The Clean Development Mechanism:

a guide
for potential
participants
in South Africa

SEPTEMBER 2002

FOREWORD

I am pleased to support this publication – The Clean Development Mechanism: a guide for potential participants in South Africa.

With the Kyoto Protocol expected to come into force shortly after the Johannesburg World Summit on Sustainable Development, and at a time when there is increasing interest in cost-effective and economically viable climate change mitigation options, the Clean Development Mechanism (CDM) may provide South Africa with additional funding opportunities for a wide range of sustainable development and climate change initiatives.

South African companies participating in greenhouse gas mitigation activities may benefit by becoming increasingly competitive in meeting the world's increasing demands for products and services that achieve environmental sustainability.

Although the details of the Clean Development Mechanism are still being finalised, I believe this guide provides answers to many questions that will be raised by companies and other stakeholders wishing to discover the potential benefits and issues relating to such projects in South Africa.

I hope that you will find this guide useful and informative.

John Shaibu Kilani

CDM Executive Board Member – Africa

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CONTENTS

ACRONYMS

AIJ	Activities Implemented Jointly
AAUs	Assigned Amount Units
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CERUPT	Certified Emission Reduction Procurement Tender
CO_2	Carbon dioxide
COP	Conference of the Parties
DEAT	Department of Environmental Affairs and Tourism (RSA)
DNA	Designated National Authority
DOE	Designated operational entity
EB	Executive Board
EIA	Environmental impact assessment
EMS	Environmental management system
ERI	Energy Research Institute, University of Cape Town
ERUPT	Emission Reduction Procurement Tender
ERUs	Emission Reduction Units
FCO	Foreign and Commonwealth Office (UK)
FDI	Foreign direct investment
FES	Future Energy Solutions from AEA Technology plc
GHG	Greenhouse gas
FDI	Foreign direct investment
GJ	Gigajoule
GWh	Gigawatt hours
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standards Organisation
JI	Joint Implementation
LFG	Landfill gas
LULUCF	Land use, land use change and forestry
MW	Megawatt
NCCC	National Committee on Climate Change
NGO	Non-governmental organisation
PCF	Prototype Carbon Fund (World Bank)
PDD	Project design document
QMS	Quality management system
RMUs	Removal units
tCO_2e	Tonnes of carbon dioxide equivalent
TJ	Terajoules
UNFCCC	United Nations Framework Convention on Climate Change
WSSD	World Summit on Sustainable Development

WHY WORRY ABOUT CLIMATE CHANGE?

The capture of heat energy by water vapour, carbon dioxide and other gases in the atmosphere is a natural process – indeed, it enables the Earth to maintain a suitable temperature for life. However, human activities are adding increasing quantities of greenhouse gases (GHGs) to the atmosphere, thus causing more energy to be stored. This is leading to increases in average global temperatures that may drive major changes in the climate system. The Intergovernmental Panel on Climate Change (IPCC), a body of over 3,000 leading scientists believes that "there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities" (IPCC, 2001).

Although the Earth's climate fluctuates naturally (such as in the ice ages), changes are now faster than any natural process and unprecedented impacts are expected. Higher temperatures and changes in rainfall patterns affecting natural and human systems will cause severe impacts such as:

- reduced food security
- droughts
- loss of life due to catastrophic floods
- submergence of land by rises in the sea level
- increased spread of diseases such as malaria
- loss of wildlife areas, eg forests and coral reefs.

Countries and groups with the least resources have least capacity to adapt and are the most vulnerable. South Africa – with its arid environment and large numbers of people below the poverty line – is particularly susceptible to the impacts of climate change.

There are six GHGs; carbon dioxide has the most impact (~70%), followed by methane (~20%) and nitrous oxide (6-7%). GHG emissions result from a range of human activities, including:

- burning fossil fuels
- industrial processes
- transport
- agriculture
- deforestation.

Tackling climate change requires the 'mitigation' of GHGs, ie reducing emissions and promoting their increased absorption by vegetation through forestry and land use changes such as different agricultural practices. This will require changes to fundamental activities throughout all sectors of the global economy including energy, transport, land use, etc. Because GHGs mix in the Earth's atmosphere, neither the source of emissions nor how and where emissions are reduced matters. This underlies the justification for international co-operation.

WHAT IS THE 'CARBON ECONOMY'?

The predicted widespread and severe impacts of climate change have led to a range of international and national initiatives to promote GHG mitigation by developing a 'carbon economy'. All GHGs are equated to carbon dioxide (CO_2) according to their relative impact and the commodity in this economy is tonnes of CO_2 equivalent (tCO_2e) – known as 'carbon credits' or simply 'emissions' or 'carbon'. In the carbon economy, 'carbon income' is obtained via a stream of 'carbon credits' from GHG mitigation projects, and spot and future trades of carbon take place. The market consists of a range of elements, foremost among which is the Kyoto Protocol and its mechanisms.

The international community first acknowledged climate change as an important global issue in 1992 with the adoption of the United Nations Framework Convention on Climate Change (UNFCCC). Legislation and 'market mechanisms' have since been developed to bring GHG mitigation into the global economy. These measures have potentially far reaching impacts on the global economy and their development has inevitably involved intense debate on major political, economic and technical issues. The development process – and the debate – continues.

A landmark in this process was the Kyoto Protocol, which was adopted by the international community in 1997. This contains legally binding emission targets for the developed countries (termed Annex I Parties). At Kyoto, developed countries committed themselves to reducing their overall emissions of six GHGs by at least 5% below 1990 levels over the period 2008 to 2012. This is known as the first commitment period. Specific country targets were also agreed.

Three market-based mechanisms have been developed under the Kyoto Protocol to assist investment in mitigation and to help developed countries meet their GHG emissions targets:

- An emissions trading system to enable an international market for carbon credits.
- Joint Implementation (JI) of emission reduction projects between developed countries.
- The Clean Development Mechanism (CDM) to encourage joint projects between developed and developing (ie non-Annex I) countries. Significantly, the CDM has the dual aim of reducing emissions and contributing to sustainable development in the host developing countries.

While these mechanisms are not yet fully in place (see below), a number of developed countries are implementing legislation and introducing incentives to promote GHG mitigation. These countries are acting early to ensure they achieve their national targets. Commerce and industry in these countries are also being encouraged to:

- participate in the new market instruments
- 'learn by doing'
- benefit from low prices at the outset of the new market.

There are various carbon trading schemes in place – for example in European countries and Australia – and others are being designed.

Some companies, including multinationals, anticipate that:

- GHG emissions targets will be set for companies/sectors through incentives and/or regulation
- GHG mitigation will be required by law
- carbon will become a significant commodity.

These companies are taking the lead with proactive measures such as:

- setting their own company emissions targets
- monitoring their performance against these targets
- setting up carbon trading systems within their companies
- factoring the costs of GHG mitigation into new projects
- developing new technologies
- investing in renewable energy and energy efficiency
- trading carbon both within existing trading schemes and in a 'grey' market outside recognised schemes and frameworks.

WHAT ARE THE BENEFITS OF TAKING PART IN THE CARBON ECONOMY?

A company's participation in GHG mitigation projects may have significant benefits in terms of public and shareholder perceptions of environmental integrity. Direct financial gain is perhaps of more immediate interest to the Board.

There are likely to be new sources of finance for projects mitigating GHG emissions and carbon revenue from such projects may be significant. The South African National Strategy Study on the Clean Development Mechanism (Goldblatt et al., 2002) indicates a wide range of potential additional foreign direct investment (FDI) in South Africa arising from the CDM; the median value is US$ 99 million/year. The scale and types of opportunities in South Africa are discussed on page 30.

The growing international market in carbon credits is illustrated by the creation of a range of multi-million US$ funds that rely, in varying degrees, on expected revenue from investment in GHG mitigation projects (see Table 1). Investors include development banks, national governments and companies.

The range of existing initiatives is illustrated in Box 1, which gives details of three carbon economy instruments.

- The World Bank Prototype Carbon Fund (PCF) is designed to mirror the way that CDM will operate. It was one of the first carbon funds to be developed and has an advanced portfolio of projects. Countries participating in the PCF are required to sign a Memorandum of Understanding (MoU) with the World Bank. South Africa recently signed such a MoU.
- The Dutch Government is proactive in seeking to achieve its Kyoto target, but studies indicate that economic GHG mitigation opportunities are limited in The Netherlands and that international action is needed. The Dutch have therefore developed a scheme for investing in GHG mitigation projects internationally and acquiring carbon credits.
- The UK seeks to be a leader in the carbon economy and to make London central to carbon trading. The UK Emissions Trading Scheme, which was launched in April 2002, has achieved significant liquidity within a short time (ie a significant number of companies making trades).

TABLE 1 INVESTORS IN THE CARBON ECONOMY

FUND NAME	VALUE (IF AVAILABLE)	FOCUS	REGION
PURE CARBON FUNDS			
World Bank Prototype Carbon Fund	US$ 180 million	CDM and JI projects	Worldwide
Dutch ERUPT (Carboncredits.nl)	-	Energy efficiency Cogeneration Renewable energy Forestry	Central and eastern Europe
CERUPT		CDM projects	Developing countries in Asia, Africa and Latin America
Australian GHG Friendly Programme	A$ 1-2 million/ year	Energy efficiency Renewable energy	Australia
Natsource 'Pure' Carbon Fund	Undecided	Carbon credits	Global
PRIVATE EQUITY FUNDS WITH CARBON CREDITS			
Dexia-FondElec Energy Efficiency and Emission Reduction Fund	Euro 71 million	Energy efficiency	Central and eastern Europe
Renewable Energy and Energy Efficiency Fund (REEF)	US$ 65 million	Energy efficiency Renewable energy	Emerging market countries eligible for International Finance Corporation (ICF) financing
FondElec Latin American Clean Energy Services Fund	Expected US$ 35-50 million	Energy efficiency Renewable energy	Latin America
Black Emerald Leasing Partners	Expected Euro 500 million	Renewable energy Fuel cells	Europe
EcoInvest Energy C Fund	Target of US$ 40 million	Energy efficiency Renewable energy	Brazil
C-Tech Fund	Target of US$ 150-200 million	Alternative energy firms and projects	Mostly Europe, North America
PLANNED PRIVATE EQUITY FORESTRY FUNDS AND COMPANIES			
Hancock New Forests Australia	Seeking US$ 200 million to capitalise	Sustainable forestry	Australia
GMO Renewable Resources	US$ 50 million	Sustainable forestry	Southern USA Southern hemisphere Eastern Europe
Sustainable Forestry Management	Target of US$ 200 million	High carbon-yield forestry projects	Latin America, Australia, Africa

Source: Bürer, 2001

BOX 1: AN OUTLINE OF SELECTED CARBON ECONOMY INSTRUMENTS

WORLD BANK PROTOTYPE CARBON FUND (PCF)

- Current value US$ 180 million.
- Projects in Brazil, Chile, Costa Rica, Honduras, Hungary, India, Latvia, Morocco, Nicaragua and Uganda.
- Expects to pay around US$ 3/tCO_2e (on delivery of emissions reductions) to contracts now being signed.
- Carbon finance has a significant positive impact on the financial viability of projects, increasing the internal rate of return (IRR) by 0.5 to 5%, eg a PCF contract may increase the IRR of a project from 10% to 10.5–15%.
- Website: www.prototypecarbonfund.org

DUTCH CARBON CREDITS PURCHASE

- Ongoing purchase of carbon credits via public tenders (no preference for Dutch companies).
- Requirements include feasible project, validated baseline and host country approval.
- Eligible projects include renewable energy, fuel switching (oil to gas, coal to gas), energy efficiency, forestry and waste-to-energy.
- To date, price per carbon credit has been US$ 3–6/tCO_2e. This has equated to 5–10% of the investment cost for energy projects and over 50% of the investment cost for waste-to-energy projects.
- Under a JI tender held in 2000, four contracts were awarded worth US$ 26 million:
  - small hydropower and district heating in Romania
  - wind energy in Poland
  - small biomass boilers in the Czech Republic.
- Website: www.carboncredits.nl

UK EMISSIONS TRADING SCHEME

- Financial incentive provided to companies to accept legally binding targets for carbon reductions.
- Launched in April 2002. Initially involving some 34 organisations, but subsequently opened to some 6,000 UK companies with climate change agreements (CCAs), and due to be opened up to projects – rules for these due to be announced early 2003.
- Thirty-four organisations will deliver reductions of over 4 million tCO_2e over five years (with an average 12.5% reduction in emissions from their baselines) for government incentive funding totalling US$ 320 million.
- Daily trades (spot and future) in UK allowances, with current average price of around US$ 9/tCO_2e and transaction sizes of 5–15,000 tCO_2e. Spot prices approximately doubled between April and September 2002 (US$8-16/t$CO_2$e), due to needs of companies to meet their climate change agreements. Underlying balance of supply and demand may bring this value back down, particularly in non-milestone years (CCA targets are only set for alternate years).
- The UK Government intends to allow CDM credits to be traded within the UK emissions trading scheme at some point in the future. This will have the advantage of making the UK scheme consistent with global markets in terms of value of carbon, and could also stimulate demand for CDM credits within the UK. The details have not been announced, so it is not clear when and how CDM would be included. Plans may also be affected by developments in the EU emissions trading scheme, as this is likely to have an impact on the structure and operation of the UK scheme.
- Website: www.defra.gov.uk/environment/climatechange/trading/index.htm

Many consider that it will be financially attractive to invest in GHG mitigation projects in developing countries. Compared with international standards, countries such as South Africa have poor levels of energy efficiency and high pollutant levels. Some argue that the cost of reducing GHGs (the marginal abatement cost) is lower in developing countries. Some illustrative figures are given in the World Bank PCF Annual Report 2001 (World Bank, 2001), which indicates that:

- There are many opportunities to reduce GHGs in developing countries at a cost of US$ 1–4/tCO_2e.
- The cost is much higher in developed countries, with costs up to US$ 15/tCO_2e.
- In energy efficient economies, abatement costs already exceed US$ 15/tCO_2e.

The project cycle involved in a CDM project (see page 16) will require significant managerial input by participants and there will be significant costs in contracting external consultants. However, companies that already have a quality management system (QMS) and/or an environmental management system (EMS) will be in a strong position to achieve CDM requirements. A company might even consider integrating CDM into its wider approach to environmental and management systems.

Participation in the carbon economy, and CDM in particular, may have substantial direct financial benefits as well as improving public and shareholder image. Companies that climb the learning curve and participate early may face greater risks in this fledgling economy, but may be able to exploit the most financially rewarding project and trading opportunities.

WHAT IS THE CURRENT STATUS OF THE CARBON ECONOMY?

Debate continues on the existence of human-induced global warming, the need for measures to mitigate GHG emissions and the way in which to mitigate them. The evidence for human-induced climate change is becoming stronger and the debate has largely moved to how to mitigate GHG emissions. Businesses face major uncertainties – the main issues are outlined below.

In early 2001, the USA declared its opposition to the Kyoto Protocol, with President Bush calling it “fatally flawed”. Probably foremost in US concerns was the belief that the Protocol would harm the US economy. Many observers thought that US withdrawal threatened the existence of the Protocol. While this has not happened, many still consider that the lack of participation by the USA, which accounts for some 25% of global GHG emissions or 38% of emissions from developed countries, undermines the environmental integrity of the Protocol.

To enter into force the Kyoto Protocol must be ratified by 55 countries, including developed countries representing at least 55% of the total CO_2 emissions by developed countries in 1990. Given the large proportion of GHG emissions from the USA, virtually all developed countries must ratify for the Protocol to be enforced. As of 5 September 2002, 84 Parties (countries) have signed and 93 Parties have ratified or

acceded to the Kyoto Protocol. Those developed countries that have ratified or acceded account for 37.1% of 1990 emissions. Following the most recent international meeting of the so-called Conference of the Parties (COP), it appeared that all developed countries were committed to signing. Despite this, Australia has recently declared that it would not ratify and there was strong opposition to ratification within Canada. Russia has also yet to sign: ratification by Russia is crucial as it accounted for 17.4% of developed country GHG emissions in 1990. However, Canada and Russia announced at the recent World Summit on Sustainable Development (WSSD) that they are taking steps to ratify the Kyoto Protocol.

The value of carbon is another critical issue. Trading in the fledgling carbon market has so far been limited. Funds and schemes vary in terms of the returns required by investors and, if and how they are backed by restrictions or other incentives. Credits cannot (yet) be traded between schemes. Existing schemes only serve to indicate a rough potential value of carbon in developing countries such as South Africa.

Several studies of the potential demand and supply of carbon credits have been undertaken. Some of these suggest that, following US withdrawal, supply will outstrip demand and the price will be very low – perhaps around US$ 1/tCO_2e. However, other observers suggest that a number of factors (controlling monopolies, etc) will maintain the price of carbon at a level at which the revenue it generates will be a significant driver for projects.

Small elements of the 'carbon economy' exist. A step change in the importance of carbon as a commodity will only occur if the Kyoto Protocol is enforced. While there is considerable political momentum behind the Protocol, strong opposition is delaying and possibly jeopardizing its enforcement. Further steps towards enforcement may be taken at the next COP in October 2002.

BOX 2: AN EXAMPLE OF A CARBON TRADE

In July 2002, the brokerage firm CO2e.com announced the largest ever public trade in the GHG market. A Canadian company, Ontario Power Generation, bought the right to the emissions reductions associated with 9 million tonnes of carbon dioxide. This gas, which is produced as a by-product of natural gas processing, would normally have been vented into the atmosphere. Now it will be injected into former oil fields in Wyoming, Texas and Mississippi. The company has volunteered to cut its GHG emissions and sees these credits as a way to offset its fossil fuel emissions.

WHAT IS THE CLEAN DEVELOPMENT MECHANISM?

The outline of the three Kyoto mechanisms (of which the Clean Development Mechanism is one) was agreed in 1997. More detailed rules and procedures continue to be developed; the latest information is given on the UNFCCC website at http://unfccc.int. Within this site are the pages produced by the official CDM Executive Board (http://unfccc.int/cdm). Much of the following detail on CDM is taken from the report (COP 7 Report; UNFCCC, 2002) published after the seventh session of the COP held late last year. This report can be downloaded from the Internet at http://unfccc.int.

The CDM is a project-based mechanism provided for under Article 12 of the Kyoto Protocol. Participation is voluntary. The CDM will allow developed countries to acquire certified emission reductions (CERs) via GHG mitigation projects in developing countries. An essential feature is that projects must serve the dual purpose of sustainable development and GHG mitigation.

The Kyoto Protocol (see http://unfccc.int) describes the CDM as "reductions in emissions that are additional to any that would occur in the absence of the certified project activity". The hypothetical nature of the CDM makes it a complex mechanism to implement. Rules and procedures for the CDM have been agreed in outline, although many details remain to be determined before it becomes operational.

UNDERLYING PRINCIPLES OF THE CDM

In organisational terms, the CDM will be a linked set of entities serving under, and reporting to, an Executive Board (EB). This Board, which in turn reports to the COP, has been elected by the COP and is charged with relatively rapid progress in developing CDM rules.

Close assessment and monitoring of projects will be essential and Designated Operational Entities (DOEs) designated by the Executive Board will play a fundamental role in key stages of the CDM project cycle – design, authorisation, validation and registration, monitoring, verification and certification, issuance and trading (see pages 18–25).

Underlying principles include the following:

- The host country has the task of confirming that a CDM project is helping it to achieve sustainable development.
- CDM projects do not need a developed country partner and can be unilateral.
- All technologies can be used for CDM projects apart from nuclear power.
- Fast-track procedures will be developed for small-scale projects.
- The aim is to achieve equitable geographic distribution of CDM project activities.
- Investment in CDM projects must be additional to existing aid from developed countries: "public funding for CDM projects from Parties in Annex I is not to result in the diversion of official development assistance and is to be separate from and not counted towards the financial obligations of Parties included in Annex I".
- CDM projects should lead to the transfer of technology and knowledge that is both sound and environmentally safe.
- Land use, land use change and forestry (LULUCF) project activities are limited to afforestation and reforestation. There are limits to the extent to which Parties can use LULUCF projects to meet their targets.
- CDM projects will generate Certified Emission Reductions (CERs) – the carbon credits and the carbon finance return. The Executive Board will maintain the accounts or 'registries' of CERs. The potential value and trade of CERs are considered on page 25.

HOW WILL SOUTH AFRICA PLAY A PART IN THE CDM?

South Africa agreed to ratify the Kyoto Protocol in March 2002. There is support from the highest levels of the South African Government for integrating climate change considerations into long-term sustainable development goals for the nation. As described in the recent strategy study (Goldblatt et al., March 2002), the Government envisages several important opportunities under the CDM, including:

- the potential for new foreign direct investment
- the contribution of such investment to sustainable development
- technology transfer, human capacity and institutional building
- additional revenue streams via carbon credits.

There are some potential risks. These include:

- unforeseen negative impacts of investments
- inadequate returns from projects to local partners
- a possible future voluntary or involuntary emissions cap on South Africa. The sale of cheap reduction options now may make it more difficult to meet future emissions targets.

On balance, the latter are strategic issues. If South Africa engages with CDM in a strategic way, it should be able to:

- maximise local benefits
- avoid major risks
- support the global effort to reduce human-induced climate change.

The Department of Environmental Affairs and Tourism (DEAT) is the designated lead department responsible for co-ordinating the implementation of South Africa's commitments in terms of the UNFCCC and other related matters. The National Committee on Climate Change (NCCC) was formed in 1996 to advise the Minister of Environmental Affairs and Tourism. The NCCC includes representatives from:

- national and provincial government departments
- non-governmental, community-based and labour organisations
- business and industry
- the research community.

In terms of the key stages in the CDM project cycle, the issues for South Africa are:

DESIGN

Significant skills and knowledge about CDM exist in South Africa – most notably within universities, non-governmental organisations (NGOs) and some consultancies – to assist participants in South Africa with this stage. Useful contacts are given on page 36. Several useful documents are also available, eg the Clean Development Mechanism Guidebook for Southern Africa (Spalding-Fecher et al, 2002).

AUTHORISATION, VALIDATION AND REGISTRATION

CDM projects require authorisation from a Designated National Authority (DNA) in the host country (see below). DEAT has stated that the South African DNA has effectively been established within its offices. The lack of publicly announced sustainable development criteria is a key area of uncertainty in South Africa (FES and ERI, 2002). DNAs have so far been established in three developing countries (Colombia, Nicaragua and Uruguay).

VERIFICATION AND CERTIFICATION

South Africa could carry out the required verification and certification tasks using international DOEs that already have a

presence in South Africa. Development of national DOEs is also possible.

TRADING

South African participants could generate income from the sale of CERs from CDM projects.

In terms of the underlying principles, the issues for South Africa are as follows:

- Although equitable geographic distribution of CDM project activities is a stated aim, many people believe there is a danger that most CDM investment will go to Asian countries, which have a successful history in attracting foreign direct investment (FDI). Political and economic risks, both perceived and real, could impede CDM investment in Africa. South Africa must lead CDM developments on the continent or miss the opportunities it offers.
- South Africa already receives development assistance and FDI from a number of sources. It is thus well placed to take advantage of the likely additional funds available for CDM projects from developed countries.
- South Africa has a large land area that could be utilised for LULUCF project activities such as afforestation and reforestation. These would potentially help with climate change mitigation, sustainable development and poverty alleviation.
- To take advantage of the CERs generated by CDM projects, South Africa could establish a body and mechanisms for trading in the carbon economy.

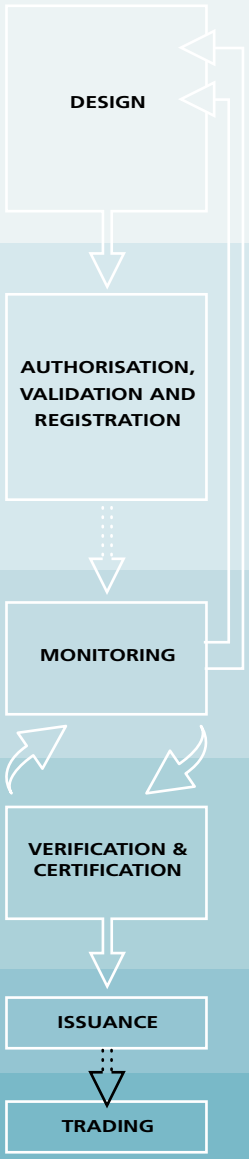
WHAT STEPS ARE INVOLVED IN A CDM PROJECT?

CDM projects will involve several extra steps compared with other energy/emissions related projects. Consistent and stringent rules are required to ensure that they produce real, measurable and long-term benefits related to the mitigation of climate change. Fig 1 summarises the five principal steps in the CDM project cycle (as recognised by the CDM Executive Board). The different steps are considered in more detail on pages 18–25.

The companies and organisations developing and investing in the project are referred to as the project participants. Countries can also invest in projects directly.

Project participants will need to hire a DOE approved by the Executive Board to undertake validation of the project design document and a different DOE to verify the project performance. These DOEs will be consultants working under contract to the project participant and selected by standard procedures such as competitive tendering.

FIG 1: SEQUENTIAL STEPS IN THE CDM PROJECT CYCLE



Project participants draw up the **project design document**. This must include:

- description of project and its boundary
- proposed GHG baseline methodology
- statement of operational life and selection of crediting period
- statement on emissions
- environmental impact analysis/assessment
- information on public funding
- public consultation summary
- monitoring plan
- calculations.

Authorisation is required from the **Designated National Authority** (DNA) in the host country. It is job of the DNA to confirm that a CDM project activity will help the country achieve sustainable development.

Validation is undertaken by an independent **Designated Operational Entity** (DOE), which:

- reviews the project design document against the requirements of the CDM
- tests assumptions
- requests revisions of the project design document (if required).

The project is **registered** by the **Executive Board** in a formal acceptance of the validated project as a CDM project activity.

The project is financed, implemented and becomes operational.

Monitoring is undertaken by the **project participants** in accordance with the plan described in the project design document. Monitoring allows the performance of the project activity in terms of mitigating GHG emissions to be assessed annually.

A **Designated Operational Entity** (DOE) is appointed to review project performance against the project design document. The DOE is likely to be different to the DOE undertaking validation. The DOE **verifies** the monitored reductions in GHG emissions that have occurred during the verification period as a result of the CDM project.

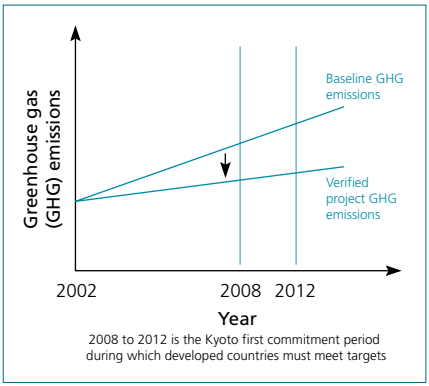
Certification is the written assurance of these reductions by the **Designated Operational Entity**.

The **Executive Board** issues **Certified Emission Reductions (CERs)**.

CERs can be traded by project participants after issuance.

A simplified graphical depiction of how a project may generate Certified Emission Reductions (CERs) through time is shown in Fig 2. The baseline is the scenario that reasonably represents the GHG emissions that would occur in the absence of the project activity. The project will generate CERs each year equivalent to the difference between the baseline and the verified GHG emissions.

FIG 2 HOW A PROJECT GENERATES CERS



2008 to 2012 is the Kyoto first commitment period during which developed countries must meet targets

The CERs generated by the project can be used by developed countries to meet their Kyoto targets during the period 2008 to 2012 (the first commitment period). CDM has 'prompt start' arrangements, ie projects can receive credits dating back to January 2000 provided the project activity is successfully validated and registered – see Box 5 for details of crediting period options. This is in contrast to Joint Implementation projects (ie those between developed countries), for which only reductions taking place after 2008 will generate credits – known as Emission Reduction Units (ERUs).

Each step will require significant managerial input by the project participants and there will be significant costs in hiring external consultants (particularly DOEs) throughout the project's lifetime. If a company is covered by a QMS or implementing an EMS (informal or formal such as ISO 14001), this will make it considerably easier to achieve the CDM requirements.

It is difficult to quote likely transaction costs for a CDM project (the additional cost of designing, registering, etc), largely because there is limited experience but also because the information is commercially sensitive. However, all agree that transaction costs will be prohibitive for small-scale projects. The Executive Board is therefore working to develop fast-track procedures for such projects (see Box 3). These may include:

- bundling of small projects
- simplified/standardised baseline procedures.

BOX 3: DEFINITION OF SMALL-SCALE CDM PROJECT ACTIVITIES

- Renewable energy projects with a maximum output capacity equivalent to up to 15MW (or an appropriate equivalent)
- Energy efficiency projects that reduce energy consumption on the supply and/or the demand side by up to the equivalent of 15GWh/year
- Other projects that reduce anthropogenic emissions by sources and that directly emit <15ktCO_2e/year.

DESIGN

The project design document (PDD) sets the context for all the following steps and sets the amount of CERs likely to arise from the project.

THE ELEMENTS OF THE PROJECT DESIGN DOCUMENT

The project design document must include the following:

- Statement of the project purpose
- Technical description of the project
- Description and justification of the project boundary (see Box 5)
- Proposed baseline methodology including:
  - either a statement of the approved methodology selected and a description of how it will be applied, or a description of a new methodology with a justification of the choice
  - a description of how national and industry policies and circumstances are taken into account.
- Statement of the estimated operational lifetime of the project and which crediting period is selected.
- Description of how anthropogenic emissions (ie those from human activities) of GHGs will be reduced below those that would have occurred without the project.
- Environmental impacts:
  - analysis of environmental impacts (including transboundary impacts)
  - environmental impact assessment (EIA) undertaken in accordance with local environmental requirements (if impacts are considered significant)
- Information on public funding from Annex I Parties and an affirmation that this funding will not divert official development assistance.
- Comments by local stakeholders, including:
  - a brief description of the consultation process
  - a summary of the comments received
  - a report of the response to these comments.
- Monitoring plan:
  - identification of data needs and data quality with regard to accuracy, comparability, completeness and validity
  - methods to be used for data collection, monitoring and reporting (including quality assurance and quality control)
  - a description and assessment of strengths and weaknesses (for new monitoring methods only)
- Calculations – description of formulae used to calculate and estimate anthropogenic emissions of GHGs from the project activity within the project boundary.

ESTABLISHING THE BASELINE

The establishment of the baseline is critical to the project's financial return. Box 4 outlines the methodologies available for baseline calculation. Box 5 indicates the options that project participants have for selecting the period of time over which CERs will be issued. Financial return will also be affected by how the project boundary is established and whether there is 'leakage'; these terms are defined in Box 5.

BOX 4: ADDITIONALITY: THE ESTABLISHMENT OF BASELINES

A CDM project is additional if anthropogenic emissions of GHGs are reduced below those that would have occurred in the absence of the proposed project activity. Additionality is judged and quantified by establishing the baseline on a project-specific basis. This is the scenario that most reasonably represents the anthropogenic emissions of GHGs that would occur in the absence of the proposed project activity.

The baseline must be established by project participants using approved methodologies. Simplified procedures can be used for small-scale projects (see Box 3). Baselines must:

- be established in a transparent and conservative manner regarding the choice of approaches, assumptions, methodologies, parameters and data sources
- take into account uncertainty
- take account of relevant national and/or industry policies and circumstances, eg power sector expansion plans and the economic situation in the sector.

The baseline can include a scenario where future anthropogenic emissions are projected to rise above current levels. The baseline must be defined in a way that CERs cannot be earned for decreases in activity levels outside the project activity or due to circumstances beyond the control of the project participants.

Project participants can select one of the following approaches. However, they must justify their choice as the most appropriate.

- Existing or historical emissions
- Emissions from a technology that is economically attractive
- Average emissions from activities undertaken in the previous five years under similar social, economic, environmental and technological circumstances, and whose performance is in the top 20% in their category.

BOX 5: CREDITING PERIOD, PROJECT BOUNDARY AND LEAKAGE

Project participants must select a crediting period from the following options:

- A maximum of seven years, which is renewed, at most, two times. At renewal, a DOE must confirm that the original project baseline is still valid or has been updated.
- A maximum of ten years with no option for renewal.

The project boundary includes all emissions of GHGs under the control of the project participants that are significant and reasonably attributable to the CDM project activity.

Leakage is defined as the net change of emissions by sources of GHGs that:

- occurs outside the project boundary
- is measurable and attributable to the CDM project activity.

AUTHORISATION, VALIDATION AND REGISTRATION

AUTHORISATION

The project must be authorised by the host country. The project design document is submitted to the South African DNA. An important element will be the assessment of this document against sustainability criteria. It is the South African DNA's prerogative to confirm whether a CDM project activity will help South Africa achieve sustainable development.

It is likely that large projects would require EIAs as part of the normal planning procedure. Authorisation as a CDM project can only be given once the EIA has been successfully completed. EIAs in South Africa are carried out on behalf of DEAT.

The DNA has effectively been established within DEAT, which has prepared sustainable development criteria for the evaluation of submissions. The final criteria are not yet available but are not expected to be more onerous than current legislation.

VALIDATION

Validation is the process of independent evaluation of a project design by a DOE against the requirements of the CDM.

Project participants will select and contract a DOE to validate their project. The DOE will review the project design document to ensure the following:

- Participation requirements are met eg participants from Parties to the Kyoto Protocol.
- Comments by local stakeholders have been invited, a summary of the comments is provided and a description is given on how these comments were taken into account.
- The environmental impacts of the project activity (including transboundary impacts) have been analysed and that, if impacts are considered significant by either the project participants or the host country, an EIA has been carried out.
- The project activity is expected to result in a reduction in anthropogenic emissions of GHGs additional to any that would occur in the project's absence.
- Baseline and monitoring methodologies comply with CDM requirements.
- Provisions for monitoring, verification and reporting comply with CDM requirements.

REGISTRATION

Registration is the formal acceptance by the Executive Board of a validated project as a CDM project activity. Registration is a prerequisite for the verification, certification and issuance of CERs related to that project activity. Box 6 outlines the membership of the Board.

BOX 6: MEMBERSHIP OF THE EXECUTIVE BOARD

The Board consists of ten members from Parties as follows:

- one member from each of the five UN regional groups
- two members from Annex I Parties
- two members from non-Annex I Parties
- a representative of the small island developing states.

Members are elected for a period of two years and can serve a maximum of two consecutive terms. The Board elects its own chair and vice-chair, with one being a member from an Annex I Party and the other from a non-Annex I Party. The positions of chair and vice-chair will alternate annually between Annex I and non-Annex I.

The current membership is listed below by country, with alternate members shown in brackets:

- Antigua and Barbuda (Samoa)
- Brazil (Chile)
- Costa Rica (Saudi Arabia)
- Denmark (Norway)
- France (Switzerland)
- Islamic Republic of Iran (Malaysia)
- Japan (Canada)
- Morocco (China)
- Russian Federation (Georgia)
- South Africa (Senegal).

MONITORING

Monitoring is an integral part of the CDM project cycle. It enables measurement of the GHG emissions from the project to be determined against both the plan and the baseline. More broadly, monitoring performance is good business practice and allows investments such as energy efficiency measures to be evaluated.

The project design document must include a monitoring plan that provides for:

- The collection and archiving of all data necessary for estimating or measuring GHG emissions occurring within the project boundary during the crediting period.
- The collection and archiving of all data necessary for determining the baseline of GHG emissions occurring within the project boundary during the crediting period.
- The identification of all potential sources of, and the collection and archiving of data on, increased GHG emissions outside the project boundary that are significant and reasonably attributable to the project activity.
- Quality assurance and control procedures for the monitoring process.
- Procedures for the periodic calculation of reductions in GHG emissions and leakage effects.
- Documentation of all the steps involved in the above calculations.

The monitoring plan must use a methodology that:

- the DOE considers appropriate
- has been successfully applied elsewhere
- reflects good monitoring practice.

Simplified procedures can be used for small-scale projects (see Box 3). If the monitoring plan is revised, this must be justified and submitted to the DOE for validation.

Implementation of the monitoring plan is necessary for verification, certification and issuance of CERs. The CERs resulting from the project are calculated by subtracting the actual emissions resulting from operation of the project from baseline emissions and adjusting for leakage.

BOX 7: AN EXAMPLE OF MONITORING: REDUCED ENERGY CONSUMPTION AT VOLKSWAGEN SOUTH AFRICA

Volkswagen South Africa (VWSA) produces around 80,000 vehicles annually. The vehicle bodies are pressed and formed on site. The engine blocks are machined and other components are added to form complete engines. The many processes required to produce a finished car consume electricity (air compressors, cooling towers, refrigeration equipment, lighting, etc), heavy fuel oil, liquid petroleum gas and some paraffin.

The plant is well run with an annual energy consumption of around 638.5TJ (177,360MWh). Energy use of this magnitude usually provides scope for efficiency measures and several were identified by VWSA. The simplest 'housekeeping' operations involved little more than repairing compressed air leaks, and turning off air compressors and lighting when they were not required. Savings of over R2 million/year were achieved from an investment of R130,000. These small number of changes also reduced CO_2 emissions by 15,000 tonnes/year. For further information on energy efficiency case studies in South Africa, visit http://www.3e.uct.ac.za

BOX 8: AN EXAMPLE OF MONITORING: IMPROVED HEATING CONTROLS AT ELECTRICAL SUBSTATIONS

This case study illustrates the advantages of monitoring the performance of energy efficiency investments to determine whether similar measures should be implemented. This example is from a UK electricity company, Southern Electric plc, which hosted a project with assistance from the UK Government's Energy Efficiency Best Practice Programme (now Action Energy) (EEBPP, 1997).

Southern Electric has over 600 major substation sites. These are heated to provide a satisfactory working environment and to protect the contents from frost and condensation. Historically, these had been electrically heated with control via an adjustable wall-mounted thermostat in each room. However, monitoring revealed that thermostats were rarely adjusted and, despite infrequent occupancy, heating was almost continuous.

In the early 1990s, Southern Electric began a programme to replace the simple thermostats at 250 substations with more sophisticated electronic controls that maintained a specified 'background' temperature unless a push-button was operated to give additional heating for a timed period.

In one of the substations, the company installed equipment to measure humidity, internal and external temperatures, and the electrical demand of the heaters. This equipment was used to collect data both before the thermostat replacement and after fitting the new controls. The monitoring demonstrated annual savings of over 32,000kWh at that station (>75%), indicating potential savings of several hundred thousands of US dollars and a payback period of less than six months for an investment programme for all Southern Electric's substations.

For further information on energy efficiency case studies in the UK, visit http://www.actionenergy.org.uk.

VERIFICATION AND CERTIFICATION

VERIFICATION

Verification is the periodic independent review and determination by a DOE of the monitored reductions in emissions of GHGs that have occurred as a result of a registered CDM project during the verification period. Project participants will select and contract the DOE – generally a different company to the one that validated the project design document.

The DOE will carry out verification as follows:

- Determine if project documents are in accordance with the requirements of the registered project design document.
- Determine the reductions in GHG emissions that have occurred as a result of the project using the procedures described in the project design document and in the monitoring plan.
- Review monitoring results and verify that:
- monitoring methodologies have been applied correctly
- documents are complete and transparent.
- Conduct on-site inspections that can include:
- review of performance records
- interviews with project participants and local stakeholders
- collection of measurements
- observation of established practices
- testing the accuracy of monitoring equipment.
- Recommend any changes to monitoring methodologies (if necessary).
- Identify and inform project participants of any concerns relating to the conformity of the project and its operation with the project design document.
- Provide a verification report that will be made publicly available.

CERTIFICATION

Certification is the written assurance by the DOE that, during a specified period, a project achieved the verified reductions in anthropogenic emissions by sources of GHGs.

Based on its verification report, the DOE will certify in writing that, during the specified period, the project achieved the verified reductions in GHG emissions that would not have occurred in the project's absence. The DOE must:

- inform project participants, the countries involved and the Executive Board
- make the certification report publicly available.

ISSUANCE OF CERS

The certification report will contain a request to the Executive Board to issue CERs equal to the amount verified by the DOE.

The issuance is considered final after 15 days, unless the Board or a project participant requests a review. A review is limited to issues of fraud, illegal action or incompetence by the DOEs.

The Executive Board will instruct the CDM registry administrator to issue the specified quantity of CERs into the pending account of the Executive Board in the CDM registry.

Following this issuance, the administrator will:

- forward an appropriate share of the CERs to cover administration expenses and to help meet adaptation* costs to the appropriate accounts in the CDM registry
- forward the remaining CERs to the accounts in the CDM registry of country investors and project participants.

CERs represent the carbon income from a project and are fundamental in this regard. Different options for trading CERs are discussed in the next section.

** the degree to which adjustments are possible in practices, processes, structures or systems in response to projected or actual changes in climate.*

WHAT ARE THE ADVANTAGES OF TRADING CERS?

The advantages to South Africa of trading CERs are:

- Participation in CDM and carbon trading will encourage investment in South Africa.
- The project participants can sell CERs and thereby generate additional income.
- Participation may create growth in the economy assisting the move towards full employment, poverty alleviation and sustainable development.

The most likely markets for CERs will be in countries that have ratified the Kyoto Protocol and have a gap between their target and their expected emissions in 2010. Companies in these countries are likely to have existing carbon liabilities that they have to meet. There is also interest by companies in other countries: companies are using CDM as an insurance policy against longer term liabilities. For example, there is a significant level of interest amongst US companies even though they are not subject to Kyoto targets on their operations in the USA.

The most likely investors in South African CDM projects will be countries that are already important investors and trade partners – a number of European countries, Japan and the USA.

Estimates of the size of the CDM market in South Africa vary widely; the National Strategy Study (Goldblatt et al., 2002) gives a range of 400–2600 $MtCO_2e$ or US$ 1–7 billion. Assuming South Africa's share of the CDM market reflects its share of world FDI, the market in South Africa will be in the region of 2.4–15.6 $MtCO_2e$ or US$ 10–100 million sales of CERs per year. The National Strategy Study estimates that at least 10 $MtCO_2e$ are available in emission reductions achievable at reasonable cost by projects of interest to private sector investors. In other words, there is sufficient supply to meet expected demand.

There are a number of potential buyers of CERs (see Box 9).

BOX 9: POTENTIAL BUYERS OF CERS

GOVERNMENTS
Those governments with a predicted shortfall relative to their Kyoto targets are likely purchasers. Examples include the Dutch Government's CERUPT and ERUPT Programmes. A pilot scheme known as Activities Implemented Jointly (AIJ) (see http://unfccc.int) attracted activity from Australia, The Netherlands, Norway, Sweden and the USA.

BROKERS
Several organisations have established themselves as brokers in environmental markets. Brokers arrange transactions between buyers and sellers, and do not usually buy on their own account. They can advise on likely prices and are a likely first port-of-call for potential sellers of CERs. Brokers may have a range of financing options available (see the section below).

TRADERS
There has not yet been sufficient liquidity to attract significant activity from traders, who seek to profit from market fluctuations by buying low and selling high.

CARBON FUNDS
The PCF (see page 8) is an example of a fund set up to help finance emission reduction projects. Private capital funds are being set up in a similar vein.

PRIVATE CORPORATIONS
Large companies may choose to invest directly in projects in developing countries in order to claim the credits to help offset their liabilities in developed countries. This is likely to be of most immediate relevance to multinationals with operations in South Africa.

Carbon savings provide additional opportunities for structured financing of projects. Upfront project finance can be arranged in a number of ways. For example, investors may want to take an equity share in the project, providing capital to fund the emission reduction aspects of the project, with rights to the CERs as part of their equity. Alternatively, investors may take a debt-based approach, making an upfront payment in exchange for the future rights to the emissions reductions. These types of transaction are most likely to arise with investors that have a broader stake in the success of the project, eg multinationals with a part share in the plant or a financial interest in the sector or the technology.

In many cases, however, transactions will:

- take place once the project is completed
- involve the project participants selling CERs to generate additional revenue from the project.

Most transactions will simply involve a direct exchange of CERs between the owner of emission reductions (eg the project participants) and the buyer. Other types of transactions can take place in the market, and will be similar to many traded commodities. These are outlined in Box 10.

BOX 10: POTENTIAL CER TRANSACTIONS

Forward stream transactions allow project developers to finance a portion of their projects through immediate revenue arising from the sale of future emissions reductions. In this type of transaction, seller creditworthiness and liability issues become important.

'Call option'. The buyer acquires from the seller the right, but not the obligation, to purchase a fixed quantity of emissions at a fixed price on or before a fixed date in the future. In return for the option premium, the seller accepts the obligation to sell the emissions if and when the buyer exercises the option. Call options are often used to hedge buyers' exposure to potential future liabilities.

The reverse of this arrangement is a 'put option', where the buyer acquires the right, but not the obligation, to sell a fixed quantity at a fixed price on or before a specified date. This arrangement could be used by project developers to hedge their projected income.

Combinations of these can be put together to provide a price floor and ceiling that provide protection from market fluctuations for the buyer and seller. Swaps are transactions in which one type of commodity is exchanged for another rather than for cash – generally because there is a tax benefit in doing so.

Bundling of emissions reductions with other energy intensive products can be used to offset the emissions associated with those products (eg coal) to make them environmentally more acceptable to the market and thereby increase their value.

The relative value of different credit types and the freedom with which they can be traded is termed 'fungibility'. The principle of market freedom has been adopted and credits arising from different Kyoto mechanisms are therefore largely equivalent. There are some restrictions on use of different credits (in particular Removal Units – see Box 11) by developed countries to meet their targets, banking of credits, etc, but these details are beyond the scope of this guide. Different types of organisation (including government, NGOs and business) can hold these credits in accounts. Box 11 gives details of different types of carbon credits.

BOX 11: CARBON CREDITS

All the following are equal to one tonne of carbon dioxide equivalent (CO_2e).

Certified Emission Reductions (CERs). GHG emission reductions achieved by project activities under the Clean Development Mechanism. The CDM's 'prompt start' arrangements (see page 17) mean that projects can receive credits dating back to January 2000.

Emission Reduction Units (ERUs). These are GHG emission reductions achieved by project activities under Joint Implementation (see page 6). Only reductions taking place after 2008 will generate credits under JI.

Assigned Amount Units (AAUs). The assigned amount is the total amount of GHG that each Party is allowed to emit during the first commitment period of the Kyoto Protocol (ie 2008 to 2012). This is broken down into measurable units which can be traded, eg either to help achieve the assigned amount or if the assigned amount is over-achieved.

Removal Units (RMUs). These are credits related to carbon 'sinks', ie eligible land use changes and forestry activities (LULUCF).

WHAT ARE THE KEY RISKS?

In addition to normal project development and investment risks, finance via the CDM has a number of important political, regulatory and market risks and uncertainties. An overview of some of the key issues is given below.

- Enforcement of Kyoto. It is not yet certain that Kyoto will be enforced, but most observers believe it may be in force by 2003. The latest information on the Parties ratifying the Protocol is given on the UNFCCC website (http://unfccc.int).

- Price of carbon and the liquidity of the market. What will be the balance of supply and demand for carbon credits? Will the price be controlled at a level at which it provides significant revenue for projects? Various models and studies (eg see the review by Goldblatt et al, 2002) have used different approaches to forecast volumes and prices of CER trade. Advice is available from brokers with carbon trade expertise, eg Natsource and Cantor Fitzgerald. Perhaps the most advanced trading platform is CO2e.com (Cantor Fitzgerald in association with PriceWaterhouseCoopers). There are also a number of briefings and journals that include carbon finance coverage, eg the Point Carbon daily e-mail briefing (http://www.pointcarbon.com) and Environmental Finance (http://www.environmental-finance.com).

- Establishment and operation of South African DNA. DEAT has established a South African CDM Secretariat and is close to finalising how the CDM rules will be implemented (the Sustainability Development Criteria are due to be published in the last quarter of 2002). More information can be obtained from DEAT and the NCCC.

- Operation of the Executive Board. It is thought that the Board will adopt a pragmatic approach rather than a bureaucratic approach, but this is uncertain. Information about the operation of the Board is given at http://unfccc.int/cdm. The Board's principle is one of transparency: the website contains notes from meetings and will contain a registry of DOEs, projects, CERs, etc.

- CDM rules. The complex nature of sustainability and environmental additionality criteria mean that small changes in interpretation might affect carbon finance or even project eligibility. For information about the CDM under development by the Executive Board, visit http://unfccc.int/cdm. Precedents are being established for baselines etc, eg under PCF. A number of energy, environmental, audit and management consultancy companies have the necessary skills and expertise, and can advise.

- DOE transaction costs. DOEs are likely to be international companies – such as the big four accountancy firms. A number of these have local offices and are South African registered companies. See Further Information for useful contact details

- Legal. There are, for example, uncertainties regarding legal ownership of CERs.

- Taxation. There are uncertainties regarding the taxation of CERs by the South African authorities and/or partner countries.

- Exploitation of opportunities in South Africa. The value of CDM investments is extracted by developed country investors, so South African partners may not gain fairly from trade. Potential project participants could seek advice or form a partnership with independent experts.
- Generation of CERs by project activity. The quantity of CERs certified may be less than planned, perhaps because of a dispute over baselines, project performance, unforeseen leakage effects, etc. Insurers such as Aon Environmental Solutions, Swiss Re and Munich Re are developing schemes to cover risks associated with CDM projects, but insurance is unlikely to be available until the rules are clearer.

WHAT PROJECTS MIGHT BE POSSIBLE IN SOUTH AFRICA?

There appear to be excellent opportunities for CDM projects in South Africa:

- large-scale projects such as clean coal technology, coal-to-gas conversions, gas supply etc that will generate millions of tonnes of credits per year
- small-scale renewable energy and energy efficiency opportunities that will enhance the rural economy and provide clean technology in manufacturing and infrastructure.

Three examples of South African projects are given below in Boxes 12–14.

The organisations listed on page 36 and the websites given on page 37 can help you to:

- learn more about the Kyoto Protocol and carbon trading
- understand how your company could take advantage of the CDM.

BOX 12: CASE STUDY: A SMALL-SCALE WIND PROJECT

South Africa has sufficient wind energy resource potential to encourage the development of small-scale projects. A typical project that would qualify under the CDM for CO_2 mitigation could have a capacity of 10MW.

A major financial barrier faced by the project would be how to obtain a suitable financial package to cover the shortfall between the cost of electricity production and the average electricity tariff charged to the municipality. This charge is approximately 50% lower than the estimated production cost from the wind farm. Details of the project are given in Table 2.

TABLE 2 SMALL-SCALE WIND PROJECT: PERFORMANCE PROFILE

CAPACITY AND OUTPUT

INSTALLED CAPACITY (MW)	CAPACITY FACTOR	ANNUAL OUTPUT (GWH)
10	33%	28,908

BASELINE AND AVOIDED EMISSIONS

In the case of South Africa, the baseline options could be (a) coal-based plant only or (b) a combination of coal, gas and hydropower. Option (a) would yield the higher number of CERs.

BASELINE	GENERATION (GWh)	EMISSIONS REDUCTION (tCO_2/YEAR)
(a) 1.08 kg CO_2/kWh	28.9	31,221
(b) 0.88 kg CO_2/kWh	28.9	25,439

PROJECT COSTS

Total cost	R125 million
Cost per MW	R12.5 million
O&M cost/year	R0.10/kWh (estimated)

CER REVENUE: Total potential revenue based on 14-year crediting period from CER sales

	CARBON PRICE		
OPTION/PRICE*	US$ 4	US$ 11	US$ 18
(a)	US$ 1.75 million	US$ 4.81 million	US$ 7.87 million
(b)	US$ 1.42 million	US$ 3.92 million	US$ 6.41 million

**CER prices based on figures from South African National Strategy on the Clean Development Mechanism (Goldblatt et al., 2002)*

ELECTRICITY SALES REVENUE

TARIFF	ANNUAL INCOME	TOTAL 14 YEAR REVENUE
R0.37/kWh	R10.7 million	R149.7 million

TOTAL PROJECT INCOME: CER + ELECTRICITY REVENUE (1US$ = R10)

	CARBON PRICE		
OPTION/PRICE*	US$ 4	US$ 11	US$ 18
Annual income (a)	US$ 1.19 million	US$ 1.41 million	US$ 1.63 million
14-year income (a)	US$ 16.72 million	US$ 19.78 million	US$ 22.84 million
Annual income (b)	US$ 1.17 million	US$ 1.35 million	US4 1.53 million
14-year income (b)	US$ 16.4 million	US$ 18.89 million	US$ 21.38 million

**CER prices based on figures from South African National Strategy on the Clean Development Mechanism (Goldblatt et al., 2002)*

BOX 13: CASE STUDY: A LANDFILL GAS PROJECT

The SouthSouthNorth project is building human and institutional capacity in the CDM project cycle through the design of candidate project activities in Brazil, Bangladesh, Indonesia and South Africa. One of the South African projects under consideration is a landfill gas utilisation project in the suburb of Bellville in the City of Cape Town. The city is permitted to continue the utilisation of the site for landfill until 2006 after which it is expected to close the site. The site will produce 16 million cubic metres of gas per year at 57% methane which is expected to last for 15 years. The gas may be used for electricity generation.

A 2MW internal combustion engine is installed to allow for increased peak generation as required and to provide for increased future gas flows as the waste decays.

TABLE 3 LANDFILL GAS PROJECT: PERFORMANCE PROFILE

CAPACITY AND OUTPUT

INSTALLED CAPACITY (MW)	CAPACITY FACTOR	ANNUAL OUTPUT (GWH)
2	52%	9.11

BASELINE AND AVOIDED EMISSIONS

In the case of South Africa, the baseline options could be (a) coal-based plant only or (b) a combination of coal, gas and hydropower. Option (a) would yield the higher number of CERs. It may be possible (depending on the baseline conditions) to bundle the electricity component of the project with avoided methane emissions up to an amount limited by the small-scale CDM project modalities of up to 15,000 tonnes of CO_2 equivalent per year (the emissions from the landfill exceed this amount). This could provide an additional income for the project of up to US$ 270,000 per year, depending on CER prices.

BASELINE	GENERATION (GWH)	EMISSIONS REDUCTION (TCO_2/YEAR)
(a) 1.08 kg CO_2/kWh	9.11	9839
(b) 0.88 kg CO_2/kWh	9.11	8017

PROJECT COSTS

Total cost	US$ million 2.42 to 2.86
Cost per MW	US$ million 1.21 to 1.43
O&M cost/year	US$164,000

CER REVENUE: Total potential revenue based on 10-year crediting period from CER sales

	CARBON PRICE		
OPTION/PRICE*	US$ 4	US$ 11	US$ 18
(a)	US$ 993,560	US$ 2.73 million	US$ 4.47 million
(b)	US$ 920,680	US$ 2.53 million	US$ 4.14 million

**CER prices based on figures from South African National Strategy on the Clean Development Mechanism (Goldblatt et al., 2002)*

ELECTRICITY SALES REVENUE (9.11 GWH/YEAR)

	TARIFF	ANNUAL INCOME	TOTAL 10-YEAR REVENUE
	US$ 0.03/kWh	US$ 273,312	US$ 2.73 million

TOTAL PROJECT INCOME: CER + ELECTRICITY REVENUE (1US$ = R10)

	CARBON PRICE		
OPTION/PRICE*	US$ 4	US$ 11	US$ 18
Annual income (a)	US$ 372,668	US$ 546,312	US$ 720,312
10-year income (a)	US$ 3.73 million	US$ 5.46 million	US$ 7.2 million
Annual income (b)	US$ 365,380	US$ 526,312	US4 1687,312
10-year income (b)	US$ 3.65 million	US$ 5.26 million	US$ 6.87 million

**CER prices based on figures from South African National Strategy on the Clean Development Mechanism (Goldblatt et al., 2002)*

BOX 14: CASE STUDY: SASOL NATURAL GAS CONVERSION PROJECT

The development of the Temane/Pande gas fields in Mozambique and the establishment of a pipeline to South Africa open various opportunities for greenhouse gas mitigation and CDM projects. The Sasol Natural Gas Conversion Project has been identified as such an opportunity.

The project involves the introduction of natural gas from Mozambique to two plants in South Africa, with a resulting reduction in GHG emissions at both plants. At Sasol Chemical Industries in Sasolburg (SCI Sasolburg), natural gas will replace coal as the feedstock for the production of synthetic gas and chemicals. At Secunda, the existing Sasol Synfuels gasification process will continue production at its current capacity for the foreseeable future using coal as a feedstock. However, future expansion will be achieved using natural gas as the feedstock. Details of the project are given in Table 4.

TABLE 4 SASOL NATURAL GAS PROJECT: PERFORMANCE PROFILE

BASELINE AND AVOIDED EMISSIONS

The baseline refers to the direct reduction of emissions at SCl Sasolburg and the avoidance of emissions at Secunda compared with business as usual with coal.

At Sasolburg, coal use will fall from 7.1 million tonnes/year to 1.9 million tonnes/year. Feedstock requirements will be met through the provision of 39 million GJ/year of natural gas. Natural gas will also be used instead of additional coal when increasing the output at the Secunda plant.

An estimated 4.2 million tCO_2e/year will be saved by the Sasolburg changes – including direct reduction and avoided emissions.

PROJECT COSTS

Total cost	R 1,155 million (Sasolburg only)
Cost per GJ	R 29.62 million

PROJECT INCOME:

	CARBON PRICE		
OPTION/PRICE*	US$ 4	US$ 11	US$ 18
Annual income	US$ 16.8 million	US$ 46.2 million	US$ 75.6 million
14-year income	US$ 235.2 million	US$ 648.8 million	US$ 1.058 billion

**CER prices based on figures from South African National Strategy on the Clean Development Mechanism (Goldblatt et al., 2002)*

FURTHER INFORMATION
USEFUL CONTACTS

The following organisations can provide assistance and advice:

Business Council for Sustainable Development: South Africa
Tel: +27 (0) 11 880 0077
Fax: +27 (0) 11 447 0848
Website: www.ief.co.za

Chemical and Allied Industries' Association (CAIA)
Tel: +27 (0) 11 482 1671
Fax: +27 (0) 11 726 8310
Website: www.caia.co.za

Development Bank of South Africa (DBSA)
Tel: +27 (0) 11 313 3911
Fax: +27 (0) 11 313 3086
Website: www.dbsa.org

Energy Research Institute (ERI), University of Cape Town
Tel: +27 (0) 21 650 3892
Fax: +27(0) 21 686 4838
Website: www.eri.uct.ac.za

Future Energy Solutions (UK)
Tel +44 (0) 1235 433302
Fax +44 (0) 1235 432923
Website www.future-energy-solutions.com

KPMG
Tel: +27 (0) 11 647 7111
Fax: +27 (0) 11 647 8000
Website: www.kpmg.co.za

PriceWaterhouseCoopers
Tel: +27 (0) 12 429 0000
Fax: +27 (0) 12 429 0100
Website: www.pwc.co.za

RMB Resources (Finance)
Tel: +27 (0) 11 282 8000
Fax: +27 (0) 11 282 8259
Website: www.rmb.co.za

South African Chamber of Business (SACOB)
Tel: +27 (0) 11 446 3800
Fax: +27 (0) 11 446 3850
Website: www.sacob.co.za

South*South*North
Tel: +27 (0) 21 425 1464
Fax: +27 (0) 21 425 1463
Website: www.southsouthnorth.org

Sustainable Energy and Climate Change Partnership (SECCP)
Tel: +27 (0) 11 339 3662
Fax: +27 (0) 11 339 3270
Website: www.earthlife.org

World Bank
Tel: +27 (0) 12 431 3100
Fax: +27 (0) 12 431 3134
Website: www.worldbank.org

FURTHER INFORMATION
USEFUL WEBSITES

SOUTH AFRICAN GOVERNMENT

Department of Environmental Affairs and Tourism	www.environment.gov.za
Department of Minerals and Energy	www.dme.gov.za
Department of Trade and Industry	www.dti.gov.za

SOUTH AFRICAN ORGANISATIONS

Energy Research and Development Centre (EDRC), University of Cape Town	www.edrc.uct.ac.za
Energy Research Institute (ERI), University of Cape Town	www.eri.uct.ac.za
Minerals and Energy Policy Centre (MEPC)	www.mepc.org.za
South*South*North	www.southsouthnorth.org
Sustainable Energy and Climate Change Partnership (SECCP)	www.earthlife.org

INTERNATIONAL BODIES AND INITIATIVES

CDM	http://unfccc.int/cdm
IPCC	www.ipcc.ch
UNFCCC	http://unfccc.int

FUNDS AND TRADING SCHEMES

Dutch Carbon Credits Purchase	www.carboncredits.nl
UK Emissions Trading Scheme	www.defra.gov.uk/environment/climatechange/trading/index.htm
World Bank Prototype Carbon Fund	www.prototypecarbonfund.org

TRADING FACILITATORS

Aon Environmental Solutions	www.aon.com
Cantor Fitzgerald	www.cantor.com
CO2e.com	www.co2e.com
Munich Re	www.munichre.com
Natsource	www.natsource.com
PriceWaterhouseCoopers	www.pwcglobal.com
Swiss Re	www.swissre.com
The Carbon Trader	www.thecarbontrader.com

MEDIA

Environmental Finance	www.environmental-finance.com
Point Carbon	www.pointcarbon.com

Disclaimer: FCO, FES and ERI take no responsibility for the content and availability of these websites. This is not an exhaustive list of contacts. The listing of an organisation should not be regarded as an endorsement of its service by the authors. Similarly, no responsibility is accepted for omissions and no claim is made for the competence or otherwise of any organisation not listed.

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Climate Change Challenge Fund

The FCO has made available £800,000 to fund the Climate Change Challenge Fund (CCCF). This Fund, jointly owned by the FCO and the Department for Environment, Food and Rural Affairs (DEFRA) in the UK, aims to tackle the issues surrounding climate change. The Fund's objectives are to:

- help developing countries move towards less carbon-intensive economic growth
- help developing countries meet convention obligations and take a full role in the Kyoto Protocol

www.fco.gov.uk/environment

Copies of the guide are available from:

IN SOUTH AFRICA:
Energy Research Institute, University of Cape Town
Private Bag, 7701 RONDEBOSCH
Tel: +27 21 650 3892 Fax: +27 21 686 4838
and
British High Commission Pretoria
255 Hill Street, Arcadia 0002, Pretoria
Tel: +27 483 1317 Fax: +27 483 1302

IN UK:
Future Energy Solutions (FES), 154 Harwell, Didcot, Oxfordshire OX11 0QJ
Tel: +44 1235 433302
Fax: +44 1235 432923

UNIVERSITY OF CAPE TOWN
Energy Research Institute

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