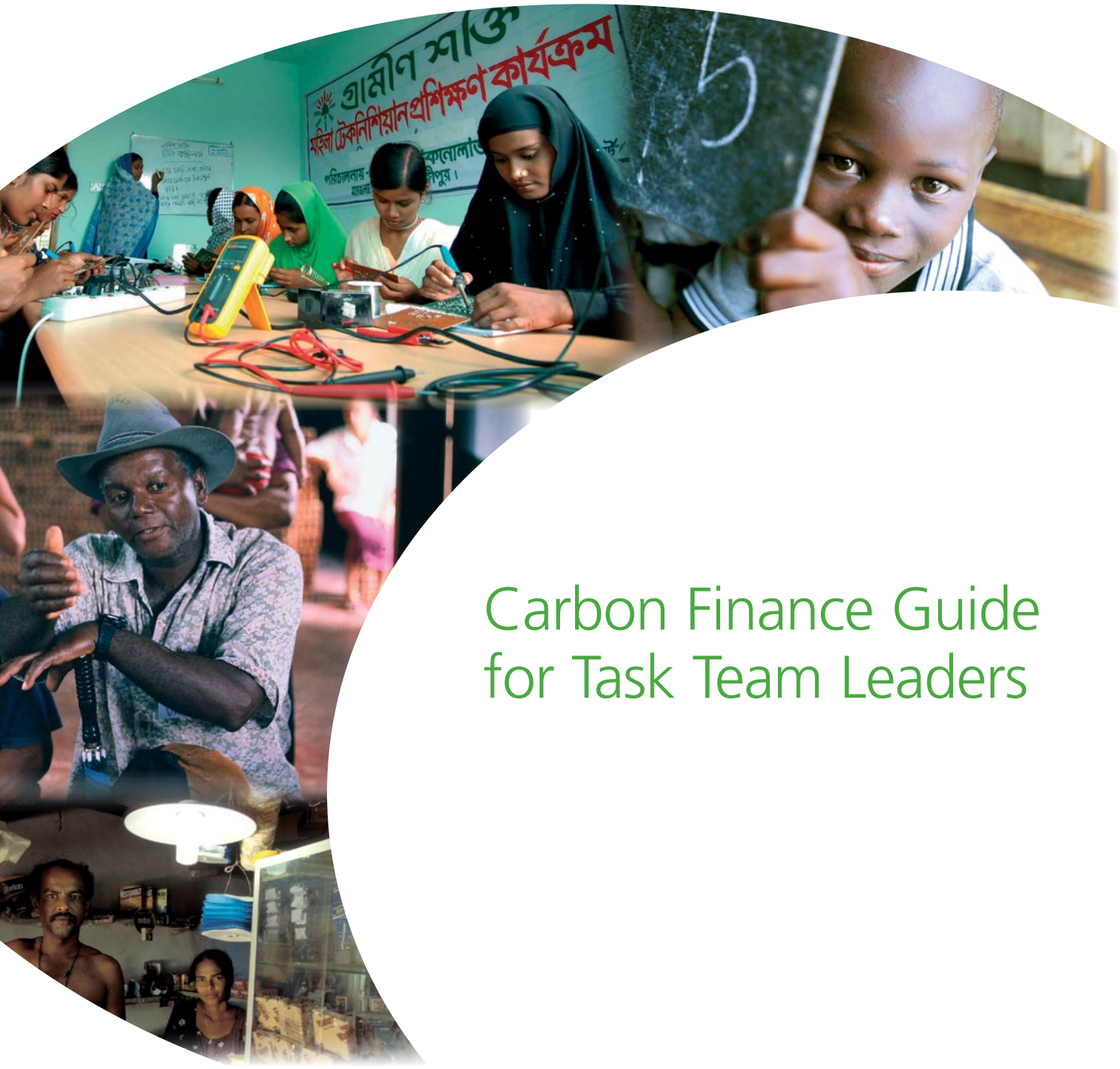


Carbon Finance Guide for Task Team Leaders

Coordinated by
Haddy J. Sey
Task Team Leader, World Bank

Written by
Maryanne Grieg-Gran, IIED
Muyeye Chambwera, IIED
Barry Kantor, South*South*North
Thais Corral, South*South*North

COMMUNITY DEVELOPMENT CARBON FUND

Carbon Finance Guide for Task Team Leaders

Coordinated by
Haddy J. Sey
Task Team Leader, World Bank

Written by
Maryanne Grieg-Gran, IIED
Muyeye Chambwera, IIED
Barry Kantor, South*South*North
Thais Corral, South*South*North

Carbon Finance Unit
World Bank
1818 H Street, NW
Washington, DC 20433 USA
Tel: (202) 473-1000
Fax: (202) 477-6391
www.carbonfinance.org

Acknowledgements
This guide was produced by the International Institute for Environment and Development (IIED) and SouthSouthNorth (SSN) for the Community Development Carbon Fund (CDCF). The main authors are Maryanne Grieg-Gran and Muyeye Chambwera of IIED, and Barry Kantor and Thais Corral of SSN. Thanks are due to Maryke Steffans for her editorial work, Eileen Higgins for layout and design, and Kate Lee of IIED for coordinating the production of the whole toolkit. We are also grateful to Andre Pinna former CDCF Manager, Jorge Gastelumendi former CDCF Analyst, Brice Quesnel the current CDCF fund Manager, and to all the World Bank staff that reviewed the toolkit drafts.

Design: Eileen Higgins email: eileen@eh-design.co.uk
Print: Park Communications web: www.parkcom.co.uk

Contents

List of figures, boxes and table

Acronyms

CCB	Climate, Community and Biodiversity (as in project design standards)
CDCF	Community Development Carbon Fund
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFU	The Carbon Finance Unit (of the World Bank)
COP	Conference of the Parties
DNA	Designated National Authority
DNV	Det Norske Veritas
DOE	Designated Operational Entity
DOE	Designated Operational Entity
ERPA	Emissions Reduction Purchase Agreement
ERU	Emission Reduction Unit
ETS	Emissions Trading System
GDP	Gross Domestic Product
IETA	International Emissions Trading Association
IDA	International Development Association (of the World Bank)
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Country
MOP	Members of the Parties
MSIF	Moldova Social Investment Fund
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
PDD	Project Design Document
PDT	Project Design Team
PP	Project Participants
RET	Renewable-energy and Energy-efficient Technology
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard
WBCSD	World Business Council for Sustainable Development

1

Introduction

The opportunities and challenges for carbon finance with community benefits

As concern increases over the impacts of climate change, policymakers are seeking cost-effective ways to reduce greenhouse gas emissions, which do not undermine the achievement of development objectives. The carbon market, which equates to over US$100 billion annually, is an important part of this quest as it allows those with high costs of abatement to pay others with lower costs to undertake emission-reducing activities. In this way, the overall costs of reducing emissions at a global level can be considerably lowered. As many of these low cost emission reduction opportunities are in developing countries, carbon projects could be beneficial for development as well as for addressing climate change. Carbon projects could offer a way of tapping into additional funds to finance development programs.

Many of the World Bank's regular development activities offer opportunities for building in emission reduction activities. But developing carbon projects that involve or benefit poor communities or poor countries can be challenging, because as in most markets, large-scale projects without complicated institutional arrangements are likely to be more competitive. Small-scale projects implying high transaction costs, and operating in high risk environments have difficulties in attracting buyers.

The Community Development Carbon Fund (CDCF), one of 10 World Bank carbon funds, has gained valuable experience in addressing these challenges and showing how carbon projects can benefit poor communities. The CDCF was created to extend the benefits of carbon finance to the poorest countries and poor communities within them. It has supported projects that measurably benefit poor communities as well as generating Kyoto-compliant emission reductions.

Aim and scope of the guide

This guide draws on the CDCF experience to help Task Team Leaders in World Bank regular projects to understand carbon finance and to identify opportunities for developing carbon finance projects that benefit communities.

It gives a basic overview of climate change in Section 1, followed in Section 2 by an explanation of the carbon market and a review of the opportunities for promoting development and in particular community benefits through climate change mitigation. Section 3 sets out the different ways in which carbon finance is relevant to regular World Bank lending and development programs, leading into an overview in Section 4 of technologies that are likely to be relevant to small carbon projects. Section 5 sets out the steps needed to develop a carbon project that can benefit or involve communities and the final Section 6 indicates some useful sources of information to get started. Throughout, the guide draws heavily on the experience of the World Bank's CDCF in promoting carbon projects that benefit poor communities.

This guide forms part of a set aimed at different audiences. One guide is targeted at local governments and the other is aimed at communities and organizations working with communities. A separate technology manual gives information on a number of small-scale technologies that would be promising for the carbon market.

2

Understanding climate change

What is climate change?

There are a number of signs that the world's climate is changing and that these changes will intensify over the coming years. The earth's average temperature is increasing, while droughts, storms and hurricanes are occurring more frequently. The increase in temperature is leading directly to a rise in sea levels and also indirectly through more rapid melting of icecaps and glaciers.

As climate is inherently variable, these changes are not always noticeable in the short-term. But when we look at trends over a long period, a 100 years or more, the changes are clearer. Measurements dating back over 100 years show that the average temperature of the earth has increased by nearly 1°C since the late 1800s and that the average sea level has risen by 10 to 20 centimeters. Scientists in the Intergovernmental Panel on Climate Change (IPCC) predict that the earth's average temperature will increase by a further 1.8 to 4°C by 2100 and average sea level will rise further by 8 to 59 centimeters.

The cause of climate change

There is scientific consensus that the main cause of these climatic changes is human activity; in particular industrialization, based on burning fossil fuels (coal, oil, gas) that has occurred over the last 150 years, the clearing of forests and the intensifying of farming practices. These activities have increased the amount of greenhouse gases in the atmosphere, notably carbon dioxide, methane and nitrous oxide. These gases act like the glass roof of a greenhouse, trapping heat from the sun and preventing it from being reflected back into space. In normal quantities these gases play a useful function, preventing the earth from losing heat and becoming too cold for human habitation. But the build up of these gases in the atmosphere in ever-increasing quantities has the very negative effect of trapping too much heat. As a consequence, temperatures are increasing, leading to a rise in sea level and a range of related effects.

Solar energy is used to light a village shop, Sri Lanka

Possible impacts of climate change

If emissions continue to increase, the impacts of climate change could make the earth uninhabitable in the long-term. For this reason, it is essential to reduce emissions. But even if we achieve this, we will still see some impacts, most of which will fall particularly hard on developing countries. Increasing temperatures and more frequent droughts will reduce agricultural yields in most tropical and sub-tropical countries and in some temperate countries. Higher temperatures

will cause insect-borne diseases such as malaria to spread over larger areas. Rising sea levels and an increased frequency of severe storms will threaten the continued existence of some low-lying islands and coastal areas, and could damage infrastructure, housing, industry and agricultural production in these regions. Water supplies will also be affected by sea level rise as saltwater makes its way into underground freshwater sources. This is already happening in Thailand, in various small islands in the Pacific and Indian Oceans and in the Caribbean. Some areas will become uninhabitable and the people that live there will need to migrate.

The Stern Review of the Economics of Climate Change translated the effects of climate change into economic terms. It predicts that global warming will lead to a 20 per cent loss of the world's economic production as measured by Gross Domestic Product (GDP) and that the poorest countries will be the worst affected.

This is in part because of their heightened exposure; many developing countries are located in drought- and flood-prone areas and heavily rely on activities such as agriculture and fishing, which are sensitive to climate variation. In addition, many developing countries lack capacity and resources to adapt to any changes in the climate.

Global efforts to address climate change through mitigation

The United Nations Framework Convention on Climate Change (UNFCCC), which took effect in March 1994, represents the first international action to address the problem of global warming. It encouraged developed countries (called Annex 1 countries in the convention) to reduce their emissions of greenhouse gases to 1990 levels by 2000, in effect to stabilize their emissions. By 2007 the convention had been ratified by 191 countries and the European Union. The Kyoto Protocol took these efforts further, providing a legally-binding framework. It was adopted in 1997 but only enforced in February 2005 after ratification by the required number of industrialized countries.

The Kyoto Protocol has two key features:

- Legally-binding emission reduction commitments.
- Flexibiliy mechanisms.

Under the Kyoto Protocol, developed countries commit to reducing their annual emissions of greenhouse gases by an average of 5 per cent below 1990 levels over the five year period from 2008 to 2012. The target is averaged over five years to take account of year-to-year fluctuations in emissions. The requirements are stricter for developed countries for two main reasons: they have greater financial resources and their accumulated emissions, produced by industry over the last century or more, greatly exceeds the emissions of developing countries.

In addition to carbon dioxide (CO_2), five other types of greenhouse gas are recognized in the Kyoto Protocol:

- Methane (CH_4).
- Nitrous oxide (N_2O).
- Hydrofluorocarbons (HFCs).
- Perfluorocarbons (PFCs).
- Sulphur hexafluoride (SF_6).

To indicate their global warming potential, emissions of these gases are converted to carbon dioxide equivalents (CO2e). For example, 1 unit of methane is considered equivalent to 21 units of carbon dioxide.

3

Promoting development through climate change mitigation

The carbon market?

A distinctive feature of the Kyoto Protocol is the concept of flexibility mechanisms. These aim to help developed countries meet their emission reduction commitments in the most efficient way possible. The mechanisms allow for trading of emission reductions between countries, so that polluters with high emission reduction costs can pay others with lower costs to cut back more. In this way the total cost of emission reductions is reduced. This flexibility is possible because a unit emission of greenhouse gas has the same impact regardless of the country where it is emitted. The mechanisms work in two main ways:

- **Emissions trading** – developed countries that reduce their emissions of greenhouse gases to levels below their assigned amount can sell these excess emission reductions to others. Conversely, they can buy emission reductions from other countries to meet their target. This mechanism has led to the establishment of regional and national emission trading systems, the largest being the European Union's (EU's) Emissions Trading System (ETS).

- **Investment in projects** – developed countries can meet part of their emission reduction requirements by investing in emission reduction projects in other countries through the following:

  - **Clean Development Mechanism (CDM)** – developed countries can invest in projects in developing countries to generate Certified Emission Reductions (CERs).
  - **Joint Implementation** – developed countries can invest in projects in other developed countries to generate Emission Reduction Units (ERUs).

Emission reduction targets are only valid for the five years from 2008 to 2012. This has created some uncertainty for the carbon market. As negotiations proceed and the evidence indicating the seriousness of climate change accumulates, it is increasingly likely that there will be a further set of emission reduction targets set and that the flexibility mechanisms of the Kyoto Protocol will be retained.

Introduction to the CDM

The CDM is the main means by which developing countries can participate in the carbon market. It was set up with two main aims:

- To assist developing countries to achieve sustainable development through benefits from greenhouse gas emission reduction projects.
- To assist developed countries to meet their emission reduction commitments by allowing them to use emission reductions from projects in developing countries to meet part of their emission reduction targets.

Under the CDM, developers of emission reduction projects, such as renewable energy or energy efficiency projects, can sell carbon credits to buyers in developed countries. The developers

of CDM projects can be private companies, particularly those involved in energy generation, energy conservation or those using significant amounts of energy, both national and local governments and in some cases non-governmental organizations (NGOs) and community-based organizations. Sometimes one or more of these stakeholder groups work in partnership to develop a CDM project.

The buyers of CDM carbon credits are governments that have emission reduction commitments under the UNFCCC/Kyoto Protocol and companies that are currently (or likely to be in the future) subject to national emission controls or are part of national or regional emissions trading schemes. Companies covered by the EU ETS can use credits from CDM projects to reach their emission targets, subject to limits set by each member state.

In order for buyers to have confidence in the carbon credits they buy from CDM projects, the Executive Board (EB) of the CDM must approve these projects. This ensures that the project meets the necessary criteria and that the carbon credits on offer are genuine and will be accepted by others. (See Section 6 for an overview of the steps involved in getting approval for a CDM project.)

The CDM, as of June 2009, had registered 1,665 projects and expects to generate 1.6 billion tons[1] of certified emission reductions (CERs) from currently registered projects by 2012[2].

Alongside the CDM registration process, some additional standards and verification processes have been developed to provide further guarantees of the emission reductions and sustainable development benefits. Credits from projects that have been certified to these standards often command a premium. The Gold Standard focuses on renewable energy or energy efficient technologies and is designed to demonstrate the sustainable development benefits of CDM projects, as these have to meet a number of criteria relating to their impact on the environment, social networks and local economy[3].

Carbon finance at the World Bank

The World Bank established the Carbon Finance Unit (CFU) with the aim of creating a global carbon market that reduces transaction costs, supports sustainable development and reaches and benefits the poorer communities of the developing world. The CFU handles a portfolio of projects, many of which have been developed separately from the Bank's regular lending operations. There is now a move to mainstream carbon finance into the Bank's regular lending and development assistance projects.

The CFU does not give grants or loans to projects but purchases emission reductions on behalf of governments and companies in developed countries that use these to meet their commitments under the UNFCCC and Kyoto Protocol. It manages a series of carbon funds, which purchase project-based emission reductions. Each fund is characterized by the nature of the projects and technologies it targets, or by the source of the funds, or in some cases by both.

The Prototype Carbon Fund was the first carbon fund set up by the CFU. The objective was to test carbon finance and learn by doing. This was followed by two funds: the CDCF and the Biocarbon Fund. These three funds pool capital contributed by governments and companies in Organization for Economic Co-operation and Development (OECD) countries to purchase greenhouse gas emission reductions from CDM projects. The CDCF targets small-scale CDM projects that benefit local communities. The Biocarbon Fund targets sustainable resource management and conservation projects that reduce emissions as well as help to alleviate poverty of local communities.

1. A metric ton is used here to describe 1000 kilograms.
2. http://cdm.unfccc.int/Statistics/index.html (viewed on 15 June 2009).
3. Introducing the Gold Standard – www.cdmgoldstandard.org (viewed on 16 June 2009).

The other funds managed by the CFU are differentiated by the source of their capital, which is country or region specific. Denmark, the Netherlands, Spain and the European Union have all set up funds with the aim of securing emission reductions to meet their international commitments. Finally, the Umbrella Carbon Facility pools finance from all the other carbon funds to purchase emission reductions from large CDM projects.

The CDCF – experience in promoting mitigation and development

The CDCF was created in response to concerns about the ability of the CDM and carbon finance to reach the smallest and poorest developing countries. The World Bank had found that because many of the poorer developing countries did not have large energy and industrial sectors, they could not generate large enough clean energy projects to qualify under the CDM. Because of the relatively high transaction costs and the high risks associated with small-scale projects, such countries were unlikely to attract carbon finance and to benefit from the CDM.

At the end of 2008, over the six years since its founding, the CDCF has supported 28 projects with Emissions Reduction Purchase Agreement (ERPA) signatures, all generating benefits for local communities, directly and indirectly. The CDCF's experience provides very useful lessons on the different ways in which carbon projects can benefit poor communities.

CDCF projects ensure benefits to local communities in two ways: either directly through the nature of the services provided by the project, for example rural electrification, or indirectly through a planned program of activities identified by the communities themselves and financed through a premium placed on the carbon payment. A key objective of the CDCF is community empowerment – to ensure that communities are capable of playing an active role in the delivery of services that improve their socioeconomic conditions. It is not considered sufficient that projects simply bring services to local communities. The community must have a voice in decisions and the capacity and resources to actively participate in the design, implementation, monitoring and maintenance of those services.

The CDCF projects have provided opportunities therefore not just to reduce carbon emissions but also to encourage innovative community-based development initiatives by linking private companies with community development projects.

CDCF experience: range and type of projects funded

CDCF has typically funded small-scale projects with emission reductions in the range of 40,000 tons of CO2e up to more than 1 million tons. By the end of 2008, CDCF had signed ERPAs for 28 projects, committing just under US$90 million to purchase emission reductions of 9.4 million tons of CO2e. It also had 14 projects in the pipeline, of which seven were at an advanced stage of the project development cycle[4].

A large proportion, some 50 per cent, of the funds committed in ERPAs were with projects in CDCF's designated priority countries. These include least developed countries (LDCs) and International Development Association (IDA) countries. To date South Asia has been the lead recipient of CDCF funds with 35 per cent of the total, followed by Africa with 31 per cent[5]. CDCF has also been active in economies in transition, such as Moldova and Georgia.

CDCF projects cover a wide range of technologies in the following three broad categories:

- **Renewable energy** – in 2008, two thirds of committed funds (approved projects and those at the carbon finance document stage) corresponded to renewable energy projects, including solar, micro-hydro, biogas digesters, geothermal energy and generation of energy from bagasse (sugarcane waste).

4. Carbon Finance for Sustainable Development 2008, Carbon Finance Unit, World Bank.
5. Based on total emission reductions and value of projects at emission reductions purchase agreement and carbon finance document stage. (Carbon Finance for Sustainable Development 2008)

- **Energy efficiency** – these accounted for 27 per cent of committed funds at the end of 2008 including reduction of energy consumption in small-scale manufacture of goods such as bricks, improved efficiency of heating in public buildings, water pumping improvements to reduce the energy required for water delivery, and co-generation (producing heat and energy).

- **Waste management** – these projects, which include improvements in methane capture from solid waste management and wastewater management, accounted for 16 per cent of CDCF's portfolio of committed funds.

How community benefits are promoted in CDCF projects

CDCF projects have operated in the same way as other CDM projects in terms of emission reductions. For example, they have used an approved methodology to estimate baseline and annual emission reductions and they have demonstrated 'additionality', or the capacity to cause a drop in emissions beyond what would have occurred in the absence of the project. However, they have had a distinctive approach to community benefits, which together with the emission reductions are an essential deliverable in the contract between the project developer and CDCF.

Each CDCF project has been designed to deliver benefits to any local community with a geographical, cultural or historical association with the project. These benefits are monitored and measured, and form part of the ERPA. In some circumstances, CDCF is paying a premium on top of the carbon price in recognition of the community benefits generated. As part of the ERPA contract, the project developer is responsible for ensuring implementation of the community benefits plan and for reporting on progress and outcomes. A monitoring plan is put in place with an agreed set of indicators developed in consultation with the local community, as well as a methodology for data collection.

Community benefits in CDCF projects can be either direct or indirect.

- **Direct benefits** – these are inherent to the nature of the project activity. For example, provision of electricity in rural areas using renewable technologies will not only deliver emission reductions but will have positive impacts on people's livelihoods. For projects that are deemed to provide sufficient direct benefits without the need for an additional benefits package, the project developer periodically provides a report.

- **Indirect benefits** – where projects do not generate sufficient direct benefits for local communities, an additional community benefits plan will be drawn up in consultation with the community. This benefits plan involves activities that the communities propose based on their own assessment of their needs and priorities and do not have to be mitigation-related activities. Typically, the benefit activities that communities choose are the building of schools and health centers, improvements in water supplies, or other infrastructure. The benefits plan is financed through a premium paid by CDCF for the emission reductions.

People collecting clean water, India

Box 1 gives an example of a CDCF project in Guyana that, although having an important aim to promote industrial activity, also provides both direct benefits in the form of electricity provision and indirect benefits to the local community.

Box 1. Skeldon sugar modernization project in Guyana – example of the use of a community benefits plan

This large industrial project uses bagasse (waste from processing sugarcane) in a power plant to produce heat and electricity (co-generation) for a sugar mill and for the national grid. The project is supported by carbon finance from the World Bank CDCF and reduces emissions by replacing light oil and diesel fossil fuels used in the mill and in grid electricity generation.

The CDCF expects to purchase 309,500 tons of CO2e from the project by 2015. The community will benefit directly from improved electrical services in the region. But there are also a number of indirect community benefits, as part of the carbon revenue from this CDM project is being used to support various activities such as assistance to a local hospital, improvements to a community center, and urban landscaping in public areas. In addition, new jobs will be created during construction and operation, both in the new sugar mill and in local farms, which will expand sugar cultivation.

Source: http://wbcarbonfinance.org

Opportunities for community-based carbon projects in the voluntary market

CDCF has played an important role in promoting small-scale CDM projects and in showing how larger projects can be designed to benefit poor communities through community benefit plans. But there may be opportunities for community-based carbon projects outside of the compliance market in the increasingly important voluntary market.

This market has developed alongside the official market, meeting the demands of buyers who have been prompted by a variety of motives. In some cases it has been the desire by individuals, organizations or companies that are not subject to emission reduction requirements to take responsibility for their emissions, in others the main driver has been concerns about reputation.

The voluntary market has developed rapidly over the last few years. A recent review[6] identified 182 suppliers operating in 28 countries and estimated the size of the market at 123 million tons of CO2e, up by 87 per cent from the previous year. This is about a third of the size of the CDM, which reached 389 million tons in the same year[7]. But the voluntary market is expanding steadily and is expected to reach 476 million tons CO2e by 2020.

From the community development perspective, the voluntary market for carbon offsets shows considerable promise. In this market, buyers have other motivations besides regulatory compliance, such as a desire to take responsibility for their impacts on the global environment or to improve reputation. They are likely to be interested in a range of attributes of the offsets such as development benefits or poverty reduction, and securing the lowest price may not be the prime concern for such buyers. This applies particularly to individual purchasers but also to businesses buying offsets for operational activities as well as NGOs and charities. There is therefore more scope for offsets from small-scale projects, which cannot compete in the CDM, to find buyers in the voluntary market.

In the early stages of the voluntary market, one of its attractions was its simplicity relative to the CDM. As projects in the voluntary market did not have to follow the CDM procedures for validating emission reductions, the process of project development and marketing of carbon credits was relatively simple, and the transaction costs were therefore lower. However, in response to misgivings about the credibility of the emission reductions a number of standards have been developed. Many projects are now seeking third party verification of their projects and emission

6. State of the Voluntary Carbon Markets 2009 – Ecosystem Marketplace and New Carbon Finance.
7. State and trends of the Carbon Markets 2009 World Bank.

reductions in order to increase credibility. Last year, 96 per cent of the transacted credits were third party verified[8].

The voluntary carbon standard (VCS), which is backed by the Climate Change Group, the International Emissions Trading Association (IETA) and the World Business Council for Sustainable Development (WBCSD), was introduced in November 2007[9]. It aims to provide a clear chain of ownership over voluntary offsets that prevents them from being used twice. This is achieved through recently launched multiple VCS registries and a central project database that will be open to the public. Last year VCS was the most popular standard accounting for nearly half of the transacted volume[10]. The VCS emphasizes the credibility of the emission reductions and gives relatively little attention to the sustainable development impact of the projects concerned. However it is increasingly applied together with other standards that emphasise these aspects. For example the Climate, Community and Biodiversity Project Design Standards (CCB Standards), which evaluate land-based carbon projects in the early stages of development, give attention to the impacts on communities and local biodiversity.

The other main player in standards is the Gold Standard, which can also be applied to voluntary projects. It has been in operation since 2006 and since the beginning of 2008 it has had a registry in place. Projects are independently verified by UN-approved Designated Operational Entities (DOEs) as in the CDM system but there are some simplifications in the procedures, in particular for micro projects delivering less than 5,000 tons of emission reductions annually. The standards place considerable emphasis on engagement with local stakeholders, requiring two consultation meetings, one in the initial stages of project development and one right before validation. One example of a voluntary gold standard project is the Zengamina mini-hydro in the North Western Province of Zambia (Box 2).

Box 2. Voluntary Gold Standard project – Zambia

The Zengamina micro-hydro in the North Western Province of Zambia

This project was designed as a Gold Standard project. It has replaced diesel generators supplying a local hospital, school and farm as well as other users, increasing the reliability of supply. This has benefited the hospital through enabling the reliable use of a range of equipment. It has also allowed students to study in the evenings and to have access to laboratories and computers. The project is expected to generate 500 tons of CO2e reductions per year initially, rising to over 3000 tons as a wider range of local users are connected. The offset retailer, ClimateCare has provided carbon finance for this project.

Source: www.cdmgoldstandard.org/fileadmin/editors/files/4_GS-stories/project-case-studies/Collections/Case_Studies.pdf

8. State of the Voluntary Carbon Markets 2009 – Ecosystem Marketplace and New Carbon Finance.
9. www.v-c-s.org
10. State of the Voluntary Carbon Markets 2009 – Ecosystem Marketplace and New Carbon Finance.

4

Carbon finance relevance to World Bank lending and development programs

Successful implementation of World Bank lending and development programs is threatened by climate change in a number of ways. Infrastructure projects could be damaged or destroyed by climate change related storms and hurricanes. Projects in low-lying coastal areas such as the mega-delta regions of South, East and Southeast Asia are particularly vulnerable, whether they involve agricultural improvement/modernization, upgrading of infrastructure, improvement of housing or water and sanitation.

It is therefore increasingly necessary to assess this risk and build in adaptive measures. For example, water supply systems could be designed to withstand more extreme storms, the physical structures of housing, public buildings and bridges could be strengthened, and alternative income-generating activities could be promoted to reduce dependence on climate-sensitive sectors. But making provisions for this increased risk will increase the cost of development programs. For this reason opportunities to build in an additional revenue stream from carbon finance may be very important.

Although carbon credits are typically a small proportion of the total revenue of CDM projects, there are a number of advantages to tapping into carbon finance. For host country governments, having this additional revenue stream may enable them to accelerate World Bank loan payments and reduce interest payments.

Certain characteristics of carbon credits are particularly advantageous. As buyers are almost always located in industrialized countries, the credits are foreign currency denominated, and tend to be associated with low risk purchasers. Their payment schedule is likely to follow a different timing to that of other revenue streams, helping to relieve cash flow problems. This may help to attract other sources of finance to the project[11]. In infrastructure projects involving public-private partnerships, and limited or nonrecourse lending from financial institutions where financiers look to the project revenues to secure debt repayments, the additional carbon revenue stream may be an important advantage.

Carbon prices have proved to be quite variable, but some buyers including the World Bank Carbon Funds are willing to agree on a fixed price, thus reducing the uncertainty associated with this revenue stream. Deals can be made where the carbon buyer pays the lender directly, thus reducing risks associated with currency conversion and transfers. This means that the interest rate on the loan can be reduced. The availability of carbon finance may also help to resolve other constraints such as regulatory uncertainty affecting the cash income from the underlying activity. In the case of the NovaGerar landfill electricity generation project in Brazil, such uncertainty

11. For more information see Tyler, E. *et al* (2007) Lessons and Guidance on Securing Financing for RE/EE projects in Southern Africa through Gold Standard Carbon Revenues. SouthSouthNorth and the Gold Standard.

precluded the use of the power purchase agreement to provide collateral for a loan. Without the loan it would not have been possible to purchase equipment for the project. But the equipment supplier agreed to lease the equipment to the project sponsor who was able to use the carbon credits to pay for this.

Many of the World Bank's regular development programs offer opportunities for building in climate change mitigation activities. An obvious example is the replacement of fossil fuel energy generation with renewable technologies such as solar and wind power in energy infrastructure projects. This may be particularly important for development in rural areas and small towns where extending the grid is too expensive. Similarly, technologies that increase the efficiency of energy use can bring about mitigation while meeting housing, heating and transport needs (See Box 3).

Box 3. Carbon finance in the transport sector

Transmilenio in Bogota, Colombia, was the first transport project to be registered under the CDM. It is a public private partnership, with the public sector responsible for the investment in the required infrastructure, such as segregated bus lanes and bus stations. The private sector is responsible for the investment in the bus fleet, the ticket selling and validation system, and the operation of the trunk and feeder services. Emissions are reduced through the following changes:

- Replacement of existing buses (on average 15 years old) by new fuel-efficient buses.
- Increased capacity of buses, which reduces emissions per passenger kilometer
- Improved operating conditions for buses, such as dedicated bus lanes and bus priority traffic signals, which reduce fuel consumption.
- Centralized bus fleet control to optimise the load factor of buses.
- Mode shift – by providing a faster, more reliable, safer and more convenient service the new system will induce a shift from passenger cars and taxis.

Sustainable development benefits include improved social wellbeing as a result of less time lost in congestion, less air pollution-related health problems and fewer accidents.

From 2001 to 2012, the estimated emission reduction from the Transmilenio project is 3.8 million tons of which 1.7 million will be sold as CERs under the CDM. At carbon credit prices in 2007, this would bring in US$30 million in carbon revenues.

Source: Grutter, J. (2007) The CDM in the Transport Sector Module 5d Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities. GTZ.

There are also opportunities in activities that are not clearly energy related, such as water and sanitation and waste management. Flaring of gas from landfill and wastewater lagoons prevents the emission of methane, a greenhouse gas (see example in Box 4 below). Further emission reductions are possible if the methane capture is linked with energy recovery.

Box 4. Using carbon finance to increase funding for urban sanitation – wastewater methane gas capture in Bolivia

The 'Bolivia urban infrastructure project', supported by the World Bank IDA, aims to improve access to basic services for the urban poor in Bolivia's major cities through targeted investments in infrastructure. One of its three components is to extend the sewerage system to residents in poor neighborhoods in Santa Cruz through construction of secondary sewerage networks, collectors and sewage pumping stations. The project will also increase of capacity of two wastewater treatment plants to enable them to process the increased wastewater flow.

The choice of technology for increasing the capacity was influenced by the possibility of acquiring carbon finance. Anaerobic wastewater lagoons are covered with high-density polyethylene covers supported by a system of floats and tubes. This captures methane gas from the lagoons, which is subsequently flared to convert the gas to carbon dioxide, resulting in substantial emission reductions. At the same time, the covers improve the efficiency of the anaerobic digestion process by raising the temperature and decreasing the available oxygen in the lagoons. This shortens the time that wastewater needs to be kept in the lagoons for treatment, effectively increasing the capacity of the system.

The CDCF proposes to purchase a total of 500,000 tons of CO2e. This will enable further extension of the sewerage network, generating significant improvements in public health.

Source: http://wbcarbonfinance.org

Despite the small scale of community-driven development, there is still scope for mitigation activities. Household solar heating systems or biogas digesters have the potential to meet community needs for heating or cooking in areas where connection to the grid is impossible because of location and topography. Renewable technologies can be useful for heating public buildings such as schools and hospitals. The Moldova biomass heating project (see Box 5) is a good example of how a community-driven development project, the Moldova Social Investment Fund, has incorporated mitigation activities and tapped into the potential of carbon finance.

Box 5. Integrating carbon finance into community-driven development: biomass and energy efficiency project and the Social Investment Fund, Moldova

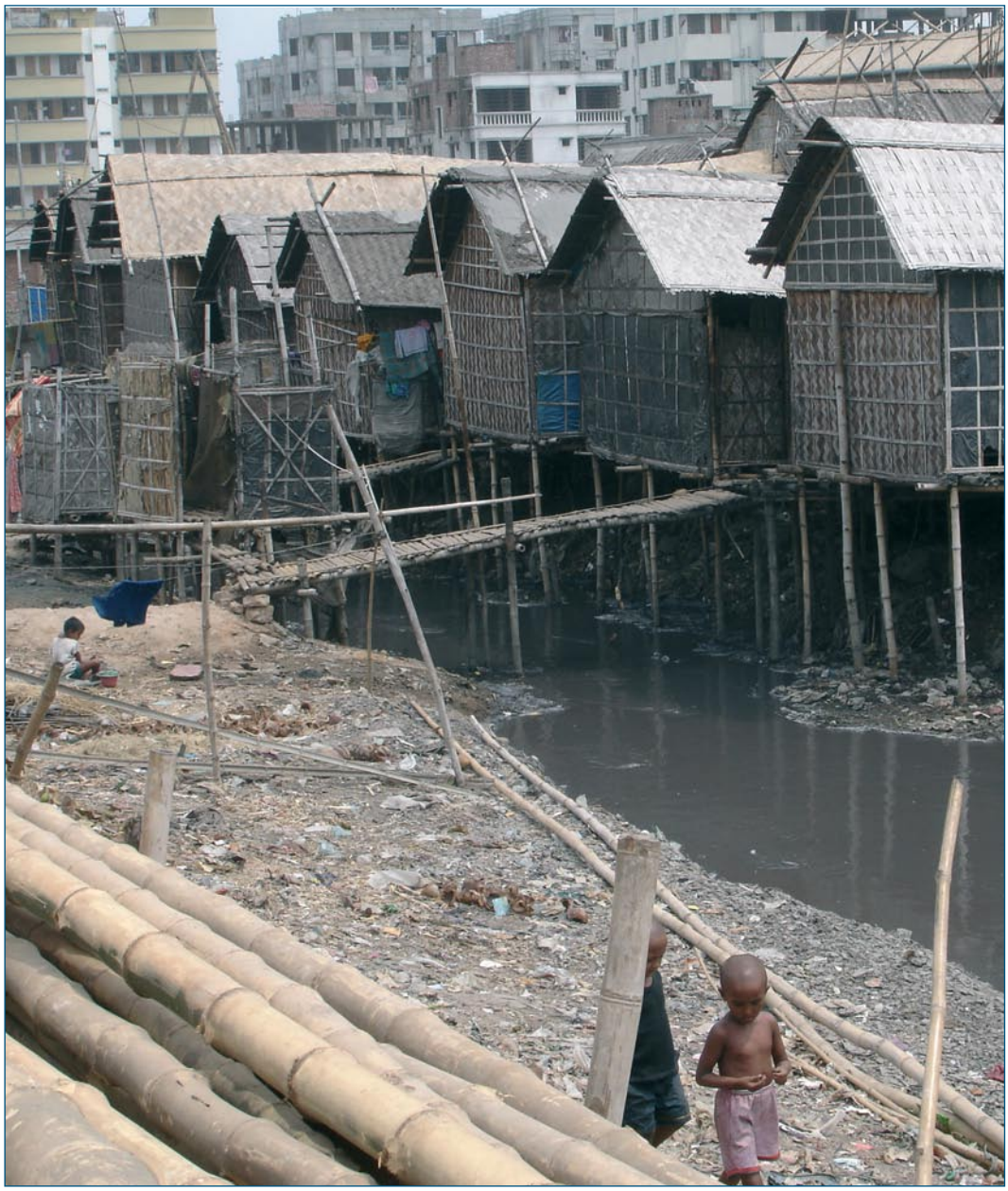
The national Moldova Social Investment Fund (MSIF) aims to empower rural communities by strengthening their capacity to make decisions, to organize and manage businesses, and to improve the quality of basic social and economic services for rural populations. The MSIF provides poor communities with small grants and technical assistance to implement micro-projects. MSIF also assists local NGOs, contractors, and government to develop new skills, and to foster new relationships and partnerships.

The CDCF biomass and energy efficiency project is generating an additional income stream for the MSIF while also improving heating in public buildings throughout the 13 municipalities in Moldova. The buildings have inefficient heating systems due to outdated boilers and deteriorated distribution networks. The project aims to improve the overall efficiency of the heating systems by 80 to 90 per cent, and to switch to biomass as an alternative fuel for heat production. It is also improving the insulation of public buildings to lower the cost of heating. The CDCF will purchase emission reductions of at least 348,000 tons CO2e over a 10 year period.

In line with the community-driven development approach of the MSIF, local communities are directly involved in identifying project activities. MSIF has also facilitated community involvement in monitoring the project performance and benefits.

Source: http://wbcarbonfinance.org

Projects in low-lying coastal areas such as the mega-delta regions of South, East and Southeast Asia are particularly vulnerable.



© IDavid Dodman, IIED

5

Relevant CDM technologies

There are various emission reduction technologies which have been tried and tested in CDM projects and other more general contexts. These technologies all contribute to sustainable development and cause no harm to the environment, relative to other technologies. All these technologies are appropriate as small-scale CDM projects and therefore have the potential to benefit small communities.

Mitigation technologies can be divided into four main categories:

- Switching to less carbon-intensive fuel.
- Increasing energy efficiency.
- Using renewable energy sources.
- Managing solid and water waste to reduce emissions.

Which of these are appropriate will depend on the local conditions. Sometimes these approaches can be applied in combination, for example using renewable energy and improving the efficiency of its use. Table 1 presents an overview of the relevant CDM technologies and corresponding examples of approved projects together with a checklist of questions to determine where each would be most appropriate.

Table 1. CDM technologies

Technology	Application	Approach to emission reduction	Examples	Key questions to determine appropriateness
Biomass	Burning biomass to produce heat and energy.	Renewable energy, energy efficiency.	Guyana: Skeldon sugar modernization project (CDCF).	Is there available biomass that is going to waste? Is there an energy need at the same place as the biomass is available, or indeed at the same plant? Is there a need for electric energy? Is it worth deliberately growing biomass? For example, does the community waste a lot of time collecting firewood; and is there enough available land to grow the biomass?
	Burning biomass for heating.	Renewable energy, energy efficiency.	Moldova: biomass heating in rural communities (CDCF).	Is there available biomass that is going to waste? Where available, is this biomass needed more for heating than electric energy. Is it worth deliberately growing biomass? For example, does the community waste a lot of time collecting firewood; and is there enough available land to grow the biomass?

Biogas	Methane from landfill.	Energy recovery.		Is there a medium to large landfill site? Is there a need for energy production very close to the landfill site? i.e. is there local industry or a local community situated next to the landfill site?
		Waste management (flaring).	Argentina: Olavarría landfill gas recovery (CDCF).	Is there a reasonably sized landfill site? Does the site require better management to avoid potential danger or bad smells?
	Methane from wastewater.	Waste management (flaring).	Bolivia: urban wastewater methane gas capture (CDCF).	Are there pools of wastewater, which are rotting, posing a health hazard or smelling bad?
	Local biogas digester plants.	Renewable energy.	Nepal: methane from manure, biogas support program.	Do households in the community need an energy source for cooking, for example where wood is scarce? Are there organic wastes that can be used – household waste is good but animal wastes offer much more opportunity. Is the community willing to be involved in 'recycling' these organic wastes? Is there sufficient available water to add to the digesters?
Solar power	Thermal solar water heaters.	Renewable energy.	Kuyasa, South Africa: low cost housing interventions (CDM Gold Standard).	Is there sufficient available sunlight? Would the community benefit from having hot water? i.e. more important in cool climates. Does the community currently burn fuel indoors to heat water with consequent adverse health impacts?
	Photoboltaic (PV) solar home systems.	Renewable energy.	Bangladesh: Grameen Shakti program (CDCF).	Is there sufficient available sunlight? Would the community benefit from electricity to run small electric appliances, such as radios and cell phones? Perhaps to replace the use of kerosene for lighting or diesel used for off-grid electricity generation.
Micro-hydro power	Micro-hydro power.	Renewable energy.	Peru: Santa Rosa micro-hydro power (CDCF). Nepal: Micro-hydro power(CDCF). Zambia: Zengamina mini-hydro (Voluntary Gold Standard).	Are there available running streams in local hills? Does the community need electricity? e.g. is the community remote and far from or inaccessible to the national grid?

Biomass technologies

Biomass technologies generate heat and energy from burning wood and other vegetable matter such as municipal and industrial waste. Because biomass is renewable, emissions released into the atmosphere are lower overall than when non-renewable fossil fuels are burnt. Although carbon is released from burning biomass, it is reabsorbed in new growth and the carbon concentration in the atmosphere remains in balance. If biomass that would otherwise be left to decompose and produce methane is burned for energy, this represents a further reduction in emissions. Simply increasing the efficiency of biomass-based heaters, cooking stoves and furnaces can also reduce emissions.

These technologies are most effective where there is abundant biomass available from agriculture or industrial operations that are not used for other purposes, such as rice husks and sugarcane bagasse.

Benefits for communities

- Users – more efficient technology reduces the amount of biomass required and hence the amount of time needed to collect the fuel.
- Technology producers – because the technologies are relatively simple, they can be manufactured locally, creating jobs.

Potential disadvantages for communities

There is a risk that biomass fuel is grown on land that would otherwise produce food. Growing biomass may also put a strain on water resources and natural vegetation. These problems are less likely to occur if agricultural waste, such as the remains of food crops, is used as the raw material. However, such waste also has other uses, such as animal fodder, and this needs to be factored into project plans.

An example of a CDM project using biomass technology – See Box 1 page 9.

Biogas technologies

Biogases such as methane can be burned to produce energy. Biogas is produced naturally by rotting biomass, and can be harvested from landfill sites (rubbish dumps) or wastewater lagoons, or from specially-made biogas digesters. Because biogas technologies reduce the emission of methane, their emission reduction potential is considerable. Further reductions are possible when biogas replaces kerosene, diesel, or non-renewable firewood as a source of energy.

Biogas technologies can be applied at different scales. Methane gas management is used in towns and cities that generate sufficient waste to warrant a landfill site and/or wastewater treatment lagoons. Individual households use biogas digesters, which run on manure or human waste, and are more appropriate for small-scale projects.

a. Methane gas management

Methane emissions from landfill or wastewater lagoons can be reduced by capturing the gas and flaring it. This converts methane to carbon dioxide, which has less potential to cause global warming. Alternatively, the gas can be burned to produce electricity for the national grid or for local use.

Benefits to communities

- Users – landfill gas can provide energy to local industry or for the national grid. If compressed, it can replace compressed natural gas for use in vehicles.

Disadvantages for communities

These projects tend to be relatively capital-intensive, generating little employment. They are not likely to benefit communities living close to the landfill or wastewater treatment sites.

An example of a CDM project using methane flaring technology

Box 6. Olavarria landfill gas recovery in Argentina

This project collects biogas, using gas extraction wells, collection piping, mechanical blowers, landfill gas condensate and flare systems. Over its life, the project will reduce emissions by over 200,000 tons of CO2e of which 131,000 will be purchased by CDCF. Because flaring offers no direct benefit to the local community, extensive consultations were held with community leaders, and provision of potable water in Espigas was identified as the most pressing need. Arranging this will form part of the community benefits plan financed by the premium on the emission reductions purchased by the CDCF.

Source: http://wbcarbonfinance.org

b. Biogas digesters

Biogas digesters are tanks where biomass residue such as crop waste, manure, human waste and sewage sludge are placed to generate methane. Water is added to aid the digestion process. Inside the digester, methane gas is separated from the liquid and solid waste.

Benefits to communities

Biogas provides a clean source of energy for cooking for rural communities, reducing time spent collecting wood for fuel and reducing indoor air pollution and associated health problems. As a by-product, it also produces a fertilizer.

Disadvantages for communities

Biogas digesters require a considerable amount of water to function and can compete with the needs of the local community. They are therefore are only appropriate where water is abundant.

An example of a CDM project using biogas digestion technology

Box 7. Methane from manure – biogas support program in Nepal

The project helps poor, rural households to install small biogas plants that would otherwise be too expensive. Decomposition of the waste in the digester generates gas that can be used for cooking, replacing traditional sources of energy such as wood, kerosene, and agricultural waste.

Source: http://wbcarbonfinance.org

Solar power

Solar power technologies such as solar cookers, heaters and driers and photovoltaic (PV) cells harness the sun's energy and reduce the need for other energy sources such as fossil fuels.

a. Solar cookers, dryers and heaters

Solar cookers use reflectors which track the sun's movements to concentrate and trap the sun's rays in the cooking container. Solar dryers use a combination of heat and air movement to remove 80 to 90 per cent of moisture from food, typically fruit and fish. Solar heaters use flat plates to collect heat from the sun and transfer it to where it is needed.

Benefits to communities

- **Users** – these technologies reduce the time and cost involved in collecting firewood or other fuels which would otherwise be used for cooking, drying or heating water. Solar drying technologies can increase the shelf-life of food, increasing income potential and food security.
- **Technology producers** – these technologies are relatively simple, they can be built and sold by local enterprises, thus creating employment opportunities.

Disadvantages to communities

These technologies do not work at night or during winter or periods of cloud cover and so are not reliable. Solar cookers involve a different way of cooking and so are less culturally acceptable. They also take longer and provide less intense heat.

b. Solar PV home systems

A typical, stand-alone solar PV home system is made up of a PV module for charging the battery, solar deep cycle battery for storage, a charge controller for the proper charging and discharging of the battery, light sources and provision for connecting other loads (radio, tape recorder, portable TV, etc.) as well as a complete set of installation hardware.

The most convenient aspect of this system is that it can provide small amounts of energy in isolated and remote areas that do not have access to the national grid. Because solar home systems are expensive, they are most likely to be useful in situations where micro credit is available to people to purchase and install the systems, for example in Bangladesh and India where the Grameen Shakti Bank operates.

Benefits to communities

- **Users** – off-grid electricity from solar power enables the use of small appliances such as radios and TVs as well as lighting and communications. This helps to run small businesses, enables children to study in the evening and, through lighting of communal spaces promotes local organizational development. These technologies also save time and cost that would otherwise be spent collecting or purchasing other fuels.

Disadvantages for communities

The cost of buying and installing solar panels remains the biggest obstacle to wide-scale use and its adoption by poor rural communities.

An example of a CDM project using solar technology

Box 8. Carbon finance and energy provision – Grameen Shakti solar home systems

This project, supported through carbon finance by the World Bank CDCF, helps poor, rural households not connected to the grid to access renewable solar electricity. The project reduces emissions by replacing kerosene used for lighting and diesel used for off-grid electricity generation.

In Bangladesh, approximately 36 per cent of the population lives below the poverty line and only 32 per cent of the population has access to grid electricity. The majority of the rural population does not have access to electricity, and 18 per cent of a household's income is spent on fuel.

The target households have no electricity and use diesel generators to electrify their houses. Grameen has initiated a project to provide micro-finance to these households through:

- Soft credit paid in instalments to make solar home systems affordable.
- Intense grassroots promotion through demonstrations, fairs, and local meetings.
- Community involvement to encourage social acceptance of solar home systems.
- Free operation and maintenance services for three years after installation, and minimal charges thereafter.

By 2015, the project will install 198,878 solar home systems, each with a capacity of 65 watts, in rural regions of Bangladesh. By replacing kerosene and diesel consumption, the project will reduce emissions by 16,351 tons CO2e per year over seven years.

Source: http://wbcarbonfinance.org

Micro-hydro

This technology provides energy from the downhill movement of water, either flowing naturally or controlled by means of a dam. The two main types are run-of-river, which uses little if any stored water to provide water flow through the turbines, and storage plants, which have the capacity to offset seasonal fluctuations in water flow.

Benefits to communities

- **Users** – micro-hydro provides cheap and reliable electricity in remote areas enabling communities to meet basic cooking, heating and lighting needs and to set up small enterprises.

Disadvantages for communities

Changing the flow of a river will affect the water supply for communities and farmers downstream.

An example of a CDM project using micro-hydro technology

Box 9. Santa Rosa micro-hydro power plant, Peru

The Santa Rosa micro-hydro power plant in Peru is a bundle of run-of-river hydro power plants that feed into the national grid and help reduce its reliance on fuel-diesel, coal- and gas-fired power plants and reduce the emission of carbon dioxide into the atmosphere. The project uses the existing irrigation infrastructure as its source of water flow. It is the first small-scale CDM project to be developed in Peru.

The project provides sustainable development benefits such as creating jobs during installation and operation. As part of the community benefits plan agreed with CDCF, a premium on the emission reduction payment will be used to improve local infrastructure, build a community center, renovate a school building and provide free electricity to a local orphanage.

Source: http://wbcarbonfinance.org

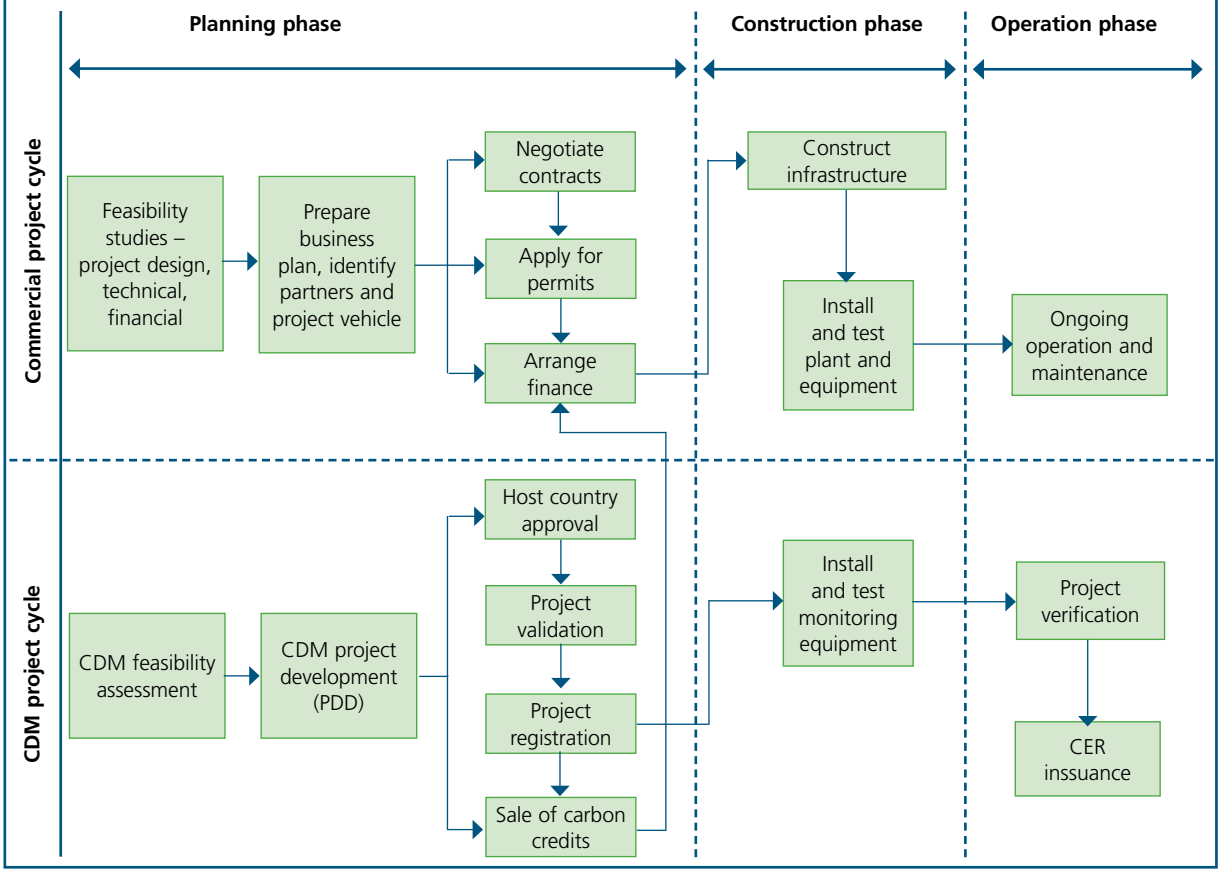
6

Steps involved in developing and implementing a CDM project

Overview of the CDM project cycle

Developing a CDM project requires all the usual steps associated with an investment project. Depending on the scale of the project, this could include a pre-feasibility study, a feasibility study, financing, and environmental and social impact assessments. In addition, there are a number of steps required to comply with the CDM rules (shown in Figure 1). Following the feasibility studies, a project design document (PDD) is prepared, reviewed by a third party, and submitted to the CDM EB for registration. When the project is implemented, emission reductions are monitored and externally verified. At this point emission reductions are certified and ready for sale.

Figure 1. The CDM project cycle and the conventional project cycle



Source: Adapted from Figure 17 in EcoSecurities and CD4CDM/UNEP (2007) Guidebook to Financing CDM Projects

Overview of the entities involved in a CDM project:

1. The project participants (PP), or project owners, have the right to the sale of any emission reductions from operations and projects related to their activities.

2. The project design team (PDT), plans the project and produces a formal document describing the project fully, i.e. the Project Design Document (PDD).

3. The Designated National Authority (DNA), who is appointed in the developing country where the project will be implemented, must confirm that the project contributes to the country's sustainable development objectives.

4. The Designated Operational Entity (DOE) examines the PDD and validates it, confirming that all assumptions are given, all calculations correct, and that on paper the project would produce the amount of emission reductions anticipated.

5. The EB, acts on behalf of the UNFCCC, registering projects, dealing with objections, approving DOEs, and approving new methodologies.

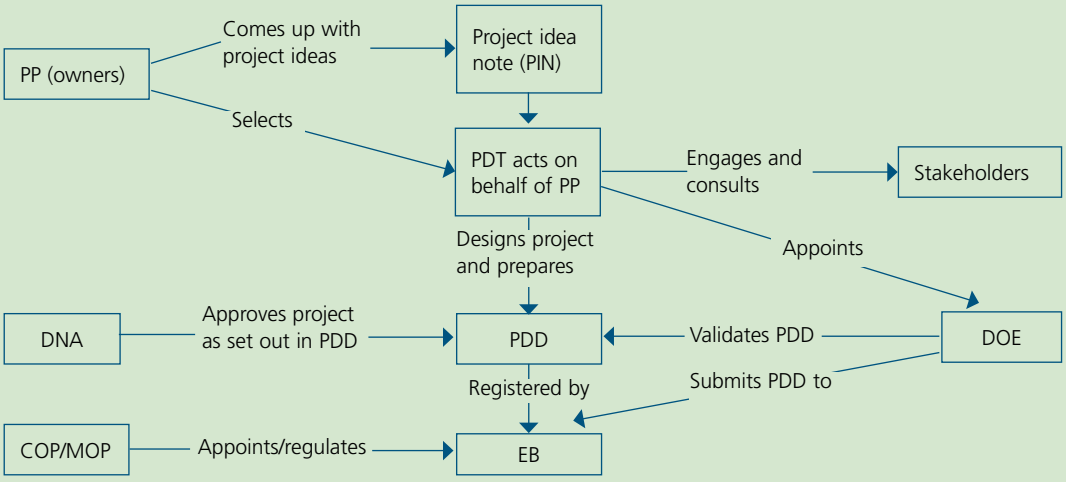
6. The Conference of the Parties (COP) or Members of the Parties (MOP) are the governments who together are the final 'legislators' of the CDM and who appoint the EB.

7. Stakeholders who would be affected by the project including potential beneficiaries or who would anticipate any social, environmental and economic contributions from the project (e.g. a community forum that represents the community that would benefit from a reduction in air pollution by replacing generators that produce carbon dioxide through burning diesel with renewable forms of energy production, e.g. micro-hydro projects).

The CDM project cycle has a number of key features:

a. Approval by the host country is required – this ensures that governments retain sovereignty over their natural resources, including their ability to mitigate greenhouse gas emissions[12]. Because the CDM aims to promote sustainable development in the host country, there must be official confirmation that the project contributes in this way. Because neither the Kyoto Protocol nor its rules of operation (e.g. the Marrakesh Accords) set out criteria for these contributions, it is up to each developing country government to assess and approve this part of CDM projects. The host country's DNA confirms its approval in writing.

Figure 2. Overview of entities and their relationships



12. The Clean Development Mechanism: A User's Guide. UNDP 2003.

b. Estimation of emission reductions is subject to an external, rigorous process of verification – most steps in the cycle are aimed at ensuring that the estimation of emission reductions resulting from the project are accurate.

- The methodology used for calculation must be approved by the EB of the CDM. The EB has approved methodologies for some of the main types of technology. If a project involves a type of technology not covered by these approved methodologies, then the project developer needs to propose a new methodology and secure approval from the EB. This process is handled by the developer's DOE, who interacts with the EB on behalf of the project developer. Each new methodology accepted by the EB may be used by future project developers.

- An independent validation of the PDD and the emissions calculations is made by a DOE who is designated by the EB before it approves the registration of the project.

- Once the project is in operation, the actual emissions that the project reduces or avoids must be confirmed. This involves two aspects – measurement of emission reductions according to the monitoring and verification protocol approved for each project; and an independent verification of the measurement by an Operational Entity, but not the DOE which validated the PDD.

c. Simplified procedures have been agreed upon for small-scale projects – this is to reduce the transaction costs associated with CDM registration. These small-scale activities are defined as[13]:

- Renewable energy activities with a maximum output capacity of up to 15megawatts.

- Energy efficiency improvement activities that reduce energy consumption on the supply and/or demand side by a maximum of 60 gigawatt hours[14] per year.

- Other project activities (agricultural projects, fuel switching, industrial processes and waste management) that result in emission reductions of no more than 60,000 CO2e per year.

Projects within these limits have reduced requirements for the PDD, methodologies for determining emission reductions, and monitoring. The stipulation that validation (before registration) and verification (when project is up and running) be carried out by different entities is also removed.

d. Bundling and programmatic approaches for scaling up – very small project activities (e.g. at the household level) using the same emission reduction technology can be combined together so that the various steps in the CDM project cycle, for example the PDD, are carried out for the whole bundle or program. The size of the total bundle should not exceed the small-scale limits i.e. 15 megawatt for renewable energy activities, 60GWh per year for energy efficiency activities, and 60,000 CO2e per year for other project activities.

e. Carbon credits can be an integral part of project financing – carbon credits are not just a source of revenue to be tapped into once the project is up and running. Because some buyers are prepared to make advance payments, carbon credits can form an integral part of the financing of the project. The carbon funds managed by the World Bank will make an advance payment of up to 25 per cent of the value of the contracted emissions where it can be demonstrated that this is necessary for the project to proceed. The carbon credit revenue stream can also be used as collateral for loan finance, particularly if there is a committed buyer.

13. CDM Glossary http://cdm.unfccc.int/Reference/Guidclarif/glos_CDM_v04.pdf
14. Gigawatt hour is a unit of electical energy equal to 1 billion watt hours.

Getting started: identifying CDM potential

As designing a CDM project and securing approval from the EB is a complex process, it is important to ensure the initial stages of project identification and preliminary assessment are correct. This will establish whether there is a good probability that the project will meet all the CDM criteria. It will also provide information required by potential financial sponsors and partners. A checklist of questions for assessing CDM potential is given in Box 11. Some of the key aspects that need to be examined are discussed below.

Box 10. Checklist of questions for assessing CDM potential

- ❑ **CDM technology** – does the project involve:
  - Renewable energy sources (wind, solar, biomass, mini-hydro)?
  - Switching from a high carbon to a low carbon fuel?
  - Energy efficiency in supply, e.g. improved electricity transmission and distribution, combined heat and power?
  - Energy efficiency in use, e.g. low energy lighting, improved building insulation, energy efficient manufacturing, transport?
  - An agricultural sector project, e.g. manure management?
  - Reduction of methane emissions from landfill and wastewater management?
  - Reforestation/afforestation?
- ❑ **Status of the technology** – does the technology meet the following conditions:
  - A proven technology, although not necessarily applied in the host country?
  - A commercially feasible technology?
  - A replicable technology and/or one that can be transferred to the host country?
- ❑ **Social and environmental contributions**
  Does the project contribute to the sustainable development objectives of the host country, in terms of its environmental, social and economic aspects?
- ❑ **Host country eligibility**
  Has the host country ratified the Kyoto Protocol?
- ❑ **Emission reductions**
  Are the likely emission reductions at least 30,000 tons CO2e per year? If not, is it possible to group a number of small projects using the same technology?
- ❑ **Additionality**
  Are there barriers, such as lack of finance and capacity, which prevent the application of the CDM technology and which would be removed through CDM registration and sale of carbon credits?
- ❑ **Project finances**
  Is the project using the CDM technology able to compete with the 'business-as-usual' technology, provided barriers are addressed and/or there is a carbon revenue stream?
- ❑ **Benefits and contribution to sustainable development**
  Will the CDM project deliver benefits such as employment creation, local business development, and access to energy that will make it acceptable to host country governments?

  Will the project deliver social benefits, such as access to energy for poor communities, enhancing its carbon revenue potential with community-oriented carbon buyers such as CDCF?
- ❑ **Institutional arrangements**
  Is there a project developer with experience in the CDM technology and related product/services?

Source: Adapted from Box 2.3 in CDM Users Guide UNEP and Screening Projects for Carbon Finance Lessons Learned from the Bank's Portfolio.

Emission reductions

The volume of emission reductions generated by the project is important because of the transaction costs incurred during the CDM registration process. If emission reductions are very small, the revenues from carbon finance will not be sufficient to cover the transaction costs and any additional costs associated with the CDM technology. Some financial sponsors expect a minimum level of emission reductions. For example the World Bank's CFU expects a reduction of 30,000 tons CO2e per year at least.

It is therefore useful to roughly estimate emission reductions at an early stage. This requires comparing the emissions from the project technology with that of the baseline – the technology that would be used in the absence of the CDM project activity. Box 12 gives an example of the calculation for replacing diesel generation with micro-hydro or introducing a more efficient generator.

Box 11. Example of calculation of emission reductions

1. Consider what technology is currently or normally used in the location – e.g. diesel fuel in generators.

2. Calculate how much energy that technology would use – e.g. 20 generators in the community running for 4 hours per day for 300 days of the year, requiring 1 litre of fuel per hour: 20 x 4 x 300 x 1 = 24,000 litres of diesel per year.

3. Calculate the amount of greenhouse gases associated with that energy use. Standard emission factors can be used – e.g. each litre of diesel oil fuel burnt will produce 0.00268 tons of CO_2. (Note that each type of fossil fuel has its own emissions factor, which must be ascertained.) 24,000 x 0.00268 = 64.32 tons of CO_2 per year.

4. Select a timescale for the project – e.g. 10 years.

5. Calculate all the emissions there would have been without the project over the selected timescale.
   10 x 64.32 tons of CO_2 = 643.2 tons of CO_2 emissions for the lifetime of your project.
   This figure gives the baseline (or without project) emissions. The next step is to calculate the emissions if the project is implemented.

6. Consider the new technology that will replace the baseline technology – e.g. a switch to a renewable energy technology such as micro-hydro, or an increase in the efficiency of the diesel generation technology.

7. Calculate the emissions the new technology of the project will involve. In the case of micro-hydro, the renewable energy has no emissions. But in the case of an energy efficiency project, such as improving the efficiency of the diesel generators that are used, there will still be considerable emissions. These are calculated in the same way as for the baseline emissions above, estimating the energy use and then applying an emissions factor – e.g. 20 generators in the community running for 4 hours per day for 300 days of the year, requiring 0.75 litre of fuel per hour. 20 x 4 x 300 x 0.75 = 18,000 litres of diesel per year e.g. each litre of diesel oil fuel burnt will produce 0.00268 tons of CO_2. (Note that each type of fossil fuel has its own emissions factor, which must be ascertained.) i.e. 18,000 x 0.00268 = 48.24 tons of CO_2 per year.

8. Calculate all the emissions for the period of the project.
   Micro-hydro = 0 tons of CO_2 emissions
   Improved energy efficiency: 10 x 48.24 tons of CO_2 = 482.4 tons of CO_2 emissions.

9. Deduct the emissions in the project scenario from the emissions in the baseline.
   Micro-hydro: 643.2 - 0 = 643.2
   Improved energy efficiency: 643.2 - 482.4 = 160.8
   At a price of, for example, US$20 per ton of CO_2 emission reductions, switching to micro-hydro would generate US$12,864, while improved energy efficiency would generate considerably less: US$3,216. Moreover, all the costs involved in designing and implementing the project as well as the 'taxes' involved need to be taken into account. The revenue from the emission reductions associated with the new technology is probably not enough in itself to cover the cost of the project. But the advantages in savings in fuel costs over the lifetime of the technology as well as the reduction in local air pollution may make it worthwhile.

Rough estimates can be made using published emission factors for different technologies (see Box 13) or manufacturers' specifications. If the project proceeds further, these estimates can be firmed up, in some cases by testing the technology in the local context.

Box 12. Information on emission factors

The Global Environment Center's CER Estimation Toolkit gives tables of estimated emission reductions from different CDM technologies at different scales in different locations. For more information go to http://gec.jp/gec/gec.nsf/en/Publications-Others-CER_Toolkit

IPCC have published tables listing fuel energy conversion tables, inter alia. For more information go to www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

Additionality

As well as calculating emission reductions, it is important to establish whether these can be considered additional to what would have occurred without the CDM project ('additionality'). The CDM rules set out two main ways of assessing and demonstrating additionality:

- **Investment analysis** – establish that the returns from the project, without the estimated revenue from the sale of carbon credits, would be less than those of realistic alternatives to the project activity. Without the carbon credits, the project would therefore not be able to compete with alternatives.

- **Barrier analysis** – establish that there are realistic barriers that would prevent the proposed project activity from occurring in normal circumstances but would be alleviated if the project activity were to be registered as a CDM activity. These barriers include:

  - investment barriers – the risk profile of the country indicates that there is no private capital available
  - technological barriers – includes lack of trained labor to operate and maintain the technology, lack of infrastructure, higher risk of technological failure in local circumstances than for alternative activities, or unavailability of the technology in the region
  - prevailing practice – means that the project activity is the first of its kind

In many cases, and particularly for small-scale projects, barrier analysis is sufficient to establish additionality. Box 14 gives an example of the use of barrier analysis to demonstrate additionality using a case study of a small hydroelectric project that has an ERPA with CDCF.

Box 13. Demonstrating additionality – La Esperanza, Honduras

A small containment run-of-river hydroelectric project operates in La Esperanza in the Intibuca region of Honduras with a total installed capacity of 12.73 megawatts. It has a contract to sell electricity to the national utility company, ENEE, for 15 years.

Additionality was demonstrated on the basis of investment and regulatory barriers. Local banks charge high interest rates, up to 15 per cent for US dollar loans, precluding the use of local finance for this project. In addition, the procedures to obtain the various regulatory permits take considerable time. As a result, only two small hydro projects have been built in Honduras in the last 10 years, even though efforts have been made by the government to promote renewable energy generation.

Source: http://wbcarbonfinance.org DNV Validation Report No. 2004 -0886 rev.01.

Financial viability

Carbon revenue is unlikely to constitute a large proportion of a project's revenues or financing. It is therefore important that the products or services provided by the CDM, for example energy provision, transport or water supply, have a solid financial base, whether through user fees or government expenditure. The carbon revenues can complement the conventional sources of finance but cannot be expected to replace them entirely.

The carbon revenue needs to be sufficient to cover any difference in cost between the CDM technology and the 'business-as-usual' technology and the transaction costs of the CDM process. If the CDM technology is the highest return alternative without the carbon revenue stream, it may not pass the additionality test, unless it can be shown that there are significant barriers. If the CDM technology costs more than the conventional alternative, the carbon revenue stream needs to be high enough to offset this gap. Problems arise when the emission reductions, and hence the carbon revenues are small, as shown in Box 15.

Box 14. When the finances do not work for CDM status

A project to introduce new energy-efficient buses in Yogyakarta, Indonesia was examined by SouthSouthNorth (SSN) for its potential to qualify for CDM status. The cost of the buses was high compared to alternatives. Even though new buses tend to be more energy efficient, SSN found that the emission reductions would be fairly limited and hence carbon revenues would be relatively small. The stream of carbon revenue would not be sufficient to make the energy-efficient buses the most viable alternative. It could not be argued that CDM status would overcome the cost barriers. SSN therefore concluded that the project was not suitable for CDM status.

Another key aspect of cost is the various transaction costs associated with applying for and maintaining CDM status. The main component of these transaction costs is the preparation of the PDD. Key factors to take into account when determining the costs of the PDD include:

- Is the project small-scale or regular? A small-scale PDD will require less resources to develop.
- Does the project require a new methodology to be developed? This again will increase costs significantly along with additional time of the DOE who makes the application on the behalf of the project developer for acceptance of the new methodology by the EB.
- How many stakeholders will be involved in determining aspects of the PDD, such as monitoring for the baseline? The more stakeholders involved, the more complex the PDD, and the more expensive it becomes.

Every project has different requirements and so it is not possible to give more than a likely range for total costs involved. Where a project involves a new kind of technology, costs will be incurred in testing to firm up estimates of emission reductions. Each DOE also charges differently, and a project with heavy reliance on consultants will be more expensive, particularly where these consultants come from the developed world.

Various estimates of the cost of PDD development show the wide range of these costs:
- US$17,000-25,000 (Ecosecurities).
- US$80,000 (Prototype Carbon Fund, World Bank).
- US$6,500-120,000 (Krey, M. (2004) *Transaction Costs of CDM Projects in India – An Empirical Survey*. HWWA Report 238).

In addition to the costs of preparing a PDD, transaction costs include various 'taxes' which are calculated as a percentage of the value or volume of CERs generated by the project.

- Up to 7 per cent of the value of CERs is taken as broker commission.
- An additional 2 per cent levy (EBs Adaptation Levy) unless the project is situated in a Least Developed Country (LDC).
- Costs of registering the project with the CDM EB. The amount depends on the volume of CERs generated:
  - US$5,000 for projects generating less than 15,000 CERs.
  - US$15,000 where projects generate from 15,000 to 200,000 CERs.
  - US$30,000 for projects generating more than 200,000 CERs.

Benefits

The nature of the benefits and beneficiaries of a CDM project may affect its carbon revenue potential and the transaction costs associated with securing government approval.

Projects with direct benefits for poor communities, for example electrification in rural areas, will be of interest to buyers that are concerned about poverty reduction and development. If poor communities do not benefit directly from the project activity, it may still be possible to identify add-on activities that will have measurable impacts for poor communities. A project to improve methane capture at a landfill site could incorporate activities aimed at improving the living and working conditions of recycling communities living at or near the site (see Box 7 Olavarria landfill, Argentina).

Institutional arrangements

The success of a project often depends on the institutional arrangements, particularly when a new technology is involved. Roles and responsibilities of each project participant needs to be clear and must match their respective capacities. To some extent, roles and responsibilities can be clarified and provision made for filling capacity gaps in the course of project development. At the early stages of assessing CDM potential, the key issue is whether there is clear ownership of the project and a team who is empowered to develop and implement the project for that owner. For example, in a project that includes renewable technologies in a housing development, it must be established whether it is the owner of the houses, the contractor installing the technologies, or the local authority commissioning the project who would be the owner of the emission reductions.

Often it is advisable to set up a company or other organization to undertake all aspects of a project as well as to own the project, for sake of clarity and also ease of management. The project developer needs the technical capacity to plan, prepare the project documents and implement the project. It is important that the project developer has the necessary technical experience in both the CDM technology and the product or service with which it is associated, such as energy provision, landfill management or wastewater treatment, or who could play this role if appropriate support was provided to them. When a number of small projects are bundled together into one larger project, the complexity is likely to increase, particularly where different technologies are used together, as each will require its own description and separate calculations for emission reductions in the PDD. This may require collaboration by different experts in the different technologies.

7

Where to get help

General guides to the CDM

A number of general guides, applicable to a range of sectors, were produced in the early years of the CDM. These guides work systematically and in detail through the various steps required to develop a CDM project. Though there have been some changes in certain aspects of the CDM since these guides were published, much of the information they contain is still valid.

The SouthSouthNorth Clean Development Practical Toolkit for Practitioners
www.cdmguide.org
This is also available from SouthSouthNorth's website together with other useful materials on the CDM and descriptions of CDM projects.
www.southsouthnorth.org

This toolkit reflects SouthSouthNorth's capacity-building experience of actual CDM projects in Brazil, South Africa, Indonesia and Bangladesh. These projects were selected because of their potential to make a significant contribution to sustainable development. The toolkit gives considerable emphasis to tools for appraising the sustainable development of projects. It is intended for use by a wide range of actors with an interest in CDM projects with sustainable development benefits, whether project owners, consultants, engineers, or government policymakers. The toolkit can be downloaded and referred to according to the phases of the project cycle. Alternatively, a search facility on the website enables users to search for the topics that are of most interest to them.

The Clean Development Mechanism: A User's Guide
UNDP/BDP Energy and Environment Group, 2003
www.energyandenvironment.undp.org/undp/indexAction.cfm?module=Library&action=GetFile&DocumentAttachmentID=1032

This guide was designed as a reference tool primarily for United Nations Development Program (UNDP) Country Offices to learn more about the opportunities and challenges of the CDM and implement projects efficiently and equitably in a variety of national and sectoral contexts. However, the topics it addresses are of interest to other organizations developing carbon projects. This document addresses issues of climate change and sustainable development including UNDP's CDM strategy, the CDM project cycle, development of the PDD, procedures for small-scale projects, governance and transaction costs, CDM transactions, and the carbon market.

CDM Information and Guidebook
Lee, M.K. (ed.) UNEP CD4CDM, 2004, Second Edition
www.cd4cdm.org/Publications/cdm%20guideline%202nd%20edition.pdf

This guidebook gives particular emphasis to the CDM project cycle and the preparation of the PDD. Each step of the CDM project cycle is explained from project design and formulation to the issuance of CERs. Chapter 5 shows how to fill out the PDD. In addition there are more general chapters on the CDM, sustainable development and project financing.

Preparation of PDDs

The CDM template for the PDD is available at:
http://cdm.unfccc.int/Reference/PDDs_Forms/PDDs/PDD_form04_v03_2.pdf

Guidelines for completing a PDD are available at:
http://cdm.unfccc.int/Reference/Documents/Guidel_Pdd/English/Guidelines_CDMPDD_NMB_NMM.pdf

However, the best guide to preparing a PDD is to refer to documents that have already been successfully validated and registered. The UNFCCC website outlines the PDDs of all the CDM projects registered so far. http://cdm.unfccc.int/Projects/registered.html

CDM PDD Guidebook: Navigating the Pitfalls
UNEP Risø Centre and DNV 2008 Second Edition
www.cd4cdm.org/Publications/PDDguidebook2ndEdition.pdf

This guidebook identifies 38 common pitfalls that CDM proponents encounter in the validation and verification of their PDDs and provides detailed guidance on how to avoid these pitfalls. It draws on the experience of Det Norske Veritas (DNV) an accredited DOE, who has validated and verified a significant proportion of CDM projects to date. The aim is to improve the quality of PDDs and so reduce transaction cost time. This guidebook does not give a detailed description of how to design a CDM project nor how to prepare monitoring reports.

Estimation of emission reductions

CER Estimation Toolkit Version 2
Global Environment Centre, Japan 2007
http://gec.jp/gec/gec.nsf/EN/Publications-Others-CER_Toolkit

This toolkit aims to assist project proponents in the initial assessment of expected CER generation. Indicative estimates of emission reductions are made at different scales and in some cases for different regions for the following technologies:
1. Increasing the blend in cement production.
2. Substitution of fossil fuels with alternative fuels in cement plant.
3. Methane avoidance by anaerobic wastewater treatment.
4. Landfill gas recovery and flaring.
5. Methane avoidance through composting.
6. Electricity generation from biomass residues.
7. Electricity generation from waste heat recovery.

Sectoral guides and experience

a. Energy

The **RETScreen Clean Energy Project Analysis Software**
www.retscreen.net/ang/home.php

This is provided free-of-charge and can be used worldwide to evaluate the energy production and savings, costs, emission reductions, financial viability and risk for various types of renewable-energy and energy-efficient technologies (RETs). The software (available in multiple languages) also includes product, project, hydrology and climate databases, a detailed user manual, and a case study based college/university-level training course, including an engineering e-textbook.

Wind power and the CDM. Emerging practices in developing wind power projects for the Clean Development Mechanism
Painuly, J.P., Clausen, N., Fenhann, J., Kamel, S. and R. Pacudan.
Energy for Development Risø National Laboratory, Denmark 2005
www.cd4cdm.org/Publications/WindCDM.pdf

This provides an overview of wind power technology and the steps involved in developing a CDM project based on wind power.

b. Transport

The CDM in the Transport Sector. Module 5d Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities
GTZ 2007
http://siteresources.worldbank.org/EXTAFRSUBSAHTRA/Resources/gtz-cdm-transport-2007.pdf
This is intended for policymakers and their advisers in developing cities and forms part of a sourcebook on various aspects of sustainable transport. This module analyses the CDM potential of different types of transport projects and sets out the major components that need to be covered when preparing a CDM transport methodology. A case study of the TransMilenio CDM project, the first registered CDM transport project is presented with details of the path towards registration, results, costs and benefits.

Financial aspects

For more assistance with project financing, visit the SSN CDM Toolkit at www.cdmguide.org or the Financing and Transaction Guide SSN available at: www.southsouthnorth.org/default.asp?/library.asp? under the SSN team publications section.

Guidebook to Financing CDM Projects
EcoSecurities and UNEP CD4CDM 2007
www.cd4cdm.org/Publications/FinanceCDMprojectsGuidebook.pdf

This guidebook aims to:
1. Guide project developers on obtaining financing for the implementation of activities eligible under the CDM.
2. Demonstrate typical approaches and methods to developing country financial institutions for appraising the viability of CDM projects and for optimally integrating carbon revenue into overall project financing.

One of the main challenges facing CDM projects, particularly in the least developed countries is to secure financing for the underlying emission reduction activities. Most financial intermediaries in the CDM host countries have limited or no knowledge of the CDM modalities and procedures. Developing country financial institutions are unable to properly evaluate the risks and rewards associated with investing or lending to developers undertaking CDM projects, and therefore have, by-and-large, refrained from financing these projects. In addition, some potential project

proponents lack experience in structuring arrangements for financing a project. The guidebook addresses these barriers by providing information aimed at both developing country financial institutions and at CDM project proponents.

Small-scale technologies

For a full list of approved small-scale methodologies see http://cdm.unfccc.int/methodologies/approved.html

Programmatic CDM

Potential and barriers for end-use energy efficiency under programmatic CDM
No. 3 CD4CDM Working Paper Series
Hinostroza, M., Cheng C.C., Zhu, X, and J. Fenhann with Figueres, C. and F. Avendano 2007
www.cd4cdm.org/Publications/pCDM&EE.pdf

This examines the scope for programmatic energy efficiency activities. It reviews the evolution of the programmatic approach, explains the rules and modalities, examines current methodologies and project pipelines that could accommodate programmatic energy efficiency activities and investigates new potential project areas. It concludes with a case study in Peru to illustrate the methodological issues in designing and implementing energy efficiency programs under the CDM.

Assessing sustainable development contribution

The SouthSouthNorth Appraisal and Ranking Matrix Tool for Sustainable Development
www.southsouthnorth.org/default.asp?/library.asp

This brief document sets out an approach for appraising and rating energy projects for their sustainable development impact at the time of project design and approval. It is targeted at project developers and host country governments. Indicators of sustainable development contribution and a suggested scoring system are set out in a table. This is followed by a short explanation of each indicator. This tool was later incorporated into the Gold Standard.

Gold Standard procedures
Gold Standard Toolkit 2.0
http://cdmgoldstandard.org/fileadmin/editors/files/6_GS_technical_docs/GSv2/GSV2_Toolkit.pdf

Step-by-step explanation of the procedures to follow to develop, validate and monitor a Gold Standard project. It is designed for multiple users: project proponents, validators and verifiers, as well as other carbon market actors. It gives detailed explanation on how to conduct a stakeholder consultation and assessment of the project and how to examine the sustainable development impact.

The Community Development Carbon Fund (CDCF) provides carbon finance to projects in the poorer areas of the developing world. The Fund, a public/private initiative designed in cooperation with the International Emissions Trading Association and the United Nations Framework Convention on Climate Change, became operational in March 2003. The first tranche of the CDCF is capitalized at $128.6 million with nine governments and 16 corporations/organizations participating in it and is closed to further subscriptions. The CDCF supports projects that combine community development attributes with emission reductions to create "development plus carbon" credits, and will significantly improve the lives of the poor and their local environment.

The World Bank Carbon Finance Unit's (CFU) initiatives are part of the larger global effort to combat climate change, and go hand in hand with the World Bank and its Environment Department's mission to reduce poverty and improve living standards in the developing world. The CFU uses money contributed by governments and companies in OECD (Organization for Economic Co-operation and Development) countries to purchase project-based greenhouse gas emission reductions in developing countries and countries with economies in transition.

The International Institute for Environment and Development (IIED) is one of the world's top policy research organisations focusing on sustainable development. With partners on five continents, IIED is helping to tackle 21st-century challenges ranging from climate change and cities to the pressures on natural resources and the forces shaping global markets. The institute works with some of the world's most vulnerable people to ensure they have a say in the policy arenas that most closely affect them – from village councils to international conventions.

SouthSouthNorth (SSN) is a network-based non-profit organisation sharing two decades of experience in the fields of climate change and social development. SSN directly pursue structural poverty reduction in Sub Saharan Africa, Asia and Latin America by building Southern capacity and delivering community based mitigation and adaptation projects.