the open market but rather used to offset Mondi's international requirements.

The project reduces greenhouse gas emissions by curbing methane emissions from biomass degradation derived from wood-related industries (chipping operations, forestry industry) and furthermore avoids carbon dioxide and methane emissions which had resulted from the coal originally used as a fuel source in the co-fired boiler.

The CDM process has taken longer and been more complex than expected with there being very little room for flexibility on the side of the Executive Board. Mondi was responsible for developing the methodology used for this project. The methodology was first submitted for approval by the executive board in October 2005 and was finally approved in September 2006 after significant reworking.

Post approval and during the verification of the first tranche of credits Mondi discovered that the methodology is too conservative in its approach to measuring the efficiency of the boiler at the mill, to the detriment of the number of offsets that can be claimed. Efforts to allow deviations from the methodology have not been successful further adding to the delays in the issuance of credits. As a result Mondi will be claiming far fewer credits in this first submission than they believe they are entitled to.

It was felt that the process of interaction between the project developer and the executive board through the DOE was too cumbersome and time consuming to the detriment of the project developers. A further delay was caused by the DOE initially used for the first issuance having their DOE status revoked. Although this was unforeseen

it does highlight the problem of not having a DOE based in South Africa with the majority of communications happening across time lines via email and telephone.

The project contributes to the sustainable development of the host country (South Africa) in a number of ways:

- Through implementation of new biomass processing equipment, the country is gaining access to a technology that has not been used in the region at this scale before;
- Energy efficiency improvement and the use of renewable energy reduce the use of fossil based resources, contributing to the sustainable use of natural resources;
- The use of waste biomass rather than coal as a fuel has local environmental benefits in that there will be a reduction in the emissions of SO_2 and NOx, thereby improving the local air quality in Richards Bay;
- There will be a small increase in employment due to construction and commissioning of the equipment, and in the supply of the additional transport needs. This will occur specifically in the small to medium sized Enterprises (SMME).

The biomass project was one of the first industrial related CDM projects in the pulp and paper industry in South Africa. Project participants, particularly Mondi, benefited from pioneering the learning experience for the CDM process and furthermore the experience has opened up a new and very attractive option for future project developments, in Mondi and South Africa.

There is scope for further replication of the project both within and outside of South Africa's borders.

Mondi Gas Turbine Co-generation

The co-generation project consisted of the installation of a combined cycle gas turbine with a heat recovery steam generator resulting in switch of fuel sources from coal and electricity to gas. The project is South Africa's first combined-cycle cogeneration project. Input into the cogeneration system is methane rich gas directly derived from natural gas and therefore the equivalent of natural gas, from an existing pipeline. The production outputs are electricity (from the gas turbine) and heat (from the heat recovery unit) supplied to Mondi's Richards Bay pulp and paper mill.

The use of gas as a fuel resulted in a reduction of other pollutants in addition to greenhouse gas emissions, in particular sulphur oxides (SO_2), carbon monoxide (CO) and particulate emissions, thereby improving the local air quality in Richards Bay. In addition the turbine proposed for Richards Bay has state of the art, dry N_2O reduction equipment, designed to restrict N_2O (nitrous oxide) emissions, ensuring no excess demineralised water consumption to achieve a level of less than 35 parts per million of N_2O emissions when firing natural gas.

This project is still awaiting approval of its methodology which was first submitted in 2005. There is complexity in the methodology as the gas supplied to Mondi is methane enriched derived from natural gas and the methodology is required to make provision for this methane gas to be considered the equivalent of natural gas. To prove this relationship requires significant input from the third party gas supplier. There has been preliminary approval of the methodology but with changes made by the Executive Board which constrain the operations of the third party supplier resulting in the project no longer being commercially viable. Efforts to get the changes rescinded have to date proved unsuccessful.

The project contributes to the sustainable development of the host country (South Africa) in a number of ways:

- South Africa has gained access to technology that has not been used in the region before. The proposed gas turbine with heat recovery is the first project of this nature in South Africa, but its success may lead to it being rolled out across other industrial operations;
- The use of gas to generate electricity introduces a step towards the diversification of supply options in the South African electricity and energy supply mix, reducing the heavy reliance (>90%) on coal for energy services;
- The self-generation of energy on site improves the security of supply and therefore reduces the risk associated with energy supply to the operation.

There is enormous scope for this project to be replicated if the issues which impact on the third party gas supplier can be resolved and the methodology approved in a format that will ensure that the project remains commercially viable.

7.7 Chloorkop

Interview with John Skew

The Chloorkop landfill site has been operating since 1997 as a disposal site for municipal waste. The project involves the extraction of landfill gas as well as the combustion of these gases by flaring and thereafter the generation of electricity.

Chloorkop realised the opportunity and set-up vertical pilot wells initially during 2005 which are now being converted to horizontal wells in order to increase the amount of gas being collected. At the time there was a certain level of awareness around CDM which fuelled this interest in setting-up the project. Electricity generation is expected to start at the end of 2009.

Sale of credits

Financial models completed on the viability of the landfill project neglected the sale of electricity, making the project only just viable. However, currently with the sale of electricity projected to take place, the project could realise a profit in future years. In

terms of the project's progress, the initial verification linked to the first monitoring period has recently been completed.

The DNA was said to perform reasonably well. At the same time it is taken into consideration that the Chloorkop project was one of the first landfill projects to be registered in South Africa. This meant that the project was a learning experience for both sides, the DNA as well as the Project Developers and owner involved. It was suggested that the DNA could assist with the establishment of a local DOE as communication with international DOE's lead to lengthy delays in the process.

7.8 Sasol Nitro

Interview with Steven Evenwell (Production Manager)

Sasol Nitro is involved in the production of nitric acid where the nitric acid produced by Sasol undergoes further processing to make fertilisers as well as explosive material where nitrous oxide is a major by-product in the process.

The method whereby nitric acid is produced entails the catalytic oxidation of ammonia. The conversion of ammonia takes place where anything from 92 – 96 per cent of the ammonia reacts forming nitric oxide. This leaves 4 – 8 per cent of the original ammonia to form N_2O among other by-products.

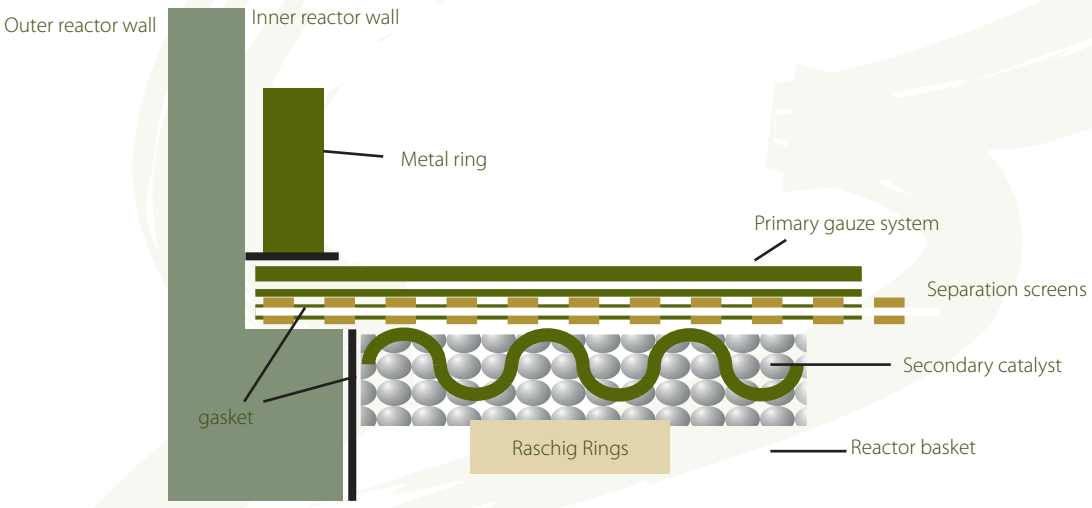
The diagram below illustrates how the N_2O reduction is achieved in the form of modifications to the various layers in the configuration of the nitric acid reactor.

The reactor basket is where the main change takes place so that the new catalyst can be installed under the gauze where the main oxidation reaction takes place.

The following advantages to using secondary catalyst over the other alternative catalysts available include:

- Operating costs as a result of energy consumption by catalyst are negligible;
- Installation required does not involved unit replacement therefore minimising required shut-down;
- Relatively low capital expenditure in comparison to alternative catalysts.

The overseas producer of the catalyst is well known and has been involved in the catalyst business for over 150 years, also working with precious metals for a variety of other complex and important applications.



Secondary catalyst installation sketch

Source: Adapted from Sasol Nitrous Oxide CDM Project Design Document Version 5, 2007

The project is being carried out at both the Sasolburg and Secunda nitric acid plants where these account for a combined PDD and therefore a combined CDM registration. The project was registered in May 2007, 6 months after submission of the PDD. As the project did not require an EIA, this cut down considerably on time taken to gain project approval.

The carbon equivalent of 1 ton of N_2O is roughly 310 tons of CO_2 which translates to a reduction of 1 million tons of CO_2 per year from both nitric acid plants. Secunda is expected to achieve 46% of these emissions with Sasolburg accounting for the remainder of these emissions.

During August 2008, the project was issued with 259,537 credits. Currently there are agreements in place with the project developer who have been contracted to trade the credits on behalf of Sasol Nitro or Sasol. Financially this project is very attractive due to the relatively low capital outlay extended as well as the high amount of credits generated resulting in a relatively short payback period

Not having a local DOE meant that response times were long and often audits would result in changes which meant more delays to the project.

It was suggested that the DNA could provide support to project owners or developers who are creating methodologies as this is where a lot of time and effort is expended during the project if a new methodology is required.

Currently Sasol has a number of other CDM projects in the pipeline which is not surprising as Sasol is involved in the manufacturing of a variety of products including chemicals, oils and gas which are used as a primary energy source in many industrial applications around South Africa.[27]

[27] www.sasol.com

7.9 Transalloys

Interview with Lou Jacobs (Services Manager)

Transalloys is one of the oldest producers of silicomanganese in South Africa. The project activity involved retro-fitting the established electrode furnaces with technology which would lead to a reduction in the amount of electricity required for the production of the silicomanganese alloy.

This was accomplished by changing both the Pitch Circle Diameter in the case of furnaces 7 and in the case of furnaces 1, 3 and 6, converting them to stationary furnaces as well as improving on the older pneumatic slipping system. The Pitch Circle Diameter is seen as an integral part of the furnace as it measures the distance between each of the three electrodes in the furnace. The international supplier involved with the modifications provides the plant with local assistance.

The catalyst behind this project was the refurbishment of furnace number 7 where the project owners wanted to improve the availability of the furnace and at the same time the efficiency. The idea was mooted to merge the refurbishment together with a CDM project leading to both economic and environmental benefits.

The project was registered during October 2007 with the PDD being approved late in 2005. Credits amounting to 160,000 tons of CO_2 for the period of 2004 – 2008 were recently issued to the plant at the end of 2008.

The major barriers encountered in developing the project were of a technical nature. The CDM Project was a learning process for Transalloys, in such a way that there were various teething problems encountered along the way while the modifications were taking place. This led to furnace downtime while the problems were being investigated.

Ultimately furnace downtime means losses in production which lead to financial losses.

This CDM project is currently one of the only CDM projects at a silicomanganese plant in SA. There are other silicomanganese plants in SA. However the replicability of this project would depend on whether there is scope for improvement at these plants as their equipment is possibly newer and more modern than that which is being used at Transalloys.

The project developers are of the opinion that apart from the financial benefit of CDM, it was beneficial for the plant to refurbish the furnaces in order to increase their efficiencies and that there are many similar opportunities throughout the country.

7.10 Tugela Sappi Mill

Interview with Gopal Naidoo (Senior Engineer)

Sappi's Tugela Mill located in Mandini, Kwazulu-Natal is responsible for the production of recycled paper and pulp amounting to 390,000 tons per year. The main energy requirement on the plant is the boiler, dating back to 1954, which provides the process with steam. Prior to implementation of the CDM Project, the mill fed the boiler on the production line entirely with coal. A CDM project activity was identified which involves a switch to biomass as a fuel source in the boiler. The term biomass can be defined as any plant substance grown with the intention of being used to produce electricity or heat and can include forest residue such as bark or decaying trees.

Sappi, as one of the largest paper and pulp manufacturers in South Africa, owns a large area of plantation forests resulting in the generation of a large amount of plant waste. The initial idea for the project arose due to the decreasing amount of available landfill space for plant waste.

The main areas in the mill requiring changes to allow the fuel-switch to occur included:

- Feed system to the boiler;
- Furnace system;
- New bark conveyor system.

The new technology incorporated into the system has been tried and tested on many similar paper manufacturing plants globally and makes use of an internationally-based supplier able to provide local support in the case of any problems while the plant is operational. Although the technology is relatively standard there are technical constraints surrounding the project activities including a lack of optimised performance in boiler feed and lower boiler efficiency.

The reduction in greenhouse gases comes as a result of the following:

- Decrease in coal-firing on the plant;
- Less land-filling taking place;
- Less transporting of coal from Mpumalanga to Durban.

By replacing a majority of the fuel source with the biomass, the company cuts back on coal in the order of 53,000 tons annually.[28] Sappi received an award for the project for the 'Most Innovative Co-generation Project' at the Africa Energy Awards in 2008.

Sale of credits

When issued, the sale of credits will take place via an intermediary firm who has had discussions with potential buyers. The amount of credits up for sale will be in the region of 55,000 CER's per year. There is the possibility that manufacturing units of Sappi (or subsidiaries) based in Europe may buy some or all of the credits making the sale of credits an intra-company transaction. This would mean that no actual financial transaction would take place but merely a transfer of the credits from the South African (non-annex 1 country) branch to the other branch (annex 1 country) waiving the requirement of an ERPA. The project has a crediting period of seven years, three times renewable.

[28] www.southafrica.info

Financial viability of Project activity/s

The project is not yet financially viable. In order to achieve financial viability of the project, the following needs to be realised:

- Increase in current operating efficiency of the boiler with modifications in place;
- Relatively high carbon credit price.

Despite financial constraints the support of the senior management at Sappi has meant that the project has a high chance of success based on the resources put aside as well as its integration into company strategy.

Constraints

A number of process constraints came up surrounding the PDD Documentation. For example, in order to gain approval of the PDD, the following changes were required:

- Measuring the weight of coal used;
- Measuring the start-up gas (as supplied by Sasol);
- Clarifying the methodology.

A further problem was that initially the Executive Board methodology laid out was not clear and well-defined at all. As the methodology was revised, the document became less ambiguous and more focused.

Comments on CDM process

The project owners found that since this was the first CDM Project in their portfolio with little know-how into the process, it was the opportunity to learn from their mistakes. Some general comments and recommendations made by the project owner on the CDM process include the fact that it is 'complex and bureaucratic' and that there are unnecessary delays involved – for example the time taken for registration and issuance steps. The project developers also noted the lack of sufficient help available from the Executive Board locally and in particular felt the need for a local DOE or increased local presence of international DOEs.

In terms of the DNA performance, both the project owner and developer were very satisfied with the DNAs performance and involvement in the CDM process. The project owner, however, did note that there was difficulty in finding the appropriate technical CDM project development support. Their experience was that there were many firms competing in this area but at the same time the project owner was left in the dark as to the competencies of each of these developers due to the lack of previous experience in the CDM environment.

Replication

Other Sappi plants around South Africa have the potential to carry out a CDM project of this nature and research is currently being done into the feasibility of setting up other CDM projects around the country. Currently other pulp and paper producers in South Africa are investing in this new technology as a means of reducing their carbon footprint.

Project Developers

CDM PROJECT DEVELOPERS KNOWN BY THE DNA TO BE OPERATING IN SOUTH AFRICA

PROJECT DEVELOPERS	WEB ADDRESS	COUNTRY OF HEAD OFFICE
Ardeer Engineering	www.ardeer.co.za	SA
AAP Carbon Limited	www.aapcarbon.com	SA
Associated Energy Services (Pty)	www.aes-africa.com	SA
Bio Coal Manufacturers and Distributors (Pty) Ltd	N/A	SA
BioTherm Energy (Pty) Ltd	www.biothermenergy.com	SA
Carbon and Environmental Option (Pty) Ltd	www.ceo-sa.co.za	SA
Carbon Reductions South Africa (Pty) Ltd (CRSA)	www.carbon-reductions.com	SA
CDM Africa Climate Solutions (Pty) Ltd	www.cdmafrica.com	SA
Clackson Power Company	www.clacksonpower.co.za	SA
Cool Earth Energy Solutions	www.coolearth.co.za	SA
C-O-Two	N/A	Germany
Danish Forestry Extension (DFE)	www.skovdyrkerne.dk	Denmark
DNS Consultants (Pty) Ltd.	N/A	SA
Eco Emfuleni (Pty) Ltd	www.ecoelectrica.co.za	SA
EcoSecurities	www.ecosecurities.com	Global
E-Hub Africa and ASHOKA	www.ashoka.org	Global
ENER.G Systems	www.energ.co.uk	UK
Envigas	N/A	SA
Environmental Intermediaries & Trading Group Limited	www.eitg.co.nz	New Zealand
Exclusive Access Trading (Pty) Ltd.	N/A	SA
Firefly Carbon	www.fireflycarbon.com	UK
Future Stock CC/ESSSA	www.esssa.co.za	SA
Gemini Structured Carbon Ltd	www.geminicarbon.com	UK
GreenStream Network	www.greenstream.net	UK
GTZ Southern Africa	www.gtz.de	Germany
Invest North West	www.inw.org.za	SA
IST Holdings (Pty) Ltd t/a Powertech	www.powertech.co.za	SA
MGM International SRL	www.mgminter.com	Brazil
Mitsubishi Corporation	www.mitsubishicorp.com	Japan
N.serve Environmental Services GmbH	www.nserve.net	Germany
National Energy Efficiency Agency of South Africa	www.savingenergy.co.za	SA
NuPlanet Clean Energy	www.nuplanet.co.za	SA
Oelsner Group	www.ruethlein.com	SA
OneWorld Sustainable Investments Pty Ltd	www.oneworldgroup.co.za	SA
ORBIT FET COLLEGE, Rustenburg	www.orbitcollege.co.za	SA
Palmer Development Group	www.pdg.co.za	SA
PFG Glass	www.pfg.co.za	SA
Promethium Carbon (Pty) Ltd.	www.promethium.co.za	SA
Quad Africa Consulting (Pty) Ltd	www.quadafrica.co.za	SA
RCS, Reflective Consulting Solutions	N/A	SA
SouthSouthNorth	www.southsouthnorth.org	Global
The Energy Development Corporation (EDC), a division of CEF (Pty) Ltd	www.cef.org.za	SA
The Ice Organisation Ltd	www.iceorg.com	UK
The Promoting Access to Carbon Equity (PACE) Centre	www.carbon.org.za	SA
Trade plus Aid	www.tradeplusaid.com	SA
Trans-Africa Projects	www.taprojects.co.za	SA
Umoya Energy (Pty) Ltd	N/A	SA

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