A User's Guide to the CDM
(Clean Development Mechanism)

Second Edition

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Pembina Institute
for Appropriate Development

About the Pembina Institute

The Pembina Institute's mission is to implement holistic and practical solutions for a sustainable world. The Pembina Institute is an independent, non-profit research, education, and advocacy organization that promotes environmental, social, and economic sustainability through the development of practical solutions for business, governments, individuals, and communities in Canada and in developing countries. The Pembina Institute provides policy research leadership on climate change, energy policy, green economies, renewable energy, and environmental governance, as well as extensive formal and public education programs.

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Preface

The Government of Canada ratified the Kyoto Protocol in December 2002. By doing so, it has committed Canada to reduce its emissions of greenhouse gases (GHGs) to 6% below 1990 levels during the period between 2008 and 2012. The Kyoto Protocol is the first step in a long process to reduce human impacts on the world's climate.

Canada and the world will reap several benefits from lowering GHG emissions. Changes in climate will be slowed, reducing the economic and social effects of severe droughts and storms. Smog and related health effects will also be reduced. Finally, economic growth will occur in industries that manufacture and install GHG reduction technologies.

The federal government released a preliminary climate change plan for Canada in November 2002.[1] Although the means by which Canada will meet its Kyoto target and the degree to which each industry will be asked to reduce its GHG emissions have yet to be outlined explicitly, companies will be expected to meet reduction targets by 2010. Although Canadian companies will be encouraged to reduce most of the emissions from their own operations through efficiency upgrades and process changes, the Kyoto Protocol also offers the option of "offsetting" some emissions through participation in international market-based investment and trading tools.

One of these tools is the Clean Development Mechanism (CDM), which provides a means for countries or companies to contribute to GHG reduction measures in developing countries in return for "certified emissions reductions" (CERs), provided that these measures also result in sustainable development. The CDM will be the first means — domestic or international — by which Canadian companies can purchase CERs that can be used to meet domestic emissions reduction commitments, or sold (traded) to other GHG emitters at a later date.

This Guide provides Canadian companies interested in using the CDM, and potential CDM project hosts in developing countries, with all the information necessary to develop environmentally sound CDM projects and steer them through the approval process. The Guide addresses the following topics:

- the basic rules governing the CDM, including sustainable development criteria;
- CDM project types;
- various investment roles for companies using the CDM;
- a step-by-step procedure on how to develop a CDM project;
- special features of energy efficiency CDM projects;
- simplified procedures that can be used for small CDM projects; and,
- examples of CDM project opportunities.

[1] The plan can be downloaded from www.climatechange.gc.ca/plan_for_canada/index.html.

List of Abbreviations

AAU	Assigned Amount Unit; equal to one tonne of carbon dioxide equivalent. Each country is given an assigned amount that it must meet, equivalent to its 1990 level of emissions minus the reduction target.
AIJ	Activities Implemented Jointly; the predecessor of the CDM and JI projects.
CCCDF	Canadian Climate Change Development Fund.
CDM	Clean Development Mechanism.
CER	Certified Emissions Reduction; the carbon credit generated from CDM projects, equal to one tonne of carbon dioxide equivalent.
CNG	Compressed Natural Gas.
CO_2e	Carbon dioxide equivalent; the conventional unit for reporting greenhouse gas emissions (see Appendix A for an overview of how to calculate this).
COP/MOP	Conference of the Parties/Meeting of the Parties; Conference of the Parties oversees global negotiations on climate change until the Kyoto Protocol is ratified, at which time the Meeting of the Parties will take over.
DOE	Designated Operational Entity (see below, under Kyoto Definitions, for definition).
ERU	Emissions Reduction Unit; the carbon dioxide credit unit derived from Joint Implementation projects.
GHG	Greenhouse Gas (see Appendix A for a list of the major gases).
JI	Joint Implementation.
kWh	Kilowatt-hour.
LULUCF	Land Use, Land Use Change and Forestry.
Mt	Megatonne (one million tonnes).
MWh	Megawatt-hour.
ODA	Official Development Assistance.
RMU	Removal Unit; the carbon dioxide credit unit derived from LULUCF activities.

Kyoto Definitions

Additionality
All CDM projects must be "additional to any that would occur in the absence of the proposed project activity" in order to be eligible for credits. This qualification is called "additionality."

Afforestation
The planting of new forests on lands that have historically not been previously forested

Annex 1 Parties
Developed (industrialized) countries designated in Annex 1 of the Kyoto Protocol Annex (38 in total).

Boundary (of the Project)
The physical area within which all six GHGs[2] will be reduced by the project activity.

Designated Operational Entity
Independent legal entity designated to validate CDM activities and emissions reductions. The Designated Operational Entity is accredited by and accountable to the Executive Board.

Executive Board
Supervisory body of the CDM, accountable to the COP/MOP (refer to the List of Abbreviations above).

Fungibility
Credits (AAUs, CERs, and RMUs) generated from Kyoto Mechanisms are exchangeable, or "fungible."

Host Party
The developing country in which the CDM project is proposed to take place.

Leakage
Any GHG emissions that occur outside of the project boundary as a result of the project.

Project Participants
The entities (e.g., a company and/or local NGO) that are developing the CDM project.

Sequestration
The capture and storage of CO_2 in terrestrial or biological processes; for example, in soil and forests.

Sinks
Biological entities, such as forests and agricultural soils, that remove carbon dioxide from the atmosphere.

Stakeholders
Any member of the public, including an individual, group, or community, that is affected, or is likely to be affected, by the proposed CDM project.

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[2] The six GHGs are listed in Appendix A. The final calculation must be in CO_2 equivalents, determined by multiplying each GHG by its Global Warming Potential (GWP). See Appendix A for GWP conversion factors.

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1 Introduction

1.1 The Kyoto Protocol

The UN Framework Convention on Climate Change (UNFCCC), adopted in 1992 and ratified in 1994, established an international legal framework to address global climate change. Parties to the Convention agreed to stabilize greenhouse gas (GHG) concentrations in the Earth's atmosphere by returning to 1990 GHG emissions levels. (A primer on climate change and GHGs is provided in Appendix A.)

At the 3rd Conference of the Parties (COP 3), held in Kyoto, Japan, in 1997, the parties adopted the Kyoto Protocol, which commits industrialized countries (defined as Annex I countries in the Protocol) to attaining legally binding GHG reduction targets during the period between 2008 and 2012. These commitments are an average of 5% below 1990 GHG emissions levels. In November 2001, at COP 7 in Marrakech, Morocco, the parties reached an agreement on the legal text needed to implement the Protocol. Notwithstanding the withdrawal of the United States from the Protocol, it is widely anticipated that enough countries will ratify the Protocol for it to enter into force in 2003.

In industrialized countries, including Canada, most GHG emissions are produced by private companies and individuals. Each country will, therefore, have to either regulate or encourage large GHG emitters to reduce these emissions. However, the Kyoto Protocol provides for a variety of measures to achieve GHG reductions through three special "Flexibility Mechanisms" — the Clean Development Mechanism, Joint Implementation, and International Emissions Trading.

> The Clean Development Mechanism (CDM) provides a means for countries or companies to financially contribute towards GHG reduction measures — and a limited number of sequestration projects — in developing countries, provided that these projects also result in sustainable development, as defined by the host country, and are implemented in an environmentally benign manner. In return, the investing company receives a "certified emissions reduction" (CER).
>
> Joint Implementation (JI) provides a means for countries or companies to invest in GHG reduction measures and sequestration projects in other industrialized countries, and gain certified credits.
>
> International Emissions Trading provides a means for emitters to purchase emissions reduction credits through a special market that will be set up for this purpose.

1.2 How Will the Kyoto Protocol Be Applied in Canada?

The Government of Canada ratified the Kyoto Protocol in December 2002. By doing so, it has committed Canada to reduce its emissions of GHGs to 6% below the 1990 level. Thus, the 1990 level of 607 Mt/yr must be reduced to 571 Mt/yr during the period between 2008 and 2012. In 2002, Canada's emissions were more than 726 Mt; therefore, Canada must reduce its emissions by at least 155 Mt/yr by 2012.

While the sharing of this commitment among industrial sectors is still being worked out, any company that currently emits a significant quantity of GHGs will be required to participate. The federal government recently

released a discussion paper outlining four policy options for meeting Canada's Kyoto commitments.[3] In all four options, a significant portion of Canada's committed GHG reductions would be achieved domestically. However, three of the four options would allow companies to offset their remaining emissions at lower cost by participating in domestic emissions trading in Canada, and by using the three international market-based investment and trading tools described above. Credit for emissions reductions achieved within Canada and through the use of these Flexibility Mechanisms will be permitted once the Protocol enters into force.
The Canadian government will assist companies in their CDM participation through training, project development, and other "capacity building" activities in developing countries (see below).

1.3 General Attributes of CDM Projects

Projects seeking approval under the CDM must lead to real, measurable reductions in greenhouse gas emissions, or lead to the measurable absorption (or "sequestration") of GHGs in a developing country. GHG emissions from a CDM project activity must also be reduced below those that would have occurred in the absence of the project. In fact, it must be shown that the project would not have been implemented without the CDM. Without this "additionality" requirement, there is no guarantee that CDM projects will create incremental GHG emissions reductions equivalent to those that would have been made in Annex I countries, or play a role in the ultimate objective of stabilizing atmospheric GHG concentrations.

In addition, all CDM projects must contribute towards sustainable development in the host country and must also be implemented without any negative environmental impacts. To ensure that these conditions are met, host countries determine whether the CDM project activity meets the sustainable development objectives in their country, and also decide whether an environmental assessment of the project is required.

Any project activity starting after January 1, 2000, will be eligible for registration and will earn CERs if it meets the criteria, rules, and modalities for CDM projects agreed to in the Marrakech Accords and at the COP 8 in October 2002. Guidelines established thus far are included in Section 4 – Developing and Implementing a CDM Project: A Step-by-Step Guide.

There are several ways that a company wanting to purchase credits can participate in the CDM. It can invest directly in a project and receive a return in the form of CERs. Depending on the financial structure of the deal, it may also receive a financial return. Alternatively, a company can simply agree to purchase CERs as they are produced. This reduces the risk to the buyer of CERs, but will come with a higher price tag.

1.4 Why Is the CDM Important to Canadian Companies?

The international community is pushing for a prompt start for the CDM, and the first projects are expected to be registered in 2003. *Thus, the CDM will become the first means — domestic or international — by which Canadian or other Annex I companies can obtain CERs that can be used to meet domestic emissions reduction commitments, or sold (traded) to other GHG emitters at a later date.*

For companies or investors that do not need CERs themselves, the CDM provides an opportunity to obtain credits now at a low cost, and then sell them to large GHG emitters when national and international GHG emissions trading comes into effect in a few years.

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[3] "A Discussion Paper on Canada's Contribution to Addressing Climate Change," May 13, 2002. See www.climatechange.gc.ca/english/actions/what_are/canadascontribution/Report051402/englishbook.pdf.

There are several benefits for companies using the CDM:

- it provides access to low-cost GHG emissions reduction opportunities before the demand for CERs increases;
- it provides an opportunity to adjust to the new reality of a more sustainable low-carbon economy ahead of the competition;
- it provides opportunities to invest in new, expanding markets and technologies; and,
- it associates the company with sustainable development, and environmental and social improvements in developing communities around the world.

1.5 Canadian Government Assistance to Companies with the CDM

The Government of Canada has set up a Clean Development Mechanism and Joint Implementation Office in the Department of Foreign Affairs and International Trade (DFAIT) to help Canadian companies use the CDM and JI. The Office will develop and disseminate information, and link with other Canadian and international programs.

The Office's mandate is to

- facilitate Canadian participation;
- conclude bilateral agreements;
- facilitate project development;
- provide technical guidance to companies;
- approve projects, as required;
- offer guidance on registration; and,
- provide analytical and policy support to negotiations.

For more information, contact

Canada's Clean Development Mechanism and Joint Implementation Office
Climate Change and Energy Division (AEC)
Department of Foreign Affairs and International Trade
125 Sussex Drive, Ottawa, ON K1A 0G2
Tel: 613-944-3039
Fax: 613-944-0064
e-mail: cdm.ji@dfait-maeci.gc.ca
Web site: www.dfait-maeci.gc.ca/cdm-ji

Outside Canada, companies and project developers should direct their questions about the CDM to the Canadian trade office in each country.

1.6 Capacity Building and Project Development Assistance

Many Annex 1 countries have made commitments to assist developing and least developed countries in their efforts to participate in the CDM, and to support adaptation, technology transfer, environmental management, and economic diversification. Canada is providing this type of assistance through the Canada Climate Change Development Fund (administered by the Canadian International Development Agency (CIDA)) and the CDM/JI Office operated by the Department of Foreign Affairs and International Trade (DFAIT).

Assistance is also being provided through multilateral organizations, such as the Global Environment Facility (GEF),[4] which is an international cooperative effort to finance actions that address environmental concerns, including climate change. GEF funding is provided on a volunteer basis from a variety of nations.

Official development assistance (ODA) and GEF support cannot be used directly to purchase CERs during the implementation of CDM project activities. However, ODA funds may be used for capacity building around CDM projects, as they may help to leverage much greater levels of investment from both the public and private sectors. For example, ODA funds may be used to train local CDM project developers, as this will help to ensure that the technology is well understood and that the project will be effective and reliable on a long-term basis.

[4] See www.undp.org/gef/portf/climate.htm.

2 Rules and Procedures Governing CDM Projects

2.1 Basic CDM Project Requirements

Real and Measurable GHG Emissions Reductions

CDM projects must lead to real, measurable reductions in greenhouse gas emissions, or lead to the measurable absorption (or "sequestration") of GHGs in a developing country. The "project boundary" defines the area within which emissions reductions or sequestration occurs. Emissions reductions must occur on the project site or "upstream" from the project. For example, in projects that reduce electricity use through efficiency or fuel substitution in a region where power is produced from fossil fuels, the emissions reductions occur upstream at the power plant.

Additional GHG Emissions Reductions

GHG emissions from a CDM project activity must be reduced below those that would have occurred in the absence of the project. In fact, it must be shown that the project would not have been implemented without the CDM. Without this "additionality" requirement, there is no guarantee that CDM projects will create incremental GHG emissions reductions equivalent to those that would have been made in Annex I countries, or play a role in the ultimate objective of stabilizing atmospheric GHG concentrations.

All CDM projects, therefore, require the estimation or measurement of "baseline" emissions — those that would have occurred without the project — and actual emissions that occur after a project has been implemented. For example, a wind power generation project might displace emissions from an existing fossil fuel power plant in a region or delay the construction of a new plant. The emissions reductions from improved fuel efficiency in an industrial process would be measured against existing plant emissions. Section 4 provides more details about how to select the boundaries of a project and establish its baseline.

Sustainable Development

All CDM projects must contribute towards sustainable development in the host country and must also be implemented without any negative environmental impacts. To ensure that these conditions are met, host countries determine whether the CDM project activity meets the sustainable development objectives in their country, and also decide whether an environmental assessment of the project is required. More details on the environmental integrity of CDM projects are given below and in Section 3.

Nuclear Power Facilities

The Marrakech Accords state that countries must refrain from including nuclear power facilities in the CDM.[5]

[5] Some have argued that, since energy generated from nuclear power has a relatively low GHG emissions factor, it should be accepted as a form of clean energy. However, the COP 6.5 negotiations, held in Bonn, Germany, in July 2001, deemed that nuclear facilities do not contribute towards sustainable development and, therefore, may not be used in the CDM to generate CERs.

Carbon Sequestration Projects (Sinks)

Although mitigation of global climate change can normally be achieved most effectively through the reduction of GHG emissions into the atmosphere, CO_2 is also assimilated, or absorbed, by plants and soils in biological processes. As such, the promotion of biological and terrestrial absorption of CO_2, or carbon "sinks," is also a valid approach to meeting GHG emissions reduction targets. Credits arising from land use, land-use change, and forestry (LULUCF) are called "Removal Units" (RMUs). International agreement on how to measure RMUs is expected by COP 9 in 2003.

The Kyoto Protocol has placed a limit on the types and quantities of LULUCF credits allowed for credit in CDM projects. Only afforestation and reforestation projects are permitted (versus, for example, forest management), and the total quantity of Removal Units may not exceed 1% of the base year (1990) emissions of an industrialized country for each of the years 2008 through 2012. Canada, whose 1990 emissions totalled 607 Mt, is not allowed more than approximately 30 Mt in total RMUs from CDM activities.[6]

2.2 CDM Project Cycle

Project Participants

In general, the following represent the participants involved in CDM projects. In some cases, the project proponent may also include the CER purchaser, should the company choose to play an active role in the development of the project, in addition to receiving the CERs.

Project Proponent: An entity, such as a company or local NGO, that develops and implements a CDM project.

CER Purchaser: A company that invests in the project or purchases CERs generated by the project.

Host Country: The developing country in which the CDM project takes place.

Executive Board: The supervisory body of the CDM, accountable to the Conference of the Parties, that oversees the global negotiations on climate change until the Kyoto Protocol is ratified. The Executive Board was elected at COP 7 and comprises 10 members of the Parties of the Protocol, representing various economic blocs.[7] Interim procedures for implementing CDM project activities and the role of the Executive Board were also agreed to at COP 7 (the Marrakech Accords), so that CDM project development could begin in 2002.

Designated Operational Entity: An independent legal entity designated to validate CDM activities and emissions reductions. The Designated Operational Entity is accredited by and accountable to the Executive Board. Project Proponents may designate the Designated Operational Entity of their choice from a list maintained by the Executive Board.

Steps in the Project Cycle

The following outlines the official steps that must be undertaken to obtain CERs. Section 4 provides more details on how to implement each of these stages.

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[6] Calculated as follows: 6 Mt/yr times 5 years = 30 Mt.
[7] For more information on the Executive Board, visit the UNFCCC CDM Web site at www.unfccc.int/cdm.

1) Validation: The project design, submitted through a Project Design Document, must be evaluated by a Designated Operational Entity against the requirements of the CDM. Validation also includes assurance that the host country agrees that the project contributes to sustainable development, that any required environmental assessment has been carried out, and that there has been adequate opportunity for public comment on the project.

2) Registration: The validated project must be formally accepted by the Executive Board, based on the recommendations from the Designated Operational Entity.

3) Verification: Once the CDM project is underway, the monitored reductions that occur as a result of the project must be reviewed periodically by the Designated Operational Entity.

4) Certification: A written assurance must be provided by the Designated Operational Entity, and confirmed by the Executive Board, that the CDM project achieved verified emissions reductions. The CERs are then assigned to the Annex 1 country in which the CER purchaser is located.

Annex I country approval of a CDM project is only required if the host country requests it. However, a Canadian company purchasing CERs through the CDM must register the project activity with the proper Canadian authority: the CDM/JI Office operated by the Department of Foreign Affairs and International Trade (DFAIT).

Small- and medium-scale renewable energy, energy efficiency, and fuel substitution projects are given special treatment under the CDM to reduce the cost and time needed for approval. Special simplified procedures, including a shorter Project Design Document, have been developed to make approval and implementation of the following types of small-scale CDM projects easier. See Section 6 for more information.

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

- Energy efficiency improvement project activities that reduce energy consumption on the supply and/or demand side by up to the equivalent of 15 GWh/yr.

- Other project activities that reduce the anthropogenic emissions by sources that directly emit less than 15 kilotonnes of carbon dioxide equivalent annually.

2.3 Environmental Integrity of CDM Projects

Sustainable Development

All CDM projects must meet sustainable development criteria set by the host country and must also be implemented without any negative environmental impacts. To ensure this condition is met in the CDM, host countries have the prerogative to determine whether the CDM project activity meets sustainable development objectives in their country. To reduce the time necessary for project approval, many host countries will publicize their sustainable development criteria ahead of time so that they can be used by project developers and users to screen CDM projects. If a host country has not published sustainable development criteria, it is recommended that project developers and purchasers of CERs only bring forward projects that have obvious and unquestionable sustainable development value (see Section 3.1).

Public Input

The host country approval process also includes consultation with project stakeholders, whose comments must be considered before the CDM project is submitted for approval. Most stakeholders will be concerned about the sustainable development value of the project and its environmental impact. There is a period before a CDM project is registered during which details of the project are made public for input and comment. Annex I country approval of a CDM project is only required if the host country requests it.

Environmental Impact Assessment (EIA)

The objective of any CDM project should be to provide environmental and social benefits, as well as to reduce GHG emissions. A host country, upon review of a preliminary project proposal, may require an environmental impact assessment (EIA), which will have to be completed before the project can proceed. The need for this EIA may also be raised during public consultations. If an EIA is required by the host country, or if stakeholder input shows that there are local environmental or social concerns about the initiative, the CDM project should be evaluated using the highest international environmental and social assessment procedures and standards, such as the criteria for hydroelectric facilities prepared by the World Commission on Dams.

The host country may also define the types of environmental impacts that would require a full EIA, but, to reduce the risk of delay and negative input from stakeholders, it is recommended that only CDM projects that can meet internationally agreed upon environmental and social standards be considered by project developers and users.

2.4 Transfer of Technology and Know-how

The transfer of environmentally safe and sound technology to developing countries through CDM projects is both crucial and required, as it furthers the objective of sustainable development. Local knowledge and circumstances should be key factors in determining the chosen technology.

2.5 Eligibility to Participate in the CDM

CDM credits will only be granted to national governments and companies in Annex 1 countries, such as Canada, that have ratified the Kyoto Protocol and agreed to meet their obligations under the Protocol regarding compliance and reporting of emissions. There is no legal limit or ceiling on the number of CDM credits that an Annex I country, such as Canada, can use to meet its Kyoto reduction target; however, individual countries may enforce internal limits or targets. For example, Canada has stated that its goal is to achieve a majority of its GHG reduction through domestic measures.

2.6 Credit Period for CDM Projects

Credit for CDM projects will be allowed only after the Protocol enters into force, which is expected to occur in early 2003. Project activities initiated after January 1, 2000, may be eligible for validation, provided that they are registered by December 31, 2005, and that they meet all the CDM provisions.

Emissions reductions in CDM projects may only be claimed for a maximum of 10 years without reappraisal of the project baseline, or for a period of seven years with two extensions of seven years each, provided that the project baseline is reviewed at the time of each renewal.

2.7 Trading of CDM Credits

CERs earned from CDM projects are a marketable commodity that may be exchanged with other corporations or national governments. A company that has earned CERs may also choose to bank them so they can be traded in future commitment periods after 2012. This is a useful strategy if the company does not require the credits in the current period and anticipates an increase in their market value. It is important to note that RMUs earned from reforestation and afforestation activities cannot be banked.

2.8 CDM-related Fees

Adaptation Fee

The impacts of climate change will be globally widespread and yet regionally uneven. Due to weaker economic situations and the inability to adapt, developing countries are more vulnerable than developed countries to the adverse effects of climate change. To help meet the costs of adaptation, the Protocol requires that 2% of CERs from CDM project activities be deposited into a designated CDM registry (account), which is administered by the Executive Board. Revenues generated through the sale of CERs in the registry will be forwarded to the countries in which CDM projects took place, and where there is a need to address the impacts of climate change.

Fees for Administrative Expenses

In addition to the provision to fund adaptation, the following CDM project registration fees will also be charged to cover the administrative costs of the Executive Board's certification process.

Average tonnes of $C0_2e$ reductions/yr	US$
</=15,000	5,000
>15,000 and </= 50,000	10,000
>50,000 and </= 100,000	15,000
>100,000 and </= 200,000	20,000
>200,000	30,000

Host countries also have the prerogative to establish their own rules for retaining financial returns or credits from CDM project activities implemented in their country. This retention of funds may be utilized, for example, to build the capacity of local companies working to further CDM-related activities. Host countries may also set minimum prices for CERs from a CDM project. It is the responsibility of the project developer, and the company purchasing CERs, to check the host country's policies.

3 Important Features of a CDM Project

This section covers some of the most important features of a CDM project:

- project sustainable development criteria;
- types of costs associated with developing and implementing a CDM project;
- options for co-financing an emissions reduction project using CERs from a CDM project; and,
- risk mitigation and the legal aspects of buying CERs.

3.1 Sustainable Development Criteria

While many countries will take different approaches to setting sustainable development criteria for CDM projects, it is useful to define a basic set of sustainability principles. In general, any project should contribute to three types of sustainability:

Ecological Sustainability

- Maintain productive capacity and renewability of species and of biologically productive land and water surfaces
- Maintain Earth's life support systems, including living ecological processes and functions, and global physical systems
- Preserve biological diversity

Economic Sustainability

- Provide all with meaningful employment and a place to make a contribution
- Create sufficient wealth to allow all to meet their needs, and attain a high quality of life
- Drive innovation and technology improvement, meeting human needs with fewer resources and less ecological damage
- Maintain physical and social infrastructure and knowledge assets for future generations

Social Justice and Equity

- Maintain cultural identity and respect
- Empower and support the participation of individuals, while protecting the strength and viability of community
- Equitably share natural resources and the benefits of development
- Provide equal access to nutrition, health, education, self confidence, and opportunity
- Foster peace and security

Some countries have already begun to identify criteria for CDM projects. The following list has been compiled from these sources and can be used for CDM project screening.

Social Criteria

- Improves quality of life, especially for the very poor
- Alleviates poverty (e.g., by providing regular income)

- Improves equity (e.g., by improving the income of poor women)

Economic Criteria

- Provides financial returns to local entities
- Results in a positive impact on balance of payments (e.g., through new investment)
- Transfers new technology

Environmental Criteria

- Reduces GHGs and the use of fossil fuels
- Conserves local resources
- Reduces pressure on local environments
- Provides heath and other environmental benefits
- Meets local renewable energy portfolio standards and other environmental policies

Appendices B1 and B2 provide CDM project guidelines developed by India and Kenya as illustrations of what can be expected from host countries.

3.2 CDM Project Types

Table 3.1 below provides some examples of CDM projects in four economic sectors: industrial, residential and community, transportation, and other. Within each sector, opportunities are divided into broad types, such as process change, energy efficiency, and fuel substitution.

3.3 CDM Project Costs

The costs of a CDM project include those of the project itself and the additional "transaction" costs associated with using the CDM.

3.3.1 Project Costs

Project costs include the following categories:

- Project design costs, including engineering studies and financial analysis.
- Capital costs or, if the project upgrades an existing system, the incremental capital costs of a low-emissions option over a baseline technology. Development projects that entail the creation of infrastructure will incur other capital costs, such as land procurement, building materials, equipment, labour, and construction permits. In some cases, the initial cost of a more efficient technology may be higher than the cost of the baseline. For example, triple-glazed windows may have a higher cost than their less efficient counterparts.
- Fuel and operating costs, or the net increase or decrease in fuel or operating costs over baseline technology. Depending on the technology applied, some CDM projects may become more or less expensive to operate. The capture of landfill gas, for example, represents an increase in operating costs for landfill owners if the baseline was simply the release of the gas into the atmosphere. On the other hand, on-site use of the gas for electricity generation may offset some fuel costs.

Table 3.1: Typical CDM Project Types

Sector	Type	Example
Industrial	*Process Change*	Dry coke quenching (iron and steel)
		Continuous digestor (pulp and paper)
	Energy Efficiency	Improved process efficiency
		High efficiency equipment and lighting
		Improved building structure
	Fuel Substitution	Biomass gasification
		Clean coal (IGCC)
		Brick making with natural gas (in place of coal)
	Electricity (on-site)	Cogeneration
Residential and Community	*Energy Efficiency*	High efficiency lighting and appliances
		Improved building structure
		Solar water heaters
		District heating
	Fuel Substitution	Biogas plants for cooking and lighting
		Efficient biomass gasifier cooking stoves
		Natural gas (in place of coal)
	Electricity (on-site)	Solar photovoltaic (PV) home systems
		Renewable energy: hydro, wind power, and large-scale solar PV
		Biomass gasification/turbine
		Landfill gas recovery/turbine
Transportation	*Energy Efficiency*	Improved vehicle efficiency
		Transit expansion
	Fuel Substitution	Biofuels (in place of fossil fuels)
		Natural gas fuels
		Landfill gas recovery/turbine
		Biomass gasification/turbine
		High efficiency natural gas
Other	*Land Use, Land Use Change, and Forestry*	Afforestation
		Reforestation

- Market barrier removal costs to achieve high market penetration in a distributed market. This normally applies to energy efficiency projects that take place in multiple locations and with large numbers of consumers. The project may entail providing a direct contribution towards a consumer's technology — such as compact fluorescent lighting — to bring the consumer's rate of return to an acceptable level.

Not all projects will involve costs in all categories. In general, all projects will experience design and transaction costs (see below). Some projects, however, do not involve the construction of a facility, but rather the promotion of an energy-saving device, such as efficient lighting. In such cases, capital costs may be minimal, but the project will incur market barrier removal costs instead.

More details on the various types of costs are provided below, and an overview of the types of costs to be expected with various CDM projects is provided in Table 3.2.

Table 3.2: Cost Types for a Variety of CDM Emissions Reduction Projects

Project Type	**Cost Type**			
	Capital cost	Incremental capital cost	Increased operating cost	Market barrier removal cost
Industrial process upgrade/efficiency	X			X
Community or residential lighting efficiency		X		X
Landfill gas recovery and power generation	X		X	
Wind power generation	X	X		
Improved transit system			X	X
Biofuels	X		X	

3.3.2 Transaction Costs

Additional CDM project costs may include the following:

During Project Design

- Selection of baseline methodology and estimation of emissions reductions
- Preparation of a CDM CER purchase agreement
- Host country approval, stakeholder input, and environmental assessment
- Preparation of the Project Design Document (PDD)
- Project validation by a Designated Operational Entity

To Register the CDM Project

- Registration fee (see Section 2.7)

Validation and Certification

- Emissions reduction measurement
- Validation by a Designated Operational Entity
- 2% adaptation fee (see Section 2.7)

Consultation with local governments for host country approval, while not expensive in monetary terms, can represent a significant investment in time that should be accounted for in the project development stage. On the other hand, the monitoring and third party verification of emissions reductions do represent a significant cost. Because the CDM is relatively new, it is difficult to estimate this cost exactly; however, it may represent up to 10% of transaction costs.

CDM projects will also incur costs related to contractual, or legal, arrangements that are not normally encountered in other development projects. For example, a broker, or intermediary, may be required to facilitate the project transaction or a CER purchase agreement (see Section 3.4). Other related legal fees may also apply (see Section 3.6 for more details).

In general, CDM project transaction costs can run as high as $200,000 for a large project. However, the baseline setting and approval processes for small-scale CDM projects will be simplified or eliminated, significantly reducing the transaction costs for these projects. More details on simplified procedures for small-scale projects can be found in Section 6.

3.4 Financing Options in a CDM Project

In general, selling CERs through the CDM will provide only part of the financing necessary for the project. A project developer wanting to use this source of "carbon financing" to make a project feasible will still need conventional financing. Nevertheless, the sale of the CERs from the project will provide the additional revenue or start-capital to make the project feasible, or remove other barriers that favour the baseline technology.

An Annex I country or company participating in the CDM[8] may choose from a variety of financial options to gain CERs from a CDM project:

- *Full or Partial Equity*: A company finances all of a CDM project, or co-finances part of a CDM project, in return for full or shared financial returns and CERs;[9]
- *Financial Contribution*: A company financially contributes towards the cost of a CDM project an amount equal to some portion of the incremental cost of the project over and above the baseline technology, or finances the removal of market barriers, in return for CERs;
- *Loan:* A company provides loan or lease financing at concessional rates in return for CERs; or,
- *Certified Emissions Reduction Purchase Agreement*: A company agrees to buy CERs as they are produced by the project.

3.4.1 Full or Partial Equity

An investing company may finance all or part of the capital cost of the CDM project in return for both financial and CER returns. The level of financing will depend on the type of project. For example, projects with relatively large capital costs, such as industrial process improvements and fuel switching, may benefit from co-financing from the investor. As in any foreign investment, the level of involvement of an investor will represent a balance between the amount of equity required to implement the project and the risk involved, as well as the expected rate of return based on the value of the CERs.

The particulars of the financial arrangement are determined on a project-by-project basis by the local project proponents and the potential investing company. The ownership of CERs becomes the subject of an annex to the conventional financing agreement. The agreement should stipulate the nature of the returns of the investing company; for example, an investor may request either full or shared financial returns, as well as CERs.

If a company is using the CDM solely to obtain credit for emissions reductions, a financial contribution or CER purchase agreement is a better option (see below).

3.4.2 Financial Contribution

A financial contribution is used when a company finances part of the incremental cost of the low-emission technology over the baseline technology, or finances the removal of market barriers preventing the low-emission technology from being used. Removal of market barriers can involve increasing rates of return

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[8] Most companies will participate in the CDM to obtain CERs to help meet their domestic emissions reduction targets in an economically efficient manner. However, companies that have no requirement to reduce GHG emissions — or that have already achieved their reduction targets — may also choose to gain ownership of CERs to sell on the international market at a future date.

[9] Local investors co-financing CDM projects in a host country may wish to share in CERs so that they have the opportunity to sell the credits at a later date.

beyond investment thresholds, supporting product marketing programs, or training entrepreneurs in the manufacture and servicing of emissions reducing technology.

In most cases, the company makes the financial contribution at the beginning of the project, and receives the rights to the CERs as they are produced. This should be clearly stipulated in a contractual arrangement between the project proponents.

Risk assessment and due diligence are still important parts of project development, but in this case it is the risk associated with the emissions reduction that must be assessed. Questions regarding the reliability of the technology and the certainty of the reductions, for example, should be considered.

Financial contributions can be used to obtain credits on a variety of project types, from renewable energy power plants and gasifiers to energy efficiency projects — any project where an incremental or barrier removal cost can be easily identified. Although the level of contribution may vary from project to project, the contribution would normally amount to no more than 10% of the total project cost.

Emissions reduction projects financed by the World Bank Prototype Carbon Fund (PCF) are good examples of projects where a financial contribution is used to secure a stream of CERs with up-front co-financing. The financial contributions for selected PCF projects are provided in Table 3.3. In general, the PCF limits its funding to 2% to 10% of the total project cost, or limits its contribution to a maximum of US$5/tonne of CO_2.[10]

3.4.3 Loan

Another option is to provide partial financing for a CDM project in the form of a loan to the local proponents, to allow them to implement the emissions reduction project. In such cases, the loan principal would be repaid over an agreed upon period, with a return in the form of CERs rather than a financial return.

For example, a company may provide a loan to a distributor of solar home systems. The distributor would use the financing as a revolving fund to buy and sell solar systems with low-interest credit terms. The CDM investor would receive CERs for each system sold.

3.4.4 CER Purchase Agreement

As an alternative arrangement to the up-front financing of a CDM project, a company may wish to buy emissions reductions as they are produced. In this case, payment for the CERs becomes an additional revenue stream for the project host. For example, in a small hydro or wind power generation project, payment for CERs provides an annual income, along with payment for electricity produced.

This option reduces the risk to the buyer of the CERs as all of the risk associated with generating the emissions reductions remains with the project developer. It also makes the transaction of purchasing credits as simple as purchasing a product. The project developer, however, must ensure that the sale price of the credits reflects all of the costs and risks associated with registering the CDM project and verifying the emissions reductions.

A CER purchase agreement formalizes the agreement to purchase the credits from the CDM project as they are produced. In many ways it is similar to a power purchase agreement, used by independent power producers. The CER purchase agreement should be finalized before the project is implemented, and can be used by a project developer to obtain conventional project financing and to steer the project through the CDM approval process.

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[10] See the FAQ at prototypecarbonfund.org.

Table 3.3: Summary of PCF Financial Contributions to Selected CDM Projects

Project	Total Project Cost (US$)	PCF Contribution (US$)	Basis of PCF Contribution	Schedule of PCF Contribution
Biomass power facility, El Salvador	$9,000,000	$989,600	Sale of carbon credits (at US$4/tonne CO_2)	PCF to provide up-front payment of 33.3%, the remainder to be paid on an annual basis for 10 years
Wind power facility, Honduras	$58,000,000	$4,048,275	Sale of carbon credits (at US$3.50/tonne CO_2)	Contributions to be paid on an annual basis for 10 years
Two wind farms, Morocco	$200,000,000	By competitive bidding	PCF funding to supplement electricity sales in order to capture commercial rate of return to investors	Payment schedule to coincide with payment schedule under power purchase agreement
Three micro-hydro facilities, Guatemala	$320,000	$15,000	Up-front value of 4,755 tonnes CO_2 over 10-year period	PCF to provide up-front financing
Geothermal facility, Guatemala	$30,000,000	Not specified	Sale of carbon credits	Yearly contributions starting when CO_2 displacement begins
Biomass power facility, Nicaragua	$2,300,000	$400,000	Financing of additional, climate-friendly component of project	10% in pre-finance date; 40% in financing; balance in equal installments for five years from start of commercial operation
Run-of-river hydro plant, Chile	$34,000,000	$3,400,000	10% of total cost	Initial payment followed by balance payments as emissions reductions are generated

3.5 How Much Are Certified Emissions Reductions Worth?

It is important for potential users of the CDM to be aware of the expected market price of CERs that might be generated from a CDM project. This will assist the project developer in deciding whether it is worthwhile to solicit carbon financing through the CDM. It will also assist the CER purchaser in determining whether it is worthwhile to provide carbon financing. For example, there is no point in investing in a CDM project at a cost of US$20/tonne CO_2 if credits can be purchased on the market for less than US$10/tonne, or emissions can be reduced domestically for US$15/tonne.

While the international market for CERs and other "Kyoto-eligible" international credit units has yet to be established, the current price of emissions reduction credits in existing carbon markets is between US$3/tonne CO_2 and US$5/tonne CO_2.[11] Higher prices can be obtained in so-called retail and niche markets for smaller

[11] Based on trading monitored by carbon brokers, such as CO2E.com (www.co2e.com), investments by the World Bank Prototype Carbon Fund (www.prototypecarbonfund.org), and project bidding programs, such as CERUPT (see Section 7)

projects, such as renewable energy projects that are seen to have additional benefits. In the absence of the participation of the United States in international carbon trading, it is anticipated that the international wholesale price of credits will not rise above US$10/tonne in the next five years.[12]

3.6 Risk, Ownership, and Legal Aspects

Besides the normal financial and other risks associated with any new project, there are two specific risks unique to CDM projects:

- the risk that emissions reductions may not occur; and,
- the risk that a company's home country may not accept the application of CERs produced towards domestic emissions reduction requirements.

3.6.1 Risk That Emissions Reductions May Not Occur

Assessment of the risk of emissions reductions not occurring becomes an important part of the due diligence assessment of the project for companies taking an active investment role in a CDM project or making an up-front contribution towards the cost of the project in return for future CERs. Conservative selection of baselines and clear emissions monitoring protocols will help to reduce the risk of overestimating emissions reductions. (Section 4 provides the necessary details to ensure these elements are considered.)

All possible events that could reduce the expected reductions need to be considered. For example, a natural disaster, such as an earthquake, may destroy infrastructure or otherwise limit a project's ability to generate CERs. Although this type of event is beyond the control of both the buyer and seller, both parties must come to an agreement regarding the ultimate responsibility for CER production should such an event occur. Project proponents may wish to invest in venture insurance to minimize the risk. Some buyers may be willing to pay a premium for verified CERs to alleviate themselves of the associated risks, while others will consider certain risks to be acceptable.

Investment agreements must clearly state how risks will be mitigated and shared. If a CER purchase agreement is being used, all of the risk is borne by the project developer or host, and this must be reflected in a higher price per tonne of emissions. The investment arrangement — which should be negotiated prior to project implementation — may be influenced by two factors:

- ***The financial arrangement that has been negotiated***: For example, a company that prefers to simply purchase CERs as they are produced will most likely not be a direct participant in the project; in this case, the seller assumes all the risk and may, as a result, sell the CERs at a premium.
- ***The ability of the project proponents to fulfill certain project approval requirements***: For example, a company may have acquired knowledge in baseline determination and thus be well suited to carry out the emissions reduction calculation (i.e., to be more directly involved than simply acting as a buyer). Doing so may help reduce the risks associated with the verification of CERs. As a result, the investing company may be able to negotiate a lower price.

[12] The United States is the world's single largest emitter of GHG emissions. If the U.S. had remained in Kyoto, it would have been a large purchaser of carbon credits. In that country's absence, demand will decrease, and thus so will the price per tonne. The figure presented is a PCF prediction.

It may be prudent to hire a qualified independent verifier to ensure the validity of the CERs. However, the buyer and seller will have to work out between themselves which entity will pay this cost. In cases in which the seller is simply purchasing CERs, this cost will be borne solely by the seller.

3.6.2 Risk of Non-Acceptance of Emissions Reductions in Home Country

The risk that the home country of the company purchasing CERs from a CDM project will not accept the value of the CERs relative to domestic commitments must be borne solely by the buyer of the CERs. Companies participating in the CDM can minimize this risk in the following ways:

- by meeting most of their emissions reduction commitments through domestic action in Canada;
- by participating in projects that are non-controversial, have obvious sustainable development value, and provide local environmental and social benefits; and,
- by making sure that the CERs are registered under programs such as the Voluntary Challenge and Registry[13] and the Baseline Protection Initiative.[14]

Should CERs fail to materialize, the exact legal agreements regarding the issue of burden will be specific to each project and the partners involved.

[13] www.vcr-mvr.ca/index_e.cfm.
[14] nccp.ca/NCCP/baseline_pro/index_e.html.

4 Developing and Implementing a CDM Project: A Step-by-Step Guide

This section details the steps that should be followed when implementing a CDM project. The project cycle can be divided into six stages, as shown in Figure 4.1 Also provided in the figure are the parties responsible for each stage and the official time requirements for certain tasks.

Figure 4.1: Overview of Project Cycle, showing official timelines and responsibilities

Stage	Task	Timeline	Responsible Party
1	**Project Screening**		PP
2	**Project Development**		
	• Estimate real emissions reductions		PP
	• Develop emissions monitoring and verification protocol		PP
	• Prepare investment plan and undertake financial analysis		PP
	• Draft Project Design Document		PP
3	**National Approval**		
	• Carry out an EIA		PP
	• Invite stakeholders' comments		PP
	• Obtain host country approval		PP
4	**Validation and Registration**		
	• Finalize Project Design Document		PP
	• Invitation of stakeholder comments	30 days	DOE
	• Validation	8 weeks	DOE
	• Registration		EB
5	**Implementation and Monitoring**		
	• Implement project		PP
	• Monitor and record emissions		PP
6	**Verification and Certification**		
	• Verify emissions reduction		DOE
	• Certify emissions reduction	15 days	EB
	• CER issuance		

Legend:
PP: Project Participant DOE: Designated Operational Entity EB: Executive Board

4.1 Stage 1: Project Screening

The purpose of this step is to determine whether the proposed project is eligible to earn CDM credits. Screening should also be used to ensure that the project meets the project developer's and investing company's own criteria, and to generally assess risks associated with the project.

Table 4.1 summarizes a basic procedure that can be used to screen a CDM project.

Table 4.1: Project Screening Criteria

Question		Answer	
		Yes	**No**
1	Is the project consistent with sustainable development priorities in the host country?	Proceed to next question.	The project is not eligible as this is a crucial element for the CDM.
2	Does the project result in real, measurable and long-term emissions reductions below those that would have happened without the project?	Proceed to next question.	The project is not eligible as this is a crucial element for the CDM.
3	Is the project activity mandated, directly or indirectly, by laws or regulations that are enforced in the host country?	The project is not eligible since the host country would have required the activity anyway in the absence of the CDM.	Proceed to next question.
4	Could the project have been undertaken as a result of normal business investment practice prevailing in the host country without the CDM?	The project is not eligible since it could have occurred in the absence of the CDM.	Proceed to next question.
5	Does the project lead to the transfer of new, environmentally efficient technologies or management practices to the host country?	Proceed to next question.	Technology transferred under the CDM must be the best commercially available in terms of GHG emissions per unit of production.
6	Is the project financed by a pre-existing official development assistance (ODA) program?	The project is not eligible.	Proceed to next question.
7	Does the project meet local country development priorities and have local support?	Proceed to next question.	It will be more difficult to obtain host country and stakeholder approval.
8	Does the project have negative environmental or social impacts?	An EIA may be required and there could be negative international publicity.	Proceed to next question.
9	Is there general stakeholder support for the project?	Proceed with project development.	It is unlikely that the CDM project will be approved by the host country.

4.2 Stage 2: Project Development

Once the decision has been made to proceed with submitting a project to the CDM, the project will need to be analyzed and developed in more detail. The following steps are involved:

1. Estimate emissions reductions
    - Choose project boundary — the physical area within which emissions reductions occur and the actual types of GHG emissions to be reduced.
    - Select project baseline — the "business as usual case" against which emissions reductions are measured.
    - Set crediting period — the period over which emissions reductions will be claimed.
    - Calculate emissions reductions against baseline
2. Prepare an emissions monitoring plan
3. Prepare an investment plan and undertake a financial analysis
4. Draft a Project Design Document

The Project Design Document (PDD) is the official document required by the host country, Designated Operational Entity (DOE), and Executive Board (EB) for project approval. It contains information about the project boundary, baseline, expected emissions reductions, and monitoring plan. The financial analysis provides a measure of how valuable the CDM is to the project at different carbon prices. The following sections describe in detail the essential aspects of each of the above steps.

4.2.1 Choose Project Boundary

The project boundary clearly identifies the sources and sinks of all six GHGs[15] that will be reduced by the project, and sets the physical area within which the emissions will be reduced. All GHG emissions that are "significant and reasonably attributable" to the project activity must be included.

Generally speaking, there are two types of emissions related to CDM project activities within the project boundary: on-site and off-site. GHG reductions (or increases) that result from the project outside of the project boundary are called "leakage."

- ***On-site emissions*** are those that arise immediately from the project activity itself. For example, when a biomass gasifier is installed in place of a diesel burner at a small manufacturing business, GHG emissions reductions will occur on-site because diesel fuel is being replaced.

- ***Off-site emissions*** are those that occur upstream or downstream from the project. The same gasifier project will also reduce emissions in the supply system of the displaced diesel fuel. This would include reduced emissions in oil exploration, the refining process, and fuel transportation.

Where electricity is saved or generated on-site, all of the emissions reductions occur upstream. For example, an energy efficiency or wind power project will result in a decrease in the demand for grid electricity. If this electricity is derived from a power grid that uses fossil fuel–based power plants, there will be a decrease in emissions at these plants. Upstream emissions reductions from grid electricity savings are usually

[15] The six GHGs are listed in Appendix A. The final calculation must be in CO_2 equivalent – this is determined by multiplying each GHG by its 'Global Warming Potential' (GWP). Also see Appendix A for GWP conversion factors.

characterized by an emissions factor that is either the weighted average of emissions reductions for all plants in the power grid, or the next new fossil fuel power plant that will be added to the grid (see also Select Project Baseline and Calculate Emissions Reductions below).

4.2.2 Select Project Baseline

The baseline of a project is a measure of the emissions that would have occurred in the absence of the proposed project activity, and is used to estimate the emissions reductions from the project. Baselines for CDM projects are normally determined on a project-by-project basis and are based on previously accepted methodologies (outlined below). Standardized baselines may be allowed for small-scale CDM projects to help offset costs (see Section 6 for more on small-scale CDM projects).

There are three acceptable methodologies that can be used to measure the baseline of a CDM project. The choice of which to apply will depend mainly on the type of project, but will also be affected by the availability of data.

1. ***Status quo emissions***: This approach assumes that without the CDM project future emissions would have been the same as current or historic emissions. Reductions from the proposed project are measured against this future projection, using an emissions factor based on current information. Although relatively easy to measure, and useful in projects that affect grid electricity, this methodology fails to take into account technological developments that lead to more efficient processes, as well as regulatory revisions and significant market restructuring that may affect the intensity of future emissions.

2. ***Market conditions***: This approach assumes that the technology normally used under current market conditions is the baseline and allows market barriers, such as lack of financing and product distribution channels, to be taken into account when selecting the baseline. This is particularly important in energy efficiency projects where these barriers discourage adoption of otherwise cost-effective high efficiency technologies, and the project removes these barriers.

3. ***Best available technology***: This approach is most useful in rapidly changing markets where historic emissions are not relevant, and the “best commercially available technology” is used as the baseline. It takes the average emissions of similar project activities undertaken in the previous five years (in similar social, economic, environmental, and technological circumstances), whose performance is among the top 20% of their category.

Sometimes, a combination of the above methodologies is required to reveal a complete picture of what would have happened in the absence of the project activity. If none of these methodologies is applicable to the project activity, a new methodology may be proposed. However, newly proposed methodologies must be approved by the Executive Board before the project can commence, so this approach may delay implementation. Regardless of the chosen methodology, a baseline must meet the following criteria:

- It must be established in a transparent and conservative manner, regarding the choice of approaches, assumptions, methodologies, parameters, data sources, and key factors.
- It must take into account relevant national and/or sectoral policies and circumstances (e.g., sectoral reform initiatives, local fuel availability, and the economic situation in the project sector). Equally important are any proposed or anticipated future policies that may affect the project or baseline scenario, as these may change the overall situation and, therefore, the allowable credits (which, in turn, will have an impact on the financial gain of the project). It is advisable to obtain, in writing, any

relevant government or business documents whose content is anticipated to have an impact on the project scenario.
- It must provide a justification of the appropriateness of the baseline choice.

When emissions reductions occur upstream from a project within an electricity grid and there is no obvious baseline power plant that can be used as a baseline, then a weighted average regional grid emissions coefficient should be used. This approach allows the use of published or commonly used standard emissions coefficients for the local or regional power grid based on current common characteristics of the grid. These include annual power production and efficiencies for each power plant (hydro, coal, natural gas) in each year that CERs will be claimed. These coefficients will be the same for all CDM projects operating in the region, unless the project specifically addresses one aspect of the load curve — e.g., it reduces peak demand.

Appendix D provides more details and an example of how weighted average emissions factors can be derived, and shows when and how a baseline should allow for transmission and distribution losses.

Examples of baseline choices for several projects financed under AIJ or by the World Bank PCF[16] are provided in Table 4.2 below.

Table 4.2: CDM Projects and Baseline Methodologies

Type of Project	Baseline Approach	Type of CDM Baseline
Biomass power facility, El Salvador	Emissions are compared to current fossil fuel–derived electricity, measured by carbon intensity. Since future additions of similar oil-based plants were expected, the source of emissions remained the same, and current emissions could be used as the baseline.	*Status quo (current) emissions.*
Wind power facility, Honduras	Current power is generated by hydropower, with thermal plant back-up. The wind farm would displace the need for the thermal plant, and, therefore, the emissions from this plant were used as the basis for the emissions reduction calculation.	*Best available technology. The average emissions of typical thermal plants in the previous five years (in similar social, economic, environmental, and technological circumstances), whose performance is among the top 20% of their category.*
Two wind farms, Morocco	Emissions are compared to current fossil fuel–derived electricity (from coal, oil, and gas), measured by carbon intensity. Since future additions of similar oil-based plants were expected, current emissions could be used as the baseline.	*Status quo (current) emissions.*
Three micro-hydro facilities, Guatemala	The three communities did not have access to electricity, so the analysis was based on the displacement of kerosene lamps for lighting.	*Market conditions. Kerosene normally used under current market conditions (market barriers prevent use of more effective technologies).*
Compact fluorescent lamps (CFLs), Mexico	Conventional incandescent lamps were replaced by CFLs. While the CFLs were cost-effective, market barriers restricted their use. The project removed these barriers.	*Market conditions. Incandescent lamps normally used under current market conditions (market barriers prevent use of CFLs or more effective technologies).*

[16] See "Project Documents" at www.prototypecarbonfund.org.

4.2.3 Set Crediting Period

The time period during which credits arising from the project can be claimed is not necessarily equal to the operational lifetime of the project activity. It is assumed that, without the project, the baseline technology will gradually improve over time and "catch up" with the CDM project technology. There are two options for the crediting period of CDM projects:

- an initial period of seven years, which may be renewed a maximum of two times, for a total of 21 years (renewals are contingent on re-validation of the original project baseline, and, in some cases, the baseline may need to be updated with newly available data); or,

- a maximum of 10 years with no option of renewal.

4.2.4 Calculate Emissions Reductions

After determining the project boundary and the baseline emissions, the net emissions reductions can be estimated. For each year in the project period, the on-site and off-site emissions of both the baseline and the project must be tallied. To estimate emissions, it will be necessary to use an emissions factor specific to the fuel displaced and project and baseline technologies.

Emissions factors for on-site emissions will be dependent on the following:

- the chemical composition of the fuel used (e.g., carbon content);
- the efficiency of fuel conversion (e.g., fuel combustion efficiency affecting CO_2, CO, and unburned fuel emissions); and,
- other characteristics of the technology that affect the production of GHGs (e.g., NO_x production related to combustion temperature).

Emissions factors for individual fuels and fuel/technology combinations can also be found on Environment Canada's GHG Web site.[17]

Emissions factors for upstream emissions will depend on the characteristics of the electricity grid or fuel supply chain. In electricity projects, upstream emissions factors are expressed in tonnes per kWh and based on either the weighted average emissions from all power plants used in the grid or the "marginal" or next plant that would added to the grid if the CDM project were not built. Appendix D provides an example of how weighted average emissions factors are estimated. These factors will depend on the location of the CDM project, but it is expected that standard emissions factors that can be used by all projects in a given area will be developed to simplify this process.

In fuel efficiency or substitution projects, the upstream emissions factors will depend on the energy used to produce and refine the fuel, and the energy used to transport the fuel to the site. In many projects these emissions are small compared with those on-site, and, therefore, the supply chain is not included within the project boundary. These emissions, therefore, become "leakage."

An excellent example of how to estimate both on-site and upstream emissions factors may be found in a landfill gas recovery and power production project financed by the World Bank PCF in Latvia.[18]

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[17] See www.ec.gc.ca/pdb/ghg/ghg_docs/Emission_Factors.pdf.
[18] See www.prototypecarbonfund.org/router.cfm?Page=DocLib&Dtype=1.

The following provides an overview of the steps involved in determining net emissions reductions. Each step must be completed for each GHG associated with the project. A template for these calculations is provided in Appendix C.

Table 4.3: Overview of Emissions Reductions Calculation

1	Estimate Total Baseline Emissions	=	Baseline On-site	+	Baseline Off-site
2	Estimate Total Project Emissions	=	Project On-site	+	Project Off-site
3	Calculate Net Emissions Reductions	=	Total Baseline	-	Total Project
4	Estimate the Carbon Dioxide Equivalent Reduction	=	Net Emissions	x	GWP[19]
5	Calculate Total Emissions Reductions	=	Sum of Carbon Dioxide Equivalent Reductions		

Many project types lead to a reduction of upstream or "off-site" emissions (see Section 4.2.1). Table 4.4 provides a generalized view of where emissions reductions occur in each type of project; it also describes typical baseline technologies, and the likely role that a CDM contribution could play in the project. Information on the special considerations required in energy efficiency projects is given in Section 5.

Table 4.4: Characteristics of Selected CDM Project Types

Project Type	Source of On-site Emissions Reductions	Source of Off-site Emissions Reductions	Baseline Technologies	Typical Role of CDM Contribution
Industrial process upgrade/efficiency	Fuel savings and changes in GHG process emissions	Electricity savings and reduction in emissions from fossil fuel production	Existing process and power grid mix	Full or co-financing of process upgrade
Community or residential lighting efficiency	None	Electricity savings	Existing power grid mix	Financing of market barrier removal
Landfill gas recovery and power generation	GHG losses and flaring	Reduced future electricity production	Current on-site situation and power grid mix	Full or co-financing of gas recovery and power plants
Wind power generation	None	Reduced future electricity production	Current/future power grid mix	Full or co-financing
Improved transit system	Reduction in automobile use	Reduction in emissions from fossil fuel production	Current automobile/transit mix	Full or co-financing
Biofuels	Reduction in fossil-based fuels	Reduction in emissions from fossil fuel production	Current vehicle efficiency	Financing of fuel distribution infrastructure or vehicle conversion

[19] GWP is the Global Warming Potential, which is unique for each GHG. See Appendix A for more details.

4.2.5 Develop Emissions Monitoring and Verification Protocol

All GHG emissions related to the project must be measured and recorded throughout the crediting period. The monitoring of emissions essentially re-tests whether the project is actually reducing GHG emissions and meeting the condition of real emissions reductions. A monitoring plan is required for project validation and must be provided in the Project Design Document (see Section 4.4 below).

In general, a monitoring plan collects and archives all data relevant for determining all GHG emissions related to the project activity. These include the following:

- project sources within the boundary area;
- baseline sources within the boundary area; and,
- any sources outside the project boundary that are significant and reasonably attributable to the project.

Most monitoring and verification (M&V) protocols will use a similar approach to that used to estimate GHG reductions described above. In an M&V protocol, emissions factors are used to convert actual measured fuel or electricity production or savings into GHG reductions. Weighted average grid emissions factors are used when a project results in upstream emissions reductions and the mix of power plants in the grid may change from year to year (see Appendix D). Special approaches needed for monitoring energy efficiency projects are described in Section 5. Simplified procedures for small-scale projects are provided in Section 6.

4.2.6 Prepare Investment Plan and Undertake Financial Analysis

Before undertaking a financial analysis of how the value of carbon credits from the CDM will benefit the project, an investment plan outlining the role of each party (local debt and equity financing, CER purchaser, etc.) should be prepared. The investment plan should identify the expected returns (i.e., financial returns and emissions reductions) that each party expects from the project. See Section 3.4 for more details on carbon financing options.

Next, identify the expected conventional financing requirements and arrangements for cost recovery that would be expected in the project. For example, in a renewable energy–based power project, conventional financing will be required for the base cost of the technology, and the sale of the power produced will contribute to cost recovery.

Most companies seeking credits for emissions reductions through a CDM project will be interested only in contributing to the part of the project that actually reduces the emissions. In some types of projects, such as small hydro or wind power, the CDM would help finance the incremental cost of the renewable energy project over the baseline technology (e.g., a gas-fired turbine or coal plant). In others, such as a landfill gas recovery project, the CDM might finance the whole project. In an energy efficiency project, where savings from reduced energy use are generated from the project, the CDM might provide financing to remove market barriers. More details on the types of financial positions that companies can take to earn CERs in CDM projects are provided in Section 3.4.

Once the expected emissions have been estimated, and the financial and investment arrangements agreed to, a financial analysis should be performed for each investor in the project, at several CER prices (per tonne). The analysis should include all costs and revenue streams associated with projects, such as an estimate of capital and operating costs, and any costs to remove barriers (such as marketing, financing, etc.). It should also include an assessment of sensitivity and risk. The results will provide an estimate of the financial returns to each investor, and the impact of the CDM on the viability of the project.

Completing the financial analysis and answering the following questions will help determine whether the project should be pursued from a financial point of view, and answer the questions on the project's "additionality" included in the CDM approval process:

- Is the project financially viable without the sale of CERs?
- Does the CDM financing or sale of CERs have a sufficient impact on the financial returns from the project or the removal of market barriers to make the project more easily implemented?
- Can financial returns and CERs be recovered effectively and at a reasonable risk?
- Is the investor's entitled share of CERs satisfactory?
- Are the emissions reduction costs (cost per tonne) satisfactory?

As mentioned earlier, the current price of GHG emissions reductions in informal carbon markets is between US$3 per metric ton (tonne) and US$5 per tonne of carbon dioxide equivalent. This is expected to rise to a maximum US$10 per tonne over the next five years, except in niche markets for smaller "high-quality" projects that might fetch higher prices.

4.2.7 Prepare Draft Project Design Document

The draft Project Design Document (PDD) will form the basis for the final PDD required by the CDM official bodies for project approval. The following provides an overview of the major components required in a PDD, while Appendix E provides the outline of the official PDD established by the UNFCCC.[20] Small-scale CDM projects are allowed to use a simplified PDD (see Section 6 and Appendix F).

Description of the project. A general description of the project should identify:

- the name of the project;
- a listing of all project proponents, including their coordinates;
- the project location, including the host country and regions, as well as a discussion of the physical location of the project activity;
- the project type — for example, reduction projects may be fuel substitution, renewable energy, or energy efficiency projects;
- a description of the technology to be employed, and, if the technology will be transferred (e.g., to local stakeholders), a discussion of how this will be accomplished;
- a brief explanation of the GHG emissions reductions that will occur as a result of the project, including a discussion of why these reductions would not occur in the absence of the project, and a discussion of any relevant national circumstances; and,
- a description of the public funding of the project, if relevant.

Baseline methodology. The name of the chosen baseline methodology must be included (see Section 4.2.2 above), along with a discussion of the following:

- why it was selected;
- how it will be applied in the context of the project;
- how it was established in a transparent and conservative manner; and,

[20] An electronic version of the CDM PDD can be accessed through the UNFCCC Web site at unfccc.int/cdm/cdmpdd.htm or by e-mailing cdm-info@unfccc.int.

- why the project is additional to the baseline scenario.

Duration of the project/crediting period. The starting date of the project must be provided, and the chosen crediting period must be clearly stated (i.e., 10 years, or 21 years with baseline renewal every seven years). The expected operational lifetime (which is not necessarily the same as the crediting period) of the project should also be stated.

Monitoring methodology and plan. As with the baseline, the monitoring methodology should be chosen from an approved list to be made available on the UNFCCC CDM Web site. In addition, a justification of the choice must be provided. The monitoring plan should identify the data used to calculate the emissions reductions, and discuss why this data is accurate, comparable (i.e., to similar projects), complete, and valid. In other words, it must show that quality assurance for data monitoring, collecting, and reporting has been implemented. If a new monitoring methodology is to be used, a detailed discussion must be presented, including the methodology's strengths and weaknesses, and whether it has been applied successfully elsewhere (Annex 4 of the PDD provides a template for this discussion).

Calculation of how GHG emissions are reduced. The net reductions in GHG emissions must be clearly identified and compared to emissions reductions that would have occurred without the project activity.

Environmental impacts. A description of the identified environmental impacts, as well as a discussion of the EIA, if applicable, must be included.

Stakeholder comments. Stakeholders must be consulted prior to the implementation of a project. Their comments, as well as the ways these comments were taken into account, must be documented.

Annex 1. Information on participants.

Annex 2. Information on public funding. Since official development assistance from Annex 1 countries cannot be used directly in the implementation of a CDM project (purchase of CERs), it must be clearly shown that funding support for any part of a project — for technology transfer, for example — is exclusive of official development assistance.

Annex 3. New baseline methodology — if different from approved approaches.

Annex 4. New monitoring methodology — if different from approved approaches.

Annex 5. Baseline data.

The draft PDD can be prepared by, or on behalf of, the project proponent (e.g., the local company, community, or NGO in the host developing country) or the company providing the CDM financing. The information provided at this stage is normally sufficient for a preliminary investment or CER purchase agreement to be prepared between the project proponent and the contributing company.

4.3 Stage 3: National Approval

At this stage, the project process must start to follow the procedures and schedule set out in the Marrakech Accords. An Environmental Impact Assessment must be performed if negative impacts are suspected. All CDM projects incorporate stakeholder input and host country approval prior to implementation. The steps during this stage are as follows:

1. Undertake environmental impact assessment (if required).
2. Obtain stakeholders' comments.
3. Obtain host country approvals.

4.3.1 Undertake Environmental Impact Assessment

If either the project proponent(s) or the host country believes that negative environmental or social impacts from the project activity will be significant, then an environmental impact assessment (EIA) must be carried out. The assessment should include impacts from both within and outside the project boundary area and follow the host country's procedures. The results of the environmental assessment must be attached to the final Project Design Document. Section 3.1 provides more details on sustainable development criteria that may serve as a basis for the EIA.

4.3.2 Obtain Stakeholders' Comments

Local stakeholders and the international community have two opportunities to provide comments on the CDM project activity. The first is the responsibility of the project proponent, who must consult with stakeholders to garner input and support for the project. A summary of this consultation process, as well as the comments received and the ways the comments were taken into consideration, must be included in the final Project Design Document.

The second opportunity for input occurs when the Designated Operational Entity makes the Project Design Document public (see Section 4.4). In this stage, stakeholders and others have 30 days to provide their comments. The DOE then evaluates the comments and determines whether the project should go forward.

4.3.3 Obtain Host Country Approvals

The project proponent must obtain written approval of the voluntary participation of each party involved — that is, Canada and the host country. Written confirmation from the host country that the project will achieve sustainable development is also required. This will be determined either on a project-by-project basis or by assessment against national sustainable development criteria (see Section 3.1).

Host country confirmation must also be attached to the final Project Design Document by the Designated Operational Entity (see below).

4.4 Stage 4: Validation and Registration

Additional stakeholder comments, as well as national approval, constitute the final requirements for project approval. Once these elements are incorporated into the draft PDD produced earlier, the PDD may be finalized and submitted to the Designated Operational Entity (DOE). The DOE evaluates a project against the requirements of the CDM, and then approves (i.e., validates) the project and refers it to the CDM Executive Board for registration. Registration is the formal acceptance of a validated project, and must be obtained prior to project implementation.

In its validation of the project activity, the DOE will ensure the following:

- voluntary participation by all parties (who must be Parties to the Kyoto Protocol) was invited;
- stakeholders' comments were received and taken into account;
- an analysis of the environmental impacts – and, if necessary, an EIA – was conducted;
- a real emissions reduction will ensue as a result of the project;
- baseline and monitoring methodologies comply with Executive Board guidelines; and,
- written confirmation by the host country that the project meets sustainable development criteria has been received.

When the DOE is satisfied that these conditions have been met, it will make the PDD public for further stakeholder input and receive comments for 30 days. After this time, any comments are taken into consideration, and the DOE will make a decision on whether to validate the project.

Once validated, the PDD and any supporting materials are forwarded to the Executive Board for approval. Approval by the Executive Board results in registration of the project. Registration is final eight weeks after the Executive Board receives the validated document, unless further review is warranted. After a project is registered, the CDM registration fee is paid (see Section 2) and the project developer may proceed with implementation.

4.5 Stage 5: Implementation and Monitoring

Once a project is implemented, emissions must be monitored. It is important to ensure that the measurement of project-related GHG emissions is done in accordance with the protocol prescribed in the PDD. Monitoring reports must be forwarded to the DOE so that emissions reductions can be verified and CERs issued.

Simplified monitoring protocols for small-scale projects may not involve actual measurement of emissions, but all the necessary information set out in the simplified protocol must be collected by the project operator to enable verification by the DOE.

4.6 Stage 6: Verification and Certification

4.6.1 Verify and Certify Emissions Reductions

The DOE will periodically review the monitoring reports associated with the project to ensure that GHG measurement is being performed in a prudent manner and that real emissions reductions are being realized. In its analysis, the DOE may conduct on-site inspections, speak with project participants and local stakeholders, and collect its own data. If necessary, the DOE may insist on additional data, which it will source. It may also require changes to the monitoring methodology for future reporting periods.

Once the DOE is assured that the requirements for verification are met, it will issue a written confirmation of verification for the project activity. The verification report will be forwarded to the Executive Board and project participants, and will also be made public. The DOE then issues a certification report to the public and the Executive Board.

4.6.2 Issuance of CERs

The certification report serves as the official request for the issuance of CERs by the Executive Board. Unless a review is required (for example, in cases of fraud or incompetence attributed to the DOE), the issuance will be deemed final 15 days after the Executive Board receives the certification report.

The CERs are dispersed by the Executive Board as follows: a 2% adaptation levy (see Section 2.7) will be deposited into the appropriate accounts of the CDM registry; the remainder will be deposited into the registry accounts of the parties (e.g., Canada) and the project participants.

5 Special Features of CDM Energy Efficiency and Fuel Substitution Projects

5.1 Characteristics of Energy Efficiency and Fuel Substitution Projects

Projects designed to promote energy efficient technologies or alternative fuels have several special features that will affect the design of a CDM project:

- most technologies are already cost-effective to energy consumers — i.e., their cost can be more than recovered through energy savings;

- technologies are not widely used because of market barriers — such as high initial cost, lack of information and financing, and perverse investment priorities — rather than poor rate of return; and,

- many electricity efficient technologies are also financially beneficial to power utilities because they lead to reductions in peak demand, and deferral of new capacity.

Most energy efficiency or fuel substitution projects, therefore, involve removing market barriers restricting the use of a technology, rather than reducing costs to consumers.

The simplest energy efficiency or fuel substitution project is one in which an energy user invests in a high efficiency technology or measure on-site. The resulting savings (from the reduction of energy use) pay for the cost of the technology, and GHG emissions are reduced either on-site (if fuel is saved) or upstream (if electricity is saved). A CDM contribution would improve the financial return to the user, in return for the CERs.

Many projects, however, involve the installation of energy efficient or alternative fuel technologies in multiple locations by energy users in a specific target market. In this case:

- energy savings are dependent on the rate of adoption of these energy efficient technologies and practices by energy consumers;
- the rate of adoption depends on the success of marketing and financing programs designed to overcome market barriers;
- successful programs often lead to increased use of energy efficient products in the marketplace, unrelated to the program;
- it is often difficult to select a baseline against which to measure energy savings, as future energy consuming behaviour without the project will depend on many factors; and,
- projects are often implemented by third parties who are neither energy users nor energy producers/suppliers.

In these types of projects, the CDM contribution is normally used to remove market barriers, provide financing, or support marketing programs, and CERs are issued for each technology product purchased and used.

Many energy efficiency and fuel substitution projects also involve the installation of a large number and variety of products in each facility or location. This makes measurement of energy savings — and, therefore, emissions reductions — difficult and costly.

Finally, emissions reductions from electricity efficiency depend on the energy sources used to generate power at the time the electricity is saved. Emissions reductions will, therefore, vary by the hour, day, season, and year, depending on the dispatch order of power plants serving the grid.

These special features of energy efficiency and fuel substitution projects have implications for

- the role of the CDM financing in the project;
- the design of the project itself;
- the selection of a baseline; and,
- the estimation and measurement of GHG emissions reductions.

5.2 The Role of CDM Financing

An energy efficiency or fuel substitution project can involve several parties:

- the energy consumer who buys and installs the efficient technology and reaps the savings;
- the supplier of the technology who sells the technology to the consumer;
- the supplier of energy who benefits from the technologies in the form of reduced peak demand or supply infrastructure deferral, while at the same time losing revenue; and,
- third parties who reduce market barriers or provide financing, usually in return for a share in the savings.

To be viable as a CDM project, a project must be financially attractive for all parties to the project — the consumer, utility, energy service company/contractor, and buyer of CERs. CERs are normally shared among the parties whose financing produces the emissions reductions. It is, therefore, very important to determine the precise role of the CDM contribution, and to agree on the sharing of CERs in advance.

Table 5.1 shows some of the ways CDM financing can be used in an energy efficiency or fuel substitution project.

Table 5.1: CDM Roles in Energy Efficiency and Fuel Substitution Projects

Role of CDM Financing	Other Parties Involved
Providing a direct contribution towards a consumer's technology costs to bring the consumer's rate of return to acceptable levels	Consumers, Suppliers
Providing financing for a technology to allow consumers to recover its full cost from savings	Consumers, Suppliers, Energy Service Companies, Financial Institutions
Supporting marketing programs that remove non-price barriers to consumer behaviour or to the purchase of technology	Consumers, Suppliers, Energy Service Companies, Utilities
Bundling multiple energy efficiency projects to meet utility demand side management (DSM) objectives	Suppliers, Utilities

5.3 Project Design

In order to be of a sufficient size to attract CDM investors or buyers of CERs, energy efficiency and fuel substitution projects often need to include many pieces of equipment and aggregated savings over a large number of plants or sites. For example, a project to install high efficiency electric motors, lighting, or boilers may need to cover several industries or homes in a given region, and involve hundreds of pieces of equipment in each location. In most cases, it is also only viable to replace existing equipment when it is not being used or it reaches the end of its useful life.

The most important elements of project design, therefore, will be the equipment replacement implementation plan, and, if the project involves many separate consumers, the marketing plan used to ensure high project participation. The marketing program can often be the most expensive part of a project.

Having a project that involves equipment replacement at multiple locations also has a significant impact on the design of an emissions reduction measurement protocol (see below).

Finally, to maximize emissions reductions at the lowest cost, the CDM project should be designed to replace equipment as it is retired, making the credit period long enough to reap all of the savings from the efficient technology being installed over its useful life. For example, it may take three years to replace all motors. If these motors last 10 years, then the credit period should be at least 13 years.

5.4 Selection of Baseline

The steps involved in setting the baseline for an energy efficiency or fuel substitution project are outlined in Table 5.2.

Table 5.2: Steps Involved in Setting the Baseline for Energy Efficiency or Fuel Substitution Projects

Step		**Specifics**
1	Define the project boundary	The market area and target market segment (e.g., electric motors in all chemical industries in a region)
2	Select the baseline technology	Document the market conditions that explain your choice (e.g., incandescent lamps, because of the high initial cost and lack of suppliers of compact fluorescent lamps)
3	Select a baseline sample	The number of current sites or pieces of equipment that are deemed representative of the market segment (e.g., 100 motors in each of five size ranges, 60 lamps per household segment, or, if a comprehensive efficiency upgrade at a single location is being considered, the whole plant)
4	Choose the method for estimating energy consumption	Normally, power times operating hours (kW x hours), or direct measurement
5	Estimate current and future energy consumption within the project boundary	Normally, sample energy consumption times market size
6	Choose "emissions coefficients" for fuel and for electricity	These are measures of the on-site and upstream emissions per unit of energy consumption. In the case of electricity, the emissions factor will normally be a standard regional factor based on the weighted average emissions from each power plant in the grid, or in some cases the next new plant (see Section 4.2 for more details)
7	Calculate the baseline emissions for the period for which emissions reductions will be claimed	Energy consumption times emissions factors

Standardized Baselines

In many energy efficiency or fuel substitution projects, standardized approaches can be used to reduce the costs of setting baselines:

- using standardized algorithms to calculate energy consumption;
- building gradual improvements in efficiency into the baseline over the credit period;
- building expected changes in grid power sources into the estimation of emissions factors;
- using standardized usage rates for end-use technologies (e.g., lighting hours or motor operating hours); and,
- using standardized sampling and data collection or measurement procedures to ensure the baseline is representative.

Baseline Corrections

In large energy efficiency projects that span several years, it may be necessary to allow for the gradual uptake of energy efficient technologies in the project baseline. Some consumers may choose to buy efficient motors or lamps on their own, without the incentives provided by the CDM project. These consumers are called "market leaders" by suppliers and "free riders" in utility demand side management (DSM) programs. The baseline emissions will, therefore, be lower than expected, and the emissions reductions attributed to the project will also be lower.

Several methods can be used to correct the baseline to take this market leadership into account, but in most cases the effect is small. It is normally accurate enough to assume that the lower energy savings due to market leadership/free rider effects will be cancelled out by increased savings from "free drivers" and market transformation effects outside the boundary (see Sections 5.5 and 5.6 below).

For more information on setting baselines in energy efficiency projects, see *Emissions Baselines: Estimating the Unknown,* Organization for Economic Cooperation and Development, International Energy Agency, 2000.[21]

5.5 Estimation of Energy Savings and GHG Emissions Reductions

Several approaches may be used to estimate the emissions reductions from an energy efficiency or fuel substitution CDM project. In all cases, the energy savings are estimated first and then translated into emissions reductions using fuel or grid electricity emissions factors. These emissions factors should be the same ones used to set the baseline emissions (see above).

Energy Savings

At the design stage of an energy efficiency project, the energy savings can be estimated by a number of means:

- by comparing baseline and project energy use using modelling;
- by using energy savings estimates from similar projects that have the same baseline; or,

[21] See www.iea.org/books/studies/2000/em.base.pdf.

- by using standard performance data for the energy efficient technologies (e.g., reduced wattage) and estimating the reductions in energy use if used instead of the baseline technology.

In projects in which the uptake of efficient technologies depends on the participation of a wide variety of consumers, estimation of energy savings must be based on the expected level of participation produced by the project's marketing program. A well-marketed, efficient industrial motor financing program with good supplier cooperation can obtain well over 50% market penetration. A project in which an energy service company signs up a group of buildings with performance contracts can result in close to 100% participation. A simple consumer giveaway program, on the other hand, will seldom result in better that 20% market penetration.

Market Impacts Unrelated to the Project

A project that involves the replacement of energy using equipment at multiple sites over a large area, and that depends on a marketing program to achieve savings, will often have impacts far outside the project boundary:

- Market leaders outside the project boundary will also adopt the energy saving technology or measure. These consumers are often called "free drivers."
- Suppliers serving the region within which the project is located will offer the energy saving technology to all their customers at a lower cost because of economies of scale. This will accelerate the migration of the market towards the more efficient technology.

It is quite difficult to estimate these impacts, and a conservative approach is to assume that these positive impacts on project savings are cancelled out by the effects of market leaders/free riders within the project boundary (see above).

One other market effect that occurs within the project boundary is the "rebound effect." This occurs when a consumer switches back to the baseline technology before the project is completed. This behaviour has only been observed where no- or low-cost measures are concerned (e.g., lower thermostat settings). In a well-designed project and marketing program, rebound can be effectively eliminated.

5.6 Measuring Emissions Reductions

Several approaches may be used to measure the actual emissions reductions from an energy efficiency or fuel substitution CDM project. In all cases, the energy savings are measured first and then translated into emissions reductions using fuel or grid electricity emissions factors. These emissions factors should be the same ones used to set the baseline emissions (see above).

Table 5.3 shows the various approaches that can be used to measure energy savings (electricity or fuel) in an energy efficiency project. Combinations of these methods may be used where necessary.

Several monitoring and verification protocols have been prepared to assist project developers with the measurement of energy savings. The best known of these is the U.S. Department of Energy's International Performance Measurement and Verification Protocol (IPMVP).[22]

[22] See www.ipmvp.org/info/info.html.

Projects that involve the replacement of baseline equipment in multiple locations require a statistical approach to savings estimation. It is not possible to measure savings in all locations, so a statistical sample must be selected. The simplest approach is to use the same sample that was used for baseline setting.

In projects where savings depend on the participation of energy consumers, statistically sound market surveys must be carried out regularly to determine the current market penetration rate. This rate can then be used with the chosen measurement approach to estimate actual savings.

Table 5.3: Approaches Used for the Estimation or Measurement of Energy Savings

Approach	Methodology	Typical Applications
Algorithms and Models	Standard equations or computer simulations are calibrated to baseline technology and energy use; savings are calculated by substituting the efficient technology as baseline technology is replaced	Projects involving replacement of a single technology in multiple locations (e.g., industrial motors or compact fluorescent lamps)
Energy Bill Analysis	Energy bills before the project (baseline) and during the project are compared; models are used to adjust for weather and other effects	Building retrofits and industrial plant upgrades involving multiple technologies
End-use Metering	The energy consumption of baseline and project technologies are measured using specially installed meters	Boiler replacement
Short-term Monitoring	Metering is carried out in several parts of a project to calibrate models	Building lighting and HVAC retrofits where few changes in usage are expected

The emissions measurement protocol prepared for the ILUMEX AIJ project in Mexico provides a good example of how to estimate energy savings in a multiple location energy efficiency project. ILUMEX involved the leasing of compact fluorescent lamps to homeowners in several communities in a region served by a power grid containing a variety of power plants.

For more information on this subject, see *Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification of Energy Efficiency Projects in Climate Change Mitigation*, Edward Vine and Jayant Sathaye, Environmental Energy Technology Division, Lawrence Berkley Laboratories Publication LBNL 41543, March 1999.[23]

[23] See http://ies.lbl.gov/iespubs/iesgpubs.html

6 Small-Scale CDM Projects

6.1 Typical Small-Scale CDM Projects

Table 6.1 provides some examples of small-scale CDM projects, including typical delivery and financing mechanisms.

Table 6.1: Examples of Small-Scale Renewable Energy and Energy Efficiency CDM Opportunities

Technology	Displaced Fuel	Delivery Model	Role of Carbon Financing	Basis for Earning CERs
Solar home systems	Kerosene or grid electricity	Third party financing	Buy-down of interest rate	Per system sold
Renewable energy mini-grid (solar PV, micro-hydro, biomass gasification, or community biogas plant)	Diesel or kerosene	Fee for electrical or gas service	Co-financing	Per unit produced
Biogas plants (cooking and lighting)	Kerosene	Entrepreneur network	Financing of marketing and training	Per system installed
Biomass gasifier (heat for small enterprises)	Diesel (burners)	Entrepreneur network with financing	Buy-down of interest rate or financing of marketing and training	Per system installed
Efficient wood and gasifier stoves (cooking)	Kerosene or LPG	Contracted artisan network	Financing of marketing and training	Per system installed
Solar water heaters (urban)	Electricity	Market expansion with financing in industrial colonies and new areas	Buy-down of interest rate and marketing support	Per system installed
Industrial process improvements and fuel switching	Diesel, coal, or fuel oil	Aggregation of sector clusters	Co-financing	Per unit of fuel displaced or product produced
Electricity efficiency (lighting, appliances, AC, etc.)	Electricity	Efficient product promotion program with financing	Support for marketing program and buy-down of financing	Per kWh saved based on user sampling
Integrated solutions (e.g., new housing with incorporated biogas)	Kerosene	House building and sale with financing (mortgage)	Buy-down of interest rate	Per standard dwelling sold

6.2 Simplified Procedures for Small-Scale CDM Projects

Many of the transaction costs involved in approving and implementing CDM projects, described in Section 3.3, will be independent of project size. These costs reduce the viability of smaller CDM projects due to smaller economies of scale. However, the CDM Executive Board recognized this problem and proposed the development of simplified procedures for small-scale CDM projects. These simplifications will allow the use of standardized baselines, a simpler Project Design Document, and streamlined monitoring procedures — all of which reduce transaction costs so that small-scale projects can offer CERs at competitive prices.

The types of CDM projects that will be eligible for the simplified procedures include the following:

- renewable energy project activities with a maximum output capacity equivalent of up to 15 megawatts (MW);
- energy efficiency improvement project activities that reduce energy consumption on the supply and/or demand side by up to the equivalent of 15 gigawatt-hours (GWh) per year; and,
- other project activities that reduce the anthropogenic emissions of sources that directly emit less than 15 kilotonnes (kt) of carbon dioxide equivalent annually.

Small-scale CDM projects will still be subject to CDM project approval requirements, such as verification by the host country regarding sustainable development priorities and an EIA, if necessary.

The following sections describe the simplified procedures for the following:

1. Proving the additionality of the project
2. Bundling projects
3. The Project Design Document
4. Selecting baselines – including for grid electricity
5. Monitoring emissions reductions

6.2.1 Additionality

All CDM projects must lead to real, measurable reductions in greenhouse gas emissions, or lead to the measurable absorption (or "sequestration") of GHGs in a developing country. GHG emissions from a CDM project activity must also be reduced below those that would have occurred in the absence of the project, and it must be shown that the project would not have been implemented without the CDM.

In small-scale CDM projects, proponents only have to describe the barriers that prevented the implementation of the CDM project, or restrict the rate of return or scope of the project, to demonstrate that the emissions reductions are additional. The following types of barriers are eligible:

- ***Investment barrier***: A financially more viable alternative to the project activity would have led to higher emissions, and the sale of CERs makes the project more viable. A qualitative explanation or a quantitative criterion (e.g., return on investment or payback period) may be used.
- ***Technological barrier***: A less technologically advanced alternative to the project activity involves lower risk due to performance uncertainty, or low market share of the new technology

adopted for the project would have led to higher emissions, and the CDM project reduces these risks, increases market share, or introduces a more advanced technology.

- ***Barrier due to prevailing practice***: Prevailing practice or existing regulatory or policy requirements would have led to the use of a technology with higher emissions, and the CDM project changes this prevailing practice.
- ***Other barriers***: Without the CDM project activity, for another specific reason identified by the project participant — such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies — emissions would have been higher.

6.2.2 Bundling and De-bundling of Projects

Small-scale CDM projects can consist of an aggregation of individual pieces of equipment at several sites — for example, solar home systems or efficient lighting systems installed at a large number of homes or buildings. Monitoring of a sample of these sites is sufficient to validate emissions reductions (see below). Several small-scale projects can also be bundled together, as long as the total size of the project does not exceed the limits for small-scale CDM projects listed above. For example, three efficient lighting projects that each have energy savings of 4 GWh/yr could be bundled together for the purposes of CDM project registration, as long as separate monitoring plans are submitted for each one.

On the other hand, projects larger that the limits for small-scale projects cannot be de-bundled to make them eligible. For example, a 100 MW wind farm cannot be split into eight small-scale projects, unless the components are designed and built at different times.

6.2.3 Project Design Document

Appendix F provides the simpler Project Design Document (PDD) that can be used for small-scale projects. Because small-scale projects are allowed to use standard baselines and monitoring procedures (see below), the section on calculating emissions reductions, baselines, and monitoring in the PDD will take less time to complete.

6.2.4 Baseline Methodology

For many types of small-scale CDM technologies, a standard baseline technology may be used, and a standard emissions factor or equation for this baseline technology used to estimate annual emissions reductions from the CDM project.

In other cases, the baseline technology that would have been used in the absence of the CDM project must be specified, and standard measures of equipment performance for the CDM and baseline technologies may be used to estimate annual emissions reductions.

CDM projects that produce or displace energy that would otherwise be supplied by external sources, such as grid electricity, earn credit for emissions reductions associated with the amount of electricity produced (e.g., from a wind farm) or saved (e.g., from an efficient lighting project). In this case, standard emissions factors for these external sources may be used to estimate annual emissions reductions. The simplified procedures for small-scale CDM projects provide two options for these standard baselines:

A standard diesel generator. This may be used for any small-scale renewable generation project or electricity efficiency project (equipment or facility) that displaces electricity from any size of grid that uses predominantly diesel or fuel oil for electricity generation. This would include diesel mini-grids and larger (e.g., island) grids that use larger fuel oil generators. The standard emissions factors are shown in Table 6.3.

Table 6.3: Standard Emissions Factors (kg CO_2/kWh) for Different Sizes of Diesel Generators

Type of Grid	Mini-grid with 24-hour Service	Mini-grid with 4- to 6-hour Service	Mini-grid Only Used When Needed
Load Factor	***25%***	***50%***	***100%***
<15 kW	2.4	1.4	1.2
>/=15 to <35 kW	1.9	1.3	1.1
>/=35 to <135 kW	1.3	1.0	1.0
>/=135 to <200 kW	0.9	0.8	0.8
>/=200 kW	0.8	0.8	0.8

A weighted average regional grid emissions coefficient. This approach must be used when the electricity is fed to or displaced from any other type of grid. It allows the use of published or commonly used standard emissions coefficients for the local or regional power grid based on current common characteristics of the grid. These include annual power production and efficiencies for each power plant (hydro, coal, natural gas) in each year that CERs will be claimed. These coefficients will be the same for all CDM projects operating in the region, unless the project specifically addresses one aspect of the load curve — e.g., reducing peak demand. Appendix D provides more information on how to determine weighted average emissions coefficients, and gives an example.

It is recommended that developers of small-scale CDM projects use average emissions factors that are already in use in their region, or that appear in the literature, when estimating emissions reductions for CDM project documents. By the time the projects are implemented, standard grid coefficients of the types listed above will be published each year by national agencies. Monitoring protocols that are used to actually calculate and verify CERs can, therefore, refer to these coefficients without having to estimate them each year.

If a CDM project displaces electricity in a grid distribution system, emissions reductions associated with the reduced distribution losses may also be added in (see Appendix D). A default value of 20% for distribution losses may be used.

A summary of standard baselines that can be used for a variety of small-scale technologies is provided in Table 6.4.

6.2.5 Monitoring Methodology

For a group of similar individual CDM technologies, annual proof that a significant sample of the devices are operating may be used as a basis to calculate annual emissions reductions for all devices. The annual emissions reduction equals the total number of devices installed times the standard emissions or equipment performance factor.

For power production and electricity efficiency in facilities, annual metering of the electricity produced or saved is used as the basis for emissions reduction. The measured emissions reduction equals the power produced multiplied by the emissions factor for a standard diesel generator, or the weighted average grid emissions factor. Reductions in grid distribution losses can also be added in by using a default of 20%.

Table 6.4 provides a summary of the simplified monitoring requirements for a variety of small-scale technologies.

Table 6.4: Simplified Baseline and Monitoring Methodologies for Small-Scale CDM Projects

Project Type	Example of Technology	Baseline Emissions[24]	Monitoring
Renewable Energy			
Electricity Generation by User	Solar, hydro, and wind home systems, solar battery chargers	Emissions coefficient of fuel displaced (kg CO_2/kWh) multiplied by: a) Number of customers * average individual consumption (kWh/yr) for the same end-use in a nearby grid-served area; or, b) Number of customers * power produced by renewable energy (kWh/yr). The impact of distribution losses may be taken into account by dividing baseline emissions by (1 – fractional loss).	An annual check that a sample of systems are still operating as planned or metered power generated. Published values for T&D losses may be used.
Mechanical Energy for the User	Wind- and solar-powered pumps, water mills	*For replacement of diesel*: diesel fuel consumption per year (kg/yr) * 3.2 kg CO_2/kg the emissions coefficient for diesel fuel. *For displacement of electricity:* power requirements (kW) multiplied by hours per year * emissions coefficient of a diesel mini-grid (kg CO_2/kWh) from Table 6.3. The impact of distribution losses may be taken into account by dividing baseline emissions by (1 – fractional loss).	An annual check that all systems are operating and estimated or measured average annual operating hours in a sample of systems. Published values for T&D losses may be used.
Thermal Energy for the User	Solar water heaters and dryers, solar cookers, biomass thermal devices	*For displacement of fossil fuels*: fuel consumption of baseline technology * the emissions coefficient of the displaced fuel; *For displacement of non-renewable biomass*: biomass consumption * an emissions co-efficient for biomass. *For displacement of electricity:* electricity consumption of baseline technology * emissions coefficient (kg CO_2/kWh) of a diesel mini-grid from Table 6.3, or a weighted average grid emissions coefficient (see Appendix D). The impact of distribution losses may be taken into account by dividing baseline emissions by (1 – fractional loss).	a) Metered energy produced by a sample of the systems; or, b) An annual check that all systems are operating and estimated or measured average annual operating hours in a sample of systems. Published values for T&D losses may be used.

[24] IPCC default values shall be used for emissions coefficients, unless otherwise stated.

Project Type	Example of Technology	Baseline Emissions[24]	Monitoring
Electricity Generation for a Grid	Photovoltaic, wind, hydro, tidal/wave, geothermal, recovered methane, and biomass power generation; cogeneration and hybrid systems less than 45 $MW_{thermal}$, with a renewable component less than 15 MW	Annual kWh produced by renewable energy * an emissions factor for a diesel mini-grid (kg CO_2/kWh) from Table 6.3, or a weighted average emissions factor (kg CO_2/kWh) (see Appendix D).	Metered electricity generated from renewable energy. In the case of generating plants co-fired with biomass, the energy content and amount of biomass used per year shall also be monitored.
Energy Efficiency			
Supply Side Improvements — Transmission and Distribution	Upgrading voltage on transmission lines, replacing a transformer, increased insulation of pipes in district heating system	Transmission or distribution losses based on the measured performance of existing equipment or national standards for the equipment's performance * an emissions factor for a diesel mini-grid (kg CO_2/kWh) from Table 6.3, or a weighted average emissions factor (kg CO_2/kWh) (see Appendix D).	Measured technical energy losses of new equipment (if applicable); otherwise, use test results from equipment.
Supply Side Improvements — Generation	Energy efficiency improvements at power stations and cogeneration	Baseline emissions are based on measured fuel consumption of existing equipment or national standards (for new facilities) * the emissions coefficient for the fossil fuel used to generate electricity.	The energy content and measured consumption of the fuel used by the generating unit, and the energy content and metered electricity or steam produced by the unit.
Demand Side Programs for Specific Technologies	Energy efficient equipment, lamps, ballasts, refrigerators, motors, fans, air conditioners, appliances, etc., with aggregate energy savings of less than 15 GWh equivalent per year.	*Displacement of fossil fuel*: existing fuel consumption or amount of fuel that would have been used by baseline technology * the emissions coefficient for the fuel. *Displacement of electricity*: The number of devices installed * the weighted average power (kW) of the baseline devices * the annual operating hours of the baseline devices * an emissions factor for a diesel mini-grid (kg CO_2/kWh) from Table 6.3, or a weighted average emissions factor (kg CO_2/kWh) (see Appendix D). The impact of distribution losses may be taken into account by dividing baseline emissions by (1 – fractional loss).	The number and nameplate performance or power of replaced (baseline) devices. a) The number and nameplate performance or power of project devices and metered operating hours for an appropriate sample of devices. b) Metered energy consumption of an appropriate sample of project devices. An annual check that a sample of non-metered devices are operating. Published values for T&D losses may be used.

Project Type	Example of Technology	Baseline Emissions[24]	Monitoring
Energy Efficiency and Fuel Switching Measures for Industrial Facilities	Energy efficient motors, fuel switching measures and efficiency measures for specific industrial processes. Aggregate energy savings must be less than 15 GWh equivalent per year.	Energy use of the existing equipment (for retrofits) or the facility (new construction) * an emissions coefficient for a diesel mini-grid (kg CO_2/kWh) from Table 6.3, or a weighted average emissions factor (kg CO_2/kWh) (see Appendix D). The impact of distribution losses may be taken into account by dividing baseline emissions by (1 – fractional loss).	*For retrofits*: document specifications of equipment displaced; meter the energy use of the facility after new equipment is installed; and calculate the energy savings. *For a new facility*: meter the energy use of the new facility and calculate the energy savings due to the equipment against baseline technology.
Energy Efficiency and Fuel Switching Measures for Buildings	Technical measures, such as HVAC and lighting. May be in retrofits or new facilities, but aggregate energy savings must be less than 15 GWh equivalent per year.	Energy use of the existing equipment (for retrofits) or the facility (new construction) * an emissions coefficient for a diesel mini-grid (kg CO_2/kWh) from Table 6.3, or a weighted average emissions factor (kg CO_2/kWh) (see Appendix D). The impact of distribution losses may be taken into account by dividing baseline emissions by (1 – fractional loss).	*For retrofits*: document specifications of equipment displaced; meter the energy use of the facility after new equipment is installed; and calculate the energy savings. *For a new facility*: meter the energy use of the new facility and calculate the energy savings due to the equipment against baseline technology.
Other Project Activities			
Switching Fossil Fuels	Retrofit projects in industrial or electricity generation applications that emit less than 15 kt of CO_2e per year.	Current emissions of the facility (emissions per unit of output), using approved emissions coefficients.	Monitor the fuel use and output prior to and after the fuel switch. Emissions coefficients for coal should be based on test results for periodic samples of the purchased coal.
Emissions Reductions in the Transportation Sector	Low GHG emission vehicles, the total of which emit less than 15 kt of CO_2e per year.	Energy use of the vehicle that would otherwise have been used * emissions factor for baseline fuel.	Track the number of low emission vehicles operating under the project, as well as the annual units of service for a sample of the vehicles.
Methane Recovery	Methane recovery from coalmines, agro-industries, landfills, wastewater treatment facilities, and other sources. Must emit less than 15 kt of CO_2e per year.	The amount of methane that would have been emitted to the atmosphere from capture and flaring during the crediting period in the absence of the project.	The measured amount of methane recovered and used as fuel or combusted, and periodic sampling of the methane to calculate the amount of methane recovered.

7 CDM Project Opportunities

The CDM will become operational when the Kyoto Protocol comes into force. This is expected in 2003, when a sufficient number of countries have ratified the Protocol.

In the meantime, several programs have been put in place that purchase carbon credits from projects using rules similar to the CDM. It is expected that these projects will be submitted for consideration as CDM projects once the CDM becomes operational, although several are considered "business as usual" projects, and may not qualify for the CDM.

Several countries and international agencies are also providing technical assistance and capacity building to identify other potential CDM projects.

7.1 Carbon Financing (Credit Purchase) Programs

7.1.1 World Bank Prototype Carbon Fund

The Prototype Carbon Fund (PCF) was established by the World Bank as a learning pilot for the implementation of CDM and JI projects. It acts like a mutual fund, investing in GHG reduction projects on behalf of several governments (including Canada) and companies that have invested in the Fund. The Fund purchases carbon credits at up to US$5 per tonne of CO_2, in return for investment of up to 10% in the project. Project participants must submit an expression of interest in the form of a Project Identification Note (PIN).

The PCF has recently established a Community Development Carbon Fund (CDCF) to invest in small-scale community projects that reduce emissions, offering a slightly higher price for each tonne of CO_2. A simpler PIN may be used for submissions to the CDCF.

More information on these Funds is available at www.prototypecarbonfund.org.

7.1.2 CERUPT

The CERUPT program is used by the Dutch government to purchase GHG emissions reduction credits. The program is administered on behalf of the Dutch government by Senter International. CERUPT will pay between €3.30 and €5.50 for carbon credits from eligible projects, depending on the type of project (e.g., renewable energy versus energy efficiency). Project participants must submit an expression of interest and project proposal, including an explanation of the baseline. More information on the tendering process can be found at www.senter.nl/asp/page.asp?id=i000000&alias=erupt.

Table 7.1 shows some of the projects being considered by the PCF and CERUPT

Table 7.1: Selected Existing CDM-eligible Projects and Proponents, by Project Type

Project Name	Host Country	Purchase Program
Gas plant	Bolivia	PCF
Onyx gas capture	Brazil	CERUPT
Chacabuquito hydroelectric	Chile	PCF
Cote hydroelectric	Costa Rica	PCF
Esti hydroelectric	Panama	CERUPT
Bayano hydroelectric	Panama	CERUPT
Fortuna hydroelectric	Panama	CERUPT
Huanza hydroelectric	Peru	CERUPT
Bujagali hydroelectric	Uganda	CERUPT
Bagasse	Brazil	CERUPT
Huitengxile wind	China	CERUPT
Jepirachi wind	Colombia	PCF
Vara Blanca wind	Costa Rica	PCF
Chorotega wind	Costa Rica	PCF
Tamil Nadu wind	India	CERUPT
Maharashtra biomass	India	CERUPT
Tamil Nadu wind/biomass	India	CERUPT
Rajasthan biomass	India	CERUPT
Wigton wind	Jamaica	CERUPT
Olkaria III geothermal	Kenya	CERUPT
Tangiers and Tarfaya wind	Morocco	PCF
Gemina rice husk	Nicaragua	PCF
West Nile hydroelectric	Uganda	PCF

7.2 CDM Assistance Programs

7.2.1 Canada Climate Change Development Program (CCCDF) and Other Canadian CDM Support Projects

The Canadian International Development Agency (CIDA) and Canada's CDM/JI Office are supporting capacity building on the CDM in several countries. This has led to the identification of several CDM projects in Asia, the Americas, and the Caribbean.

7.2.2 Japanese Government Steering Committee of the Global Warming Prevention Headquarters

The Japanese government has established a committee comprised of directors from several departments, including the Cabinet Secretariat, Ministry of the Environment, Ministry of Economy, Trade and Industry, Ministry of Foreign Affairs, Ministry of Agriculture, Ministry of Forestry and Fisheries, and Ministry of Land, Infrastructure and Transport. Project proposals may be submitted to any of these ministries for assistance and approval. More information on CDM support from the Japanese government can be found at www.env.go.jp/en/topic/cc/020722.html.

7.2.3 UNIDO Knowledge Network for Industrial Technology Transfer (KNITT)

The KNITT is provided by the United Nations Industrial Development Organization (UNIDO) and serves as a searchable database that includes CDM project opportunities. Although the CDM component is relatively new, UNIDO is currently expanding the information on this topic. More information on KNITT can be found at www.unido.org/doc/481791.htmls.

7.2.4 Asia Least-cost Greenhouse Gas Abatement Strategy (ALGAS)

The ALGAS initiative is administered by the Asian Development Bank (ADB) and provides project assistance for 12 Asian countries to reduce GHG emissions. Funding is provided from the Global Environment Facility (GEF), the ADB, and the governments of Norway and the participating Asian countries. The ALGAS program helps countries identify CDM opportunities and provides training for local experts in the energy and forestry sectors. Thus far, the ALGAS project has helped move forward 82 abatement projects. More information can be found at ntweb03.asiandevbank.org/oes0019p.nsf.

Table 7.2 shows selected CDM projects that have been developed with the support of CDM assistance programs.

7.3 CDM Project Opportunities in Asia

The Pembina Institute for Appropriate Development, Canada, and the Tata Energy Research Institute (TERI), India, are exploring the application of the CDM in Asia. This multi-year project was undertaken in collaboration with

- the Bangladesh University of Engineering and Technology in Dhaka, Bangladesh;
- the Center for Research on Material and Energy at the Technology University in Bandung, Indonesia; and,
- the Global Climate Change Institute at Tsinghua University in Beijing, China.

Phase I of the project, completed in 2000, analyzed general opportunities for the CDM in a number of sectors. A summary of the findings is shown in Table 7.3. In Phase II of the project, the partners developed several CDM projects in each of the four Asian countries. The criteria used to select these projects included country sustainable development goals, Canadian investor preferences, potential eligibility under the simplified process for small CDM projects, and the size and cost of greenhouse gas emissions reductions. A list of Phase II projects is provided below.

Individual country reports, as well as other related publications, can be downloaded from www.pembina.org/international_eco.asp or www.teriin.org/climate/cdm-asia.

Table 7.2: Selected CDM Projects and Proponents, by Project Type

Project Name	Host Country	Project Assistance
Energy Efficiency		
Light bulb replacement	Bangladesh	ALGAS
Cook stove replacement	Bangladesh	ALGAS
Iron and steel mill upgrade	Ghana	KNITT
Valco aluminum smelter efficiency	Ghana	KNITT
Improved efficiency in thermal power plants	Kazakhstan	Japan
Improved efficiency of transformers and motors	Kenya	KNITT
Efficient boilers and kiln	Kenya	KNITT
Biomass power generation	Malaysia	Japan
Senelec steam generator efficiency	Senegal	KNITT
SONACOS efficiency	Senegal	KNITT
Electric motor efficiency	Zimbabwe	KNITT
Vegetable cold storage cogeneration	Bangladesh	CIDA
Natural gas tri-generation for industrial park	China	CIDA
Fuel Switching		
Gas network expansion	Bangladesh	ALGAS
Utilization of plantation waste and forest sequestration	Indonesia	Japan
Brick firing	Zimbabwe	KNITT
Natural gas conversion — transport	Bangladesh	ALGAS
Gasohol — transport	India	Japan
Brick manufacturing	Bangladesh	CIDA
Refinery waste integrated combined cycle power generation	India	CIDA
Renewable Energy		
Palm oil plant gas capture	Malaysia	Japan
Bangkok landfill gas capture	Thailand	Japan
Brick firing	Zimbabwe	KNITT
Webuye Falls hydroelectric	Kenya	KNITT
Solar homes	Bangladesh	ALGAS
Micro-hydro	Indonesia	CIDA
Rice husk power plant II	Thailand	Japan
Wind power generation	India	CIDA
Wind power generation	China	CIDA
Palm oil waste power generation	Indonesia	CIDA

Sources: CDM Watch, www.cdmwatch.org, and Pembina Institute, www.pembina.org.

Bangladesh

Vegetable cold storage cogeneration: Existing vapour compression refrigeration coolers will be partially replaced by a cogeneration scheme consisting of waste heat utilization by absorption refrigeration chillers. This project will consist of 8 to 10 units of 300 kW each, with a total CO_2 mitigation potential of 3,000 tonnes per year.

Brick manufacturing efficiency: Efficient natural gas–burning Hoffmann kilns will replace coal-burning, crude technology Bull Trench kilns. This project will consist of 10 to 100 new Hoffmann kilns, providing a total CO_2 mitigation potential of approximately 50,000 tonnes per year.

China

Natural gas–fired tri-generation plant in an industrial park: This 100 MW project will provide energy conservation and better environmental quality, firstly by combining power generation heat production and cooling, resulting in gross thermal efficiency up to 76%, and secondly by substituting natural gas for coal, which will significantly reduce SO_2, CO_2, and total suspended particulates (TSP).

Wind power generation: Wind power is a priority energy technology for China, and development of renewable energy is a major component in China's energy development strategy. China has abundant wind resources and the exploitable wind energy potential is estimated to be 253 GW. The project identified is a 171 MW plant being built in four phases in the province of Hebei.

India

Integrated refinery waste gasification combined cycle (IGCC) power generation: This 500 MW IGCC power plant will improve gross efficiency from 35% to 58%, compared with a conventional coal-based plant in India, saving 0.34 kg CO_2/kWh generated. It will also reduce emissions of SO_x, NO_x, TSP, and solid waste disposal, as well as the energy and resources spent to produce and transport coal.

Wind power generation: Wind power is a priority option for India, with an estimated potential of 45,000 MW (at 50 m hub height). Using wind power is estimated to save 1.16 kg CO_2/kWh of power generated. Two projects are being developed: a 15 MW project in Tamil Nadu, and a 25 MW project in Karnataka.

Indonesia

Palm oil waste power generation: This power plant will use a specially designed high pressure boiler and steam turbo-generator to generate 10.3 MW of electricity from six palm oil waste electricity plants. The "empty fruit bunch" waste is a technically challenging fuel, due to its high moisture content, fibrous nature, and ash to slag ratio.

Micro-hydro power generation: This project will consist of a group of micro-hydro units to supply the grid and displace fossil fuel generation.

Table 7.3: CDM Opportunities in Asia

Emissions Reduction Option	Price Range	Bangladesh	China	India	Indonesia
Energy Efficiency					
Iron and Steel — dry coke quenching	Low			X	
Iron and Steel — efficiency in rerolling mills	Low	X			
Pulp and Paper — continuous digestor	Low–Medium	X		X	
Electric Motors	Medium		X	X	
Industrial Boilers	Low		X		
Brick Manufacturing	Low	X			
Cement Manufacture — wet to dry process	High	X			
Salt Production from Power Plant Effluent	Medium				X
Urea Fertilizer Plants	Medium	X			
Renewable Energy					
Wind Power	High		X	X	
Micro-hydro	High				X
Water Pumping (PV, wind)	Medium–High	X		X	
Solar Thermal	High		X	X	
Solar Home Systems	Medium			X	
Geothermal Power Plant	High				X
Geothermal Heat for Agricultural Activities	Medium				X
Biomass Gasification	High		X	X	
Rice Husk-based Small Power Generation Units	High				X
Transportation Sector					
Gasohol Fuel, Biodiesel	Medium				X
CNG Vehicles	Low–Medium	X			X
PV-based Small Vehicle	High				X
Modal Shift (road to rail)	High	X			
Power Generation					
Renovation and Modernization	High			X	
Integrated Gasification Combined Cycle Coal	Medium–High	X		X	
Pressurized Fluidized Bed Combustion	Low		X	X	
Transmission Losses	High	X			
Distribution Network Improvement	Medium	X			
Aeroderivative Turbines	Medium	X			
Cogeneration, Commercial, and Industrial	Low	X	X		
Coal Drying Using Power Plant Waste Heat	Low				X

Appendix A: Primer on Climate Change and Greenhouse Gases

What Are Greenhouse Gases?

Greenhouse gases (GHGs) in the atmosphere create a "greenhouse effect" that keeps the Earth's surface much warmer than it would otherwise be by trapping outgoing infrared radiation. The six primary GHGs of concern[25] are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6).

The greenhouse effect is predicted to instigate a rise in average global temperatures of 1.4°C to 5.8°C over this century — hence the term "global warming." However, this temperature rise will be accompanied by weather extremes, which is why this phenomenon is more accurately described as climate change.

High levels of emissions from human activities have caused concentrations of GHGs in the atmosphere to increase markedly since the beginning of the industrial era, adding an extra "human-induced greenhouse effect." Since 1750, atmospheric concentrations of carbon dioxide have increased by 31%, methane by 151%, and nitrous oxide by 17%.

In 2000,[26] Canadian industry produced approximately 371 million tonnes (Mt) of GHG emissions — roughly 50% of Canada's total emissions. The two largest contributors were electricity generation, with 128 Mt, and the petroleum industry, which includes oil and gas production, transmission, and distribution, accounting for 135 Mt. Most of the remainder was produced by energy-intensive industries, such as cement, chemicals, iron and steel, petroleum refining, pulp and paper, and smelting and refining. Emissions are largely a product of the combustion of fossil fuels, such as coal, oil, and natural gas, but fugitive emissions and emissions from industrial processes are also important.

Measures that can be taken to reduce GHG emissions include improving energy efficiency, switching to less carbon-intensive fuels, increasing the use of renewable energy, and adopting cogeneration technologies. Some sectors also have cost-effective opportunities to reduce fugitive and industrial process emissions.

Properties of Greenhouse Gases

Table A.1 provides an overview of the various GHGs and their properties. The standard for reporting GHG emissions is in carbon dioxide equivalent (CO_2e). To obtain this, each GHG must be multiplied by its Global Warming Potential (GWP). For example, if a landfill releases 10 Mt of methane a year, the CO_2 equivalent is 10 Mt x 21 (GWP) = 210 Mt. Therefore, the landfill releases 210 Mt CO_2e/year.

[25] Concern is based on (1) the sheer quantity of the gas in the atmosphere (with carbon dioxide being the most prevalent), and, (2) the relative ability of the gas to retain heat in the atmosphere (this is called the Global Warming Potential (GWP) – for example, methane has a GWP 21 times more powerful than carbon dioxide, and nitrous oxide has a GWP 310 times that of carbon dioxide).

[26] The latest year for which emissions figures are available. See "Canada's Greenhouse Gas Inventory 1990-2000," Environment Canada, 2002, found at www.ec.gc.ca/Climate/whatsnew/020501_b_e.htm.

Table A.1: Properties of Greenhouse Gases

Greenhouse Gas	Chemical Symbol	Global Warming Potential (GWP)
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
Hydrofluorocarbons	HFC-23	11,700
	HFC-125	2,800
	HFC-134a	1,300
	HFC-152a	140
Perfluorocarbons	CF_4 (Tetrafluromethane)	6,500
	C_2F_6 (Hexafluroethane)	9,200
Sulphur hexafluoride	SF_6	23,900

Appendix B1: Government of India Interim Approval Guidelines for the CDM

Purpose

The purpose of the clean development mechanism (CDM) is defined in Article 12 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change. The CDM has a two-fold purpose: (a) to assist developing country Parties in achieving sustainable development, thereby contributing to the ultimate objective of the Convention, and (b) to assist developed country Parties in achieving compliance with part of their quantified emissions limitation and reduction commitments under Article 3. Each CDM project activity should meet the above two-fold purpose.

Eligibility

The project proposal should establish the following in order to qualify for consideration as a CDM project activity:

Additionalities:

- Emission Additionality: The project should lead to real, measurable and long term GHG mitigation. The additional GHG reductions are to be calculated with reference to a baseline.
- Financial Additionality: The funding for CDM project activity should not lead to diversion of official development assistance. The project participants may demonstrate how this is being achieved.
- Technological Additionality: The CDM project activities should lead to transfer of environmentally safe and sound technologies and know-how.

Sustainable Development Indicators

It is the prerogative of the host Party to confirm whether a clean development mechanism project activity assists it in achieving sustainable development. The CDM should also be oriented towards improving the quality of life of the very poor from the environmental standpoint.

The following aspects should be considered while designing CDM project activities:

- Social well-being: The CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contributing to provision of basic amenities to people leading to improvement in their quality of life.
- Economic well-being: The CDM project activity should bring in additional investment consistent with the needs of the people.
- Environmental well-being: This should include a discussion of the impact of the project activity on resource sustainability and resource degradation, if any, due to the proposed activity; biodiversity-friendliness; impact on human health; reduction of levels of pollution in general.

- Technological well-being: The CDM project activity should lead to transfer of environmentally safe and sound technologies with a priority to the renewables sector or energy efficiency projects that are comparable to best practices in order to assist in upgrading of the technological base.

Baselines

The project proposal must clearly and transparently describe the methodology of determination of the baseline. It should conform to following:

- Baselines should be precise, transparent, comparable and workable;
- Should avoid overestimation;
- The methodology for determination of baseline should be homogeneous and reliable;
- Potential errors should be indicated;
- System boundaries of baselines should be established;
- Interval between updates of baselines should be clearly described;
- Role of externalities should be brought out (social, economic and environmental);
- Should include historic emission data-sets wherever available;
- Lifetime of project cycle should be clearly mentioned.

The baseline should be on a project-by-project basis except for those categories that qualify for simplified procedures. The project proposal should indicate the formulae used for calculating GHG offsets in the project and baseline scenario. Leakage, if any, should be described. For the purpose of Project Idea Notes (PIN), default values may be used with justification. Determination of the base project which would have come up in the absence of the proposed project should be clearly described in the project proposal.

Financial Indicators

The project participants should bring out the following aspects:

- Flow of additional investment
- Cost effectiveness of energy saving
- Internal Rate of Return (IRR) without accounting for CERs
- IRR with CERs
- Liquidity, N.P.V., cost/benefit analysis, cash flow etc., establishing that the project has good probability of eventually being implemented
- Agreements reached with the stakeholders, if any, including power purchase agreements, Memoranda of Understanding, etc.
- Inclusion of indicative costs related to validation, approval, registration, monitoring and verification, certification, share of proceeds

- Funding available, financing agency and also description of how financial closure seeks to be achieved

Technological Feasibility

The proposal should include following elements:

- The proposed technology/process
- Product/technology/material supply chain
- Technical complexities, if any
- Preliminary designs, schematics for all major equipment needed, design requirement, manufacturers' name and details, capital cost estimate
- Technological reliability
- Organizational and management plan for implementation, including timetable, personnel requirements, staff training, project engineering, CPM/PERT chart etc.

Risk Analysis

The project proposal should clearly state risks associated with it including apportionment of risks and liabilities; insurance and guarantees, if any.

Credentials

The credentials of the project participants must be clearly described.

For more information, see India's CDM Web site at www.envfor.nic.in/cc/cdm/criteria.htm.

Appendix B2: Kenyan Government Guidelines on the CDM

In order to ensure that CDM projects are environmentally effective and lead to sustainable development as well, they must be based on principles of equitable allocations and be directed to projects focused on non-greenhouse gas emitting technologies, especially renewable energy technologies. Consequently, for developing countries like Kenya to derive maximum benefits from CDM projects, a number of issues must be taken into account, including, but not limited to, the following:

Project Criteria

All CDM projects must satisfy the following requirements:

- demonstrate a firm and tangible contribution to sustainable development;
- be supportive of and consistent with national development priorities and be linked to poverty reduction;
- implement technologies that are locally appropriate, environmentally friendly, and energy efficient; have necessary precautions in place to avoid dumping of substandard technologies;
- contribute to the enhancement of national institutional and human capacity building;
- accord highest priority to activities that generate maximum economic, social, and environmental benefits;
- address community needs and priorities through effective public participation in project design, planning, and implementation to ensure equitable distribution of sustainable development benefits;
- contribute to global efforts to achieve stabilisation of greenhouse gas concentrations in the atmosphere in accordance with Article 2 of the Convention;
- ensure that CDM financial inflows are over and above the existing Official Development Assistance (ODA); and,
- be consistent with the objectives of Agenda 21 and relevant environmental conventions, such as the Convention on Biological Diversity, the Ramsar Convention on Wetlands, and the Convention to Combat Desertification, as well as with local and national environmental management laws.

Share of Proceeds

The sharing of proceeds from CDM activities is a crucial issue of interest to Kenya, like any other Party to the UNFCCC. However, the share of proceeds shall be based on a formula to be agreed on by the international community under the auspices of the Conference of the Parties/Meeting of the Parties (COP/MOP). The proceeds to be shared will include the emissions reduction or offset credits. CDM projects must include a nominal levy (adaptation levy) of the savings accruing to the investing country Party, the percentage of which will be determined by COP/MOP. Kenya will support such an agreement on the share of proceeds provided that a significant portion of the shares remain behind.

Methodological Issues

The methodological issues that deal with operation of CDM projects at the national level should take the following into consideration:

Baselines

Baselines need to be developed on a project-by-project basis during the initial phases of CDM. Sectoral baseline arrangements should be avoided as they could result in "free-riding" projects that claim emissions reductions that either would have happened anyway or that in reality do not accrue. Moreover, any project proposed under CDM must result in lower emissions than the current business-as-usual scenario. The prevailing business-as-usual scenario will serve as the basis for determining the level of CERs accruing from project implementation.

Project Validation

Every CDM project must be thoroughly assessed to determine whether the proposed action conforms to the criteria identified above before it is validated by the CDM National Clearing House (NCH).

Verification and Certification

Verification and certification will take place at two levels. At the national level, the National Climate Change Focal Point (NCCFP) will appoint a panel of local experts to verify the CERs accruing from all CDM projects while, at the international level, a body designated by the COP/MOP will perform certification and verification of all CDM projects.

Project Monitoring and Evaluation (M&E)

Once a CDM project implementation gets underway, a mechanism for regular M&E will be developed. The purpose of M&E is to ensure that the project implementation conforms to the set criteria throughout the project lifecycle.

Project Financing

The financing arrangement will be agreed upon by a host entity and the Annex I Party investor. Once an agreement has been reached, the project proposal will be submitted to the respective governments for approval and any other necessary action.

Land Use, Land Use Change, and Forestry (LULUCF)

There are still far too many scientific uncertainties associated with carbon sequestration by forests and land use changes. These uncertainties are compounded by the lack of capacity to quantify these changes in Kenya. CDM forestry projects are long term by nature and it would be difficult to deny Kenyans the use of forest products and services reserved for CDM when the Kenyans need them. Moreover, there is minimal or no technology transfer in the afforestation programs as stated in the CDM.

While the demand for forestry products is growing nationally and internationally against the background of a dwindling forestry resource base, there is no doubt about the need for forestry projects in Kenya. Forestry projects should continue within other frameworks, such as the UN Convention on Biodiversity and the UN Convention to Combat Desertification, as well as through other bilateral or multilateral arrangements. Decisions on LULUCF projects under CDM should be suspended until scientific uncertainties and other outstanding issues are resolved at the COP/MOP level.

Appendix C: Net Emissions Reductions Calculation

Determination of the net emissions reduction will facilitate the financial analysis since the international carbon market will be based on $ per tonne of CO_2e or C.[27]

The units of each gas must be specified individually. Not all greenhouse gases (GHGs) are easily measured in tonnes or megatonnes (the conventions for emissions reporting) since they are present in much smaller quantities. However, the final calculation should report all GHG emissions in tonnes (t) of carbon dioxide equivalent (CO_2e).

Note also that there are several types of HFCs and CFCs, as identified in Step 4 below; each, if applicable, should be included in Steps 1 to 3.

1. Determine Total Baseline Emissions

		CO_2	**CH_4**	**N_2O**	**HFC**	**CFC**	**SF_6**
A	**On-site emissions**						
B	**Off-site emissions**						
C	***Total Baseline Emissions (A+B)***						

2. Determine Total Project Emissions

		CO_2	**CH_4**	**N_2O**	**HFC**	**CFC**	**SF_6**
D	**On-site emissions**						
E	**Off-site emissions**						
F	***Total CDM Project Emissions (D+E)***						

3. Determine Net Emissions Reduction

		CO_2	**CH_4**	**N_2O**	**HFC**	**CFC**	**SF_6**
C	**Total Baseline Emissions**						
F	**Total CDM Project Emissions**						
G	***Net Emissions Reductions (C–F)***						

[27] Conversion of CO_2e to C is easily accomplished by multiplying the tonnes of CO_2e by 0.273.

4. Convert Net Reductions into CO_2e Using the Global Warming Potential (GWP) of Each GHG

	Net GHG Reduction (From G above, in tonnes)	GWP	CO_2e (tonnes)
CO_2		1	
CH_4		21	
N_2O		310	
HFC-23		11,700	
HFC-125		2,800	
HFC-134a		1,300	
HFC-152a		140	
CF_4		6,500	
C_2F_6		9,200	
SF_6		23,900	
Total Emissions Reductions			

Appendix D: Emissions Coefficients for Electric Power Grids

Weighted Average Grid Emissions Coefficients

In a CDM project that displaces grid electricity through electricity efficiency or fuel substitution, the project baseline emissions are those from the generation of electricity in the national grid for each year of the CDM crediting period (7 or 10 years). To estimate these baseline emissions, two things are required: the typical daily load curve and the power plants dispatched to satisfy that typical load curve each hour of the day. The baseline is, therefore, the weighted average CO_2 emission per unit of electricity (kWh) produced by the grid for the different years of the crediting period.

This can be computed using a *simple dispatch rule* from the following information:

- the daily load curve;
- the type of power plant, i.e., baseload or peaking;
- the efficiencies of the different power plants;
- the fuel used in each power plant;
- planned capacity expansion; and,
- assumed marginal power plants beyond the utility plan period.

This approach must be used when the electricity displaced is from any grid that does not use a single power source (e.g., a diesel mini-grid). It allows the use of published or commonly used standard emissions coefficients for the local or regional power grid based on current common characteristics of the grid. These include annual power production and efficiencies for each power plant (hydro, coal, natural gas) in each year that CERs will be claimed. These coefficients will be the same for all CDM projects operating in the region, unless the project specifically addresses one aspect of the load curve — e.g., reducing peak demand.

Weighted average emissions coefficient (kg/kWh) =

$$\frac{\text{Sum product [electricity produced by each plant (kWh/yr) * emissions coefficient for that plant (kg/kWh)]}}{\text{Total electricity generated}}$$

In areas where there is a rapid increase in the demand for electricity, emissions coefficients for the so-called "built marginal" plants may be used. This is the weighted average of the five most recently built power plants or the plants that meet the most recent 20% of demand.

Weighted average emissions coefficient for built marginal (kg/kWh) =

$$\frac{\text{Sum product [electricity produced by each plant (kWh/yr) * emissions coefficient for that plant (kg/kWh)]}}{\text{Electricity generated by the five most recent plants or 20\% of current demand}}$$

If the project addresses peak demand, then emissions coefficients for the plants that are used to meet peak demand (e.g., gas turbine generators) may be used.

How to Allow for Transmission and Distribution (T&D) Losses

Transmission losses occur in the high voltage network that delivers power to local substations. These losses are relative low and usually are less than 5%.

Distribution losses occur in the medium and low voltage feeders that supply individual customers. These losses depend on the length and loading of the feeders, and the voltage in these feeders. Many rural feeders in India are low voltage, very long, and chronically overloaded. Voltage drops of 40% can occur by the end of the feeder and losses up to 20% or more are common.

These T&D losses are called "technical losses," Many States, however, include "non-technical losses," such as theft or other unmetered/uncollected uses, in T&D losses. The usual practice is also to load all losses for all sectors into the catch-all of "agriculture." This means the total "losses" can be 35% or even higher.

T&D losses only need to be taken into account in end-use demand side electricity efficiency CDM projects. A power generation project, such as wind or micro-hydro, will still be subject to the same losses, whereas an efficiency project will displace both generation and technical losses (not theft, etc.).

In an efficiency project, care must be taken to use T&D losses that are appropriate to the end use. A rural efficiency project should use typical or published technical losses for rural feeders. An urban efficiency project should use lower losses.

Baseline electricity usage = electricity consumption by baseline technology / (1 – T&D losses)

Annual electricity savings = end-use savings in electricity / (1 – T&D losses)

A Case Study – Bangladesh

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The average daily load curve for Bangladesh shows that approximately 85% of the energy dispatched is baseload, even though the peak power requirement is nearly 50% of the baseload requirement. This implies that the intermediate and peaking plants will have an average annual load factor (ALF) below 30%, and indeed some will have an ALF of 20% or less. Table D.1 presents data related to the gas-based power plants that can only be used as base load.

Table D.1 Baseload Natural Gas Power Plants and Their Base Year (2001) Generation

No.	Name	Type (fuel)	Generation Capacity (MW)	Base Year Net Generation (GWh)	Heat Rate	Retirement Year
1	Ashuganj 1-2	ST (gas)	100	670	15,034	2006
2	Ghorasal 1-2	ST (gas)	80	415	16,022	2006
3	Siddhirganj	ST (gas)	50	293	13,812	2006
5	Ashuganj	CC (gas)	74	173	15,873	2010
7	Chittagong	ST (gas)	55	328	15,350	2014
8	Ashuganj 3-5	ST (gas)	450	2,730	11,724	2015
9	Fenchuganj	CC (gas)	90	273	13,110	2015
10	Ghorasal 3-6	ST (gas)	840	4,077	12,141	2017
11	Rauzan	ST (gas)	420	1,583	11,981	2017
		Total	**2,159**	**10,542**		

From the existing power plants, nearly 1,500 MW will remain operational up to and beyond 2014. The box below shows the gas turbines and oil-fired power plants of the national grid, along with their base year generation.

Gas turbine	763 MW	3,621 GWh
Oil-fired power plants	436 MW	1,123 GWh
(i) Steam turbine (FO)	262 MW	905 GWh
(ii) Diesel	132 MW	191 GWh
(iii) LDO/SKO	49 MW	27 GWh

As can be seen, 262 MW of the oil-fired capacity is baseload, while the remaining 181 MW is peaking capacity. The oil-fired power plants are all expected to be phased out and the predominant peaking plant will be a gas-fired combustion turbine power plant. In the base year (FY01), the gas turbines and peaking oil-fired power plants produced a total of 3,839 GWh of electricity, which is 24% of the total 16,254 GWh produced.

To estimate future emission coefficient, the marginal power plants need to be identified. It is obvious that the starting point for this is the government/utility plan. The national utility's capacity expansion plan up to 2008 is shown in summarized form in Table D.2.

Table D.2 Utility Capacity Expansion Plan

	FY02	FY03	FY04	FY05	FY06	FY07	FY08
New CC	360	810	980	1,380	2,280	2,370	2,820
New coal					250	250	250
New ST	210	210			270	690	690
New hydro							100
ST addition to simple cycle			40	149	149	149	149

NOTE: CC = Combined Cycle; ST = Steam Thermal; FY = Financial Year.

The most noteworthy aspect of the proposed expansion program is the nearly 3,000 MW combined cycle power plants. With increasing demand for electricity, more and more new baseload plants will be added. It is now almost a certainty that most new baseload power plants will be gas-fired combined cycle ones, with a heat rate of 7,200 kJ/kWh or better. This implies that emissions from the national grid baseload power generation will keep on decreasing.

A very simplified dispatch rule, as detailed below, was used to estimate the year-wise weighted average CO_2/kWh for the national grid for the crediting period from 2005 to 2014.

(i) In the financial year 2001 (FY2000–01), the central load dispatch centre dispatched 16,254 GWh of electricity. The power plants used for this purpose, along with their base year data, are shown in Appendix A. The base year production has been used to determine the annual load factor (ALF) for the existing plants in the national grid.

(ii) The available capacity during the crediting period has been worked out based on the information provided in Table 1 about the existing gas-fired baseload plants.

(iii) The general shape of the load curve is assumed to remain the same over the 10-year crediting period. In particular, it is assumed that the intermediate and peak electricity will be a fixed proportion of the total electricity requirement.

(iv) From an analysis of the energy curve of August 20, 2002, the intermediate and peak electricity consumed is estimated to be 15% of the total electricity consumed. Since it has been assumed that this ratio will remain fixed for every day of the crediting period, the annual energy electricity requirement can be multiplied by 0.15 to determine the intermediate and peak electricity requirement for any given year.

(v) During the crediting period, the intermediate and peak MWh requirement, above that which can be supplied by the existing plants and those planned up to 2008, has been assumed to be entirely supplied by gas turbine power plants with an efficiency of 27.5% (heat rate of 13,091 kJ/kWh).

(vi) The electricity requirement up to 2008 is met by the existing plants minus the retired ones plus the planned power plants shown in Table D.1.

(vii) Beyond 2008, the baseload is supplied predominantly by combined cycle gas-fired power plants with a thermal efficiency of 50% (heat rate of 7,200 kJ/kWh). A small amount of supply is projected to be available from a 250 MW addition to the coal-fired power plant expected to go into operation in 2006. Additionally, 1,000 MW of steam thermal power plants, which might be built as extensions to the existing and planned steam thermal plants, and for which finance may be made available through mechanisms like supplier's credit, have been assumed.

The Bangladesh Power Development Board's *Power Sector Master Plan* has estimated that the electricity demand growth would be approximately 8% up to 2015. There is already evidence that such a high growth rate will probably not be realized. There are clear indications that the economy will not perform as projected and that the ambitious capacity expansion plans will not materialize. Thus, for this project, a 7% demand growth has been used. Assuming a demand growth of 7%, the electricity requirement between 2005 and 2014 has been calculated starting with a base year (FY01) net generation of 16,254 GWh, and is presented in the second column of Table D.3. These data have been used along with the dispatch rule discussed above to arrive at the weighted average CO_2 emission of the grid. The full details of the calculations appear in Annex A. Table D.3 presents a summary of the final results of those calculations. Column 3 presents the power requirement in MW to meet the projected demand. The weighted average CO_2 emission for the grid is presented in column 5, while column 4 presents the hypothetical equivalent based on entirely natural gas generation.

Table D.3 Weighted Average CO2 Emissions During the Crediting Period (2005 to 2014)

Year	GWh	MW	Average Heat Rate Based on Natural Gas Generation (kJ/kWh)	Weighted Average CO_2 Emissions (kg/kWh)
2001	16,254	3,588	12,993	0.7289
2005	21,306	4,242	11,168	0.6159
2006	22,797	4,465	11,587	0.6421
2007	24,393	4,803	11,614	0.6455
2008	26,100	5,068	11,375	0.6329
2009	27,927	5,343	11,137	0.6202
2010	29,882	5,590	11,293	0.6313
2011	31,974	5,922	11,055	0.6183
2012	34,212	6,270	10,856	0.6075
2013	36,607	6,643	10,673	0.5974
2014	39,170	6,946	10,358	0.5788
Mean (2005 to 2014) weighted average CO_2 emissions = 0.6190 kg/kWh				

Annex A:
Calculation of Weighted Average Grid Emissions Coefficient for Bangladesh

GAS TURBINES

	MW	Heat Rate	MW-%	HR-Weight		
Ashuganj	50	23569	0.0655	1544		
Shah 1	70	19818	0.0917	1818		
Shah 2	70	15561	0.0917	1428		
Shylet	20	15899	0.0262	417		
Haripur	90	11266	0.1180	1329		
Chattagong	52	13110	0.0682	893		
Baghabari	71	13753	0.0931	1280		
Westmont	90	16275	0.1180	1920		
NEPC	110	16275	0.1442	2346		
RPCL	140	13110	0.1835	2406		
	763			15381	**23.4%** →	Weighted Average Efficiency

GAS STEAM TURBINES and COMBINED CYCLE

	MW	GWh	Heat Rate	MW-%	HR-Weight		
Ashuganj 1-2	100	670	15034	0.0463	696		
Ghorasal 1-2	80	415	16022	0.0371	594		
Siddhirganj	50	293	13812	0.0232	320		
Ashuganj CC	74	173	15873	0.0343	544		
Chittagong	55	328	15350	0.0255	391		
Ashuganj 3-5	450	2730	11724	0.2084	2444		
Fenchuganj	90	273	13110	0.0417	547		
Ghorasal 3-6	840	4077	12141	0.3891	4724		
Rauzan	420	1583	11981	0.1945	2331		
	2159	**10542**			**12590**	**28.6%**	Weighted Average Efficiency

OIL-FIRED - STEAM TURBINES, CT and DIESEL ENGINES

	MW	Heat Rate	MW-%	HR-Weight		
Khulna 1	95	14982	0.2179	3264		
Khulna 2	55	15000	0.1261	1892		
Khulna 3	46	13110	0.1055	1383		
Bheramara	54	16444	0.1239	2037		
Saidpur	18	16108	0.0413	665		
Barisal	40	16108	0.0917	1478		
Rangpur	18	16108	0.0413	665		
KPCL	110	16275	0.2523	4106		
	436	**124135**		**15490**	**23.2%** →	Weighted Average Efficiency

Weighted Average Grid Emission For 2005

	Electricity		Power		Efficiency		CO_2	
	GWh	(%)	MW	ALF	HR	(%)	kg/kWh	Weight
New CC	3638	16.5%	519	0.8	7200	50.0%	0.4039	0.0665
New Coal	0	0.0%	0	0.7	11077	32.5%	1.0479	0.0000
New ST	1288	5.8%	210	0.7	11077	32.5%	0.6214	0.0362
New GT	1567	7.1%	358	0.5	13091	27.5%	0.7344	0.0521
ST addition	914	4.1%	149	0.7	0	100.0%	0.0000	0.0000
Hydro (old+new)	1007	4.6%	230	0.5	0	100.0%	0.0000	0.0000
Old ST+CC (gas)	10402	47.0%	2159	0.55	12587	28.6%	0.7062	0.3322
Old Oil (all)	883	4.0%	336	0.3	15517	23.2%	1.1379	0.0454
Old GT	2414	10.9%	501	0.55	15385	23.4%	0.8631	0.0942
TOTAL	22113	100.0%	**4462**					**0.6265**

CC - Combined Cycle, ST - Steam Turbine, GT - Gas Turbine
ST Addition - Adding steam turbine to existing gas turbine
ALF - Annual Load Factor
HR - Heat Rate (kJ/kWh)

Average Heat Rate Based on Natural Gas Generation → 11168

Weighted Average Grid Emission For 2014

	Electricity		Power		Efficiency		CO_2	
	GWh	(%)	MW	ALF	HR	(%)	kg/kWh	Weight
New CC	17132	38.8%	2445	0.8	7200	50.0%	0.4039	0.1565
New Coal	3066	6.9%	500	0.7	11077	32.5%	1.0479	0.0727
New ST	4231	9.6%	690	0.7	11077	32.5%	0.6214	0.0595
New GT	6721	15.2%	1534	0.5	13091	27.5%	0.7344	0.1117
ST addition	914	2.1%	149	0.7	0	100.0%	0.0000	0.0000
Hydro (old+new)	1445	3.3%	330	0.5	0	100.0%	0.0000	0.0000
Old ST+CC (gas)	8432	19.1%	1750	0.55	12587	28.6%	0.7062	0.1347
Old Oil (all)	289	0.7%	110	0.3	15517	23.2%	1.1379	0.0074
Old GT	1975	4.5%	410	0.55	15385	23.4%	0.8631	0.0386
TOTAL	44205	100.0%	**7918**					**0.5811**

CC - Combined Cycle, ST - Steam Turbine, GT - Gas Turbine
ST Addition - Adding steam turbine to existing gas turbine
ALF - Annual Load Factor
HR - Heat Rate (kJ/kWh)

Average Heat Rate Based on Natural Gas Generation → 10358

Appendix E: Project Design Document

The following is the text of the proposed PDD template (as of August 29, 2002), available on the UNFCCC CDM Web site at unfccc.int/cdm.

A. General description of project activity

A.1. Title of the project activity:

A.2. Description of the project activity:

(Please include in the description
- the purpose of the project activity
- the view of the project participants of the contribution of the project activity to sustainable development (max. one page).)

A.3. Project participants:

(Please list Party(ies) and private and/or public entities involved in the project activity and provide contact information in Annex 1.)

(Please indicate at least one of the above as the contact for the CDM project activity.)

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host country Party(ies):

A.4.1.2. Region/State/Province, etc.:

A.4.1.3. City/Town/Community, etc.:

A.4.1.4. Detail on physical location, including information allowing the unique identification of this project activity *(max. one page)*:

A.4.2. Category(ies) of project activity

(Using the list of categories of project activities and of registered CDM project activities by category available on the UNFCCC CDM web site, please specify the category(ies) of project activities into which this project activity falls. If no suitable category(ies) of project activities can be identified, please suggest a new category(ies) descriptor and its definition, being guided by relevant information on the UNFCCC CDM web site.)

A.4.3. Technology to be employed by the project activity:

(This section should include a description on how environmentally safe and sound technology and know-how to be used is transferred to the host Party, if any.)

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

(Please explain briefly how anthropogenic greenhouse gas (GHG) emission reductions are to be achieved (detail to be provided in section B.) and provide the total estimate of anticipated reductions in tonnes of CO_2 *equivalent as determined in section E. below.)*

A.4.5. Public funding of the project activity:

(In case public funding from Parties included in Annex I is involved, please provide in Annex 2 information on sources of public funding for the project activity, including an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of those Parties.)

B. Baseline methodology

B.1. Title and reference of the methodology applied to the project activity:

(Please refer to the UNFCCC CDM web site for the title and reference list as well as the details of approved methodologies. If a new baseline methodology is proposed, please fill out Annex 3. Please note that the table "Baseline data" contained in Annex 5 is to be prepared parallel to completing the remainder of this section.)

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

B.3. Description of how the methodology is applied in the context of the project activity:

B.4. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity *(i.e., explanation of how and why this project is additional and therefore not the baseline scenario)*:

B.5. Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity*:*

B.6. Details of baseline development

B.6.1. Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

B.6.2. Name of person/entity determining the baseline:

(Please provide contact information and indicate if the person/entity is also a project participant listed in Annex 1.)

C. Duration of the project activity / Crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

(For a definition by the Executive Board of the term "starting date", please refer to UNFCCC CDM web site. Any such guidance shall be incorporated in subsequent versions of the CDM-PDD. Pending guidance, please indicate how the "starting date" has been defined and applied in the context of this project activity.)

C.1.2. Expected operational lifetime of the project activity: (*in years and months, e.g., two years and four months would be shown as: 2y-4m)*

C.2. Choice of the crediting period and related information: *(Please underline the appropriate option (C.2.1. or C.2.2.) and fill accordingly)*

(Note that the crediting period may only start after the date of registration of the proposed activity as a CDM project activity. In exceptional cases, the starting date of the crediting period can be prior to the date of registration of the project activity as provided for in paras. 12 and 13 of decision 17/CP.7 and through any guidance by the Executive Board, available on the UNFCCC CDM web site.)

C.2.1. Renewable crediting period *(at most seven (7) years per period)*

C.2.1.1. Starting date of the first crediting period *(DD/MM/YYYY)*:

C.2.1.2. Length of the first crediting period *(in years and months, e.g., two years and four months would be shown as: 2y-4m)*:

C.2.2. Fixed crediting period *(at most ten (10) years)*:

C.2.2.1. Starting date *(DD/MM/YYYY)*:

C.2.2.2. Length (max. 10 years) *(in years and months, e.g., two years and four months would be shown as: 2y-4m)*:

D. Monitoring methodology and plan

(The monitoring plan needs to provide detailed information related to the collection and archiving of all relevant data needed to
- estimate or measure emissions occurring within the project boundary;
- determine the baseline; and,
- identify increased emissions outside the project boundary.

The monitoring plan should reflect good monitoring practice appropriate to the type of project activity. Project participants shall implement the registered monitoring plan and provide data, in accordance with the plan, through their monitoring report.

Operational entities will verify that the monitoring methodology and plan have been implemented correctly and check the information in accordance with the provisions on verification. This section shall *provide a detailed description of the monitoring plan, including an identification of the data and its quality with regard to accuracy, comparability, completeness and validity, taking into consideration any guidance contained in the methodology.*

Please note that data monitored and required for verification and issuance are to be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.)

D.1. Name and reference of approved methodology applied to the project activity:

(Please refer to the UNFCCC CDM web site for the name and reference as well as details of approved methodologies. If a new methodology is proposed, please fill out Annex 4.)

(If a national or international monitoring standard has to be applied to monitor certain aspects of the project activity, please identify this standard and provide a reference to the source where a detailed description of the standard can be found.)

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

D.3. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

(Please add rows to the table below, as needed)

ID number *(Please use numbers to ease cross-referencing to table D.6.)*	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic /paper)	For how long is archived data to be kept?	Comment

D.4. Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources.

(Please add rows to the table below, as needed.)

ID number *(Please use numbers to ease cross-referencing to table D.6.)*	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic /paper)	For how long is archived data to be kept?	Comment

D.5. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and identification if and how such data will be collected and archived.

(Depending on the methodology used to determine the baseline this table may need to be filled. Please add rows to the table below, as needed.)

ID number *(Please use numbers to ease cross-referencing to table D.6.)*	Data type	Data variable	Data unit	Will data be collected on this item? (If no, explain.)	How is data archived? (electronic /paper)	For how long is data archived to be kept?	Comment

D.6. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored. *(Data items in tables contained in section D.3., D.4. and D.5. above, as applicable.)*

Data *(Indicate table and ID number, e.g., D.4-1; D.4-2.)*	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.

D.7. Name of person/entity determining the monitoring methodology:

(Please provide contact information and indicate if the person/entity is also a project participant listed in Annex 1 of this document.)

E. Calculation of GHG emissions by sources

E.1. Description of formulae used to estimate anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

E.2. Description of formulae used to estimate leakage, defined as: the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and that is measurable and attributable to the project activity: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

E.3. The sum of E.1. and E.2. representing the project activity emissions:

E.4. Description of formulae used to estimate the anthropogenic emissions by sources of greenhouse gases of the baseline: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

E.5. Difference between E.4. and E.3. representing the emission reductions of the project activity:

E.6. Table providing values obtained when applying formulae above:

F.	**Environmental impacts**

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts *(Please attach the documentation to the CDM-PDD.)*

F.2. If impacts are considered significant by the project participants or the host Party: *please provide conclusions and all references to support documentation of an environmental impact assessment that has been undertaken in accordance with the procedures as required by the host Party.*

G.	**Stakeholders' comments**

G.1. Brief description of the process on how comments by local stakeholders have been invited and compiled:

G.2. Summary of the comments received:

G.3. Report on how due account was taken of any comments received:

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

(Please copy and paste table as needed)

Organization:	
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

NEW BASELINE METHODOLOGY

The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity. A baseline shall cover emissions from all gases, sectors and source categories listed in Annex A of the Kyoto Protocol within the project boundary. The general characteristics of a baseline are contained in para. 45 of the CDM M&P.

For guidance on aspects to be covered in the description of a new methodology, please refer to the UNFCCC CDM web site.

Please note that the table "Baseline data" contained in Annex 5 is to be prepared parallel to completing the remainder of this section.)

1. Title of the proposed methodology:

2. Description of the methodology:

2.1. General approach *(Please check the appropriate option(s))*

- o Existing actual or historical emissions, as applicable;
- o Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;
- o The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category.

2.2. Overall description (other characteristics of the approach):

3. Key parameters/assumptions (including emission factors and activity levels), and data sources considered and used:

4. Definition of the project boundary related to the baseline methodology:

(Please describe and justify the project boundary bearing in mind that it shall encompass all anthropogenic emissions by sources of greenhouse gases under the control of the project participants that are significant and reasonably attributable to the project activity. Please describe and justify which gases and sources included in Annex A of the Kyoto Protocol are included in the boundary and outside the boundary.)

5. Assessment of uncertainties:

(Please indicate uncertainty factors and how those uncertainties are to be addressed.)

6. Description of how the baseline methodology addresses the calculation of baseline emissions and the determination of project additionality:

(Formulae and algorithms used in section E)

7. Description of how the baseline methodology addresses any potential leakage of the project activity:

(Please note: Leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary and which is measurable and attributable to the CDM project activity.)

(Formulae and algorithms used in section E.5)

8. Criteria used in developing the proposed baseline methodology, including an explanation of how the baseline methodology was developed in a transparent and conservative manner:

9. Assessment of strengths and weaknesses of the baseline methodology:

10. Other considerations, such as a description of how national and/or sectoral policies and circumstances have been taken into account:

Annex 4

NEW MONITORING METHODOLOGY

Proposed new monitoring methodology

(Please provide a detailed description of the monitoring plan, including the identification of data and its quality with regard to accuracy, comparability, completeness and validity)

1. Brief description of new methodology

(Please outline the main points and give a reference to a detailed description of the monitoring methodology).

2. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:

(Please add rows to the table below, as needed)

ID number *(Please use numbers to ease cross-referencing to table 5)*	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic /paper)	For how long is archived data kept?	Comment

3. **Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources:**

(Please add rows to the table below, as needed.)

ID number *(Please use numbers to ease cross-referencing to table 5)*	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic /paper)	For how long is archived data kept?	Comment

4. **Assumptions used in elaborating the new methodology:**

(Please list information used in the calculation of emissions which is not measured or calculated, e.g., use of any default emission factors.)

5. **Please indicate whether quality control (QC) and quality assurance (QA) procedures are being undertaken for the items monitored**. *(See tables in sections 2 and 3 above.)*

Data *(Indicate table and ID number, e.g., 3.-1.; 3.-2.)*	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.

6. **What are the potential strengths and weaknesses of this methodology?** *(Please outline how the accuracy and completeness of the new methodology compares to that of approved methodologies.)*

7. **Has the methodology been applied successfully elsewhere and, if so, in which circumstances?**

After completing above, please continue filling sub-sections D.2. and following.

<u>Annex 5</u>

TABLE: BASELINE DATA

(Please provide a table containing the key elements used to determine the baseline (variables, parameters, data sources, etc.). For approved methodologies you may find a draft table on the UNFCCC CDM web site. For new methodologies, no predefined table structure is provided.)

Appendix F: Project Design Document for Small-Scale CDM Projects

The following is the text of the PDD template for small-scale CDM projects (as of January 21, 2003), available on the UNFCCC CDM Web site at unfccc.int/cdm.

A. General description of project activity

A.1 Title of the project activity:

A.2 Description of the project activity:

(Please include in the description
- the purpose of the project activity
- the view of the project participants of the contribution of the project activity to sustainable development (max. one page).)

A.3 Project participants:

(Please list Party(ies) and private and/or public entities involved in the project activity and provide contact information in Annex 1 of this document.)

(Please designate one of the above as the official contact for the CDM project activity.)

A.4 Technical description of the project activity:

A.4.1 Location of the project activity:

A.4.1.1 Host country Party(ies):

A.4.1.2 Region/State/Province, etc.:

A.4.1.3 City/Town/Community, etc.:

A.4.1.4 Detailed description of the physical location, including information allowing the unique identification of this project activity *(max. one page)*:

A.4.2 Type and category(ies) and technology of project activity:

(Please specify the type and category of the project activity using the categorization of appendix B to the simplified M&P for small-scale CDM project activities, hereafter referred to as appendix B. Note that appendix B may be revised over time and that the most recent version will be available on the UNFCCC CDM web site.

In this section you shall justify how the proposed project activity conforms with the project type and category selected (for simplicity, the rest of this document refers to "project category" rather than "project type and category").

If your project activity does not fit any of the project categories in appendix B, you may propose additional project categories for consideration by the Executive Board, in accordance with paragraphs 15 and 16 of the simplified M&P for small-scale CDM project activities. The final SSC-PDD project design document shall, however, only be submitted to the Executive Board for consideration after the Board has amended appendix B as necessary.)

(This section should include a description of how environmentally safe and sound technology and know-how is transferred to the host Party, if such a transfer is part of the project.)

A.4.3 Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

(Please state briefly how anthropogenic greenhouse gas (GHG) emission reductions are to be achieved (detail to be provided in section B.) and provide the estimate of total anticipated reductions in tonnes of CO_2 equivalent as determined in section E. below.)

A.4.4 Public funding of the project activity:

(Indicate whether public funding from Parties included in Annex I is involved in the proposed project activity. If public funding from one or more Annex I Parties is involved, please provide information on sources of public funding for the project activity in Annex 2, including an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of those Parties.)

A.4.5 Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

(Please refer to appendix C to the simplified M&P for the small-scale CDM project activities for guidance on how to determine whether the proposed project activity is not a debundled component of a larger project activity.)

B. Baseline methodology

B.1 Title and reference of the project category applicable to the project activity:

(Please refer to the UNFCCC CDM web site for the most recent list of the small-scale CDM project activity categories contained in appendix B of the simplified M&P for small-scale CDM project activities.)

B.2 Project category applicable to the project activity:

(Justify the choice of the applicable baseline calculation for the project category as provided for in appendix B of the simplified M&P for small-scale CDM project activities.)

B.3 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity (*i.e., explanation of how and why this project is additional and therefore not identical with the baseline scenario*):

(Justify that the proposed project activity qualifies to use simplified methodologies and is additional using attachment A to appendix B of the simplified M&P for small-scale CDM project activities.)

(National policies and circumstances relevant to the baseline of the proposed project activity shall be summarized here as well.)

B.4 Description of the project boundary for the project activity*:*

(Define the project boundary for the project activity using the guidance specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities.)

B.5 Details of the baseline and its development:

B.5.1 Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:

B.5.2 Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

B.5.3 Name of person/entity determining the baseline:

(Please provide contact information and indicate if the person/entity is also a project participant listed in Annex 1 of this document.)

C. Duration of the project activity and crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity:

(For a definition of the term "starting date", please refer to the UNFCCC CDM web site.)

C.1.2 Expected operational lifetime of the project activity: *(in years and months, e.g., two years and four months would be shown as: 2y-4m)*

C.2 Choice of the crediting period and related information: *(Please underline the selected option (C.2.1 or C.2.2) and provide the necessary information for that option.)*

(Note that the crediting period may only start after the date of registration of the proposed activity as a CDM project activity. In exceptional cases, the starting date of the crediting period can be prior to the date of registration of the project activity as provided for in paragraphs 12 and 13 of decision 17/CP.7 and through any guidance by the Executive Board, available on the UNFCCC CDM web site.)

C.2.1 Renewable crediting period *(at most seven (7) years per crediting period)*

C.2.1.1 Starting date of the first crediting period *(DD/MM/YYYY)*:

C.2.1.2 Length of the first crediting period *(in years and months, e.g., two years and four months would be shown as: 2y-4m)*:

C.2.2 Fixed crediting period *(at most ten (10) years)*:

C.2.2.1 Starting date *(DD/MM/YYYY)*:

C.2.2.2 Length (max. 10 years): *(in years and months, e.g., two years and four months would be shown as: 2y-4m)*

D. Monitoring methodology and plan

(The monitoring plan shall incorporate a monitoring methodology specified for the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities and represent good monitoring practice appropriate to the type of project activity.

The monitoring plan shall also provide information on the collection and archiving of the data specified in appendix B of the simplified M&P for small-scale CDM project activities to:
- Estimate or measure emissions occurring within the project boundary;
- Determine the baseline, as applicable;
- Estimate leakage, where this needs to be considered

Project participants shall implement the registered monitoring plan and provide data, in accordance with the plan, through their monitoring reports.

Operational entities will verify that the monitoring methodology and plan have been implemented correctly and check the information in accordance with the provisions on verification. This section shall provide a detailed description of the monitoring plan, including an identification of the data to be collected, its quality with regard to accuracy, comparability, completeness and validity, taking into consideration any guidance contained in the methodology, and archiving of the data collected.

Please note that monitoring data required for verification and issuance are to be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

An overall monitoring plan that monitors performance of the constituent project activities on a sample basis may be proposed for bundled project activities. If bundled project activities are registered with an overall monitoring plan, this monitoring plan shall be implemented and each verification/certification of the emission reductions achieved shall cover all of the bundled project activities.)

D.1 Name and reference of approved methodology applied to the project activity:

(Please refer to the UNFCCC CDM web site for the most recent version of the indicative list of small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities.)

(If a national or international monitoring standard has to be applied to monitor certain aspects of the project activity, please identify this standard and provide a reference to the source where a detailed description of the standard can be found.)

D.2 Justification of the choice of the methodology and why it is applicable to the project activity:

(Justify the choice of the monitoring methodology applicable to the project category as provided for in appendix B.)

D.3 Data to be monitored:

(The table below specifies the minimum information to be provided for monitored data. Please complete the table for the monitoring methodology chosen for the proposed project activity from the simplified monitoring methodologies for the applicable small-scale CDM project activity category contained in appendix B of the simplified M&P for small-scale CDM project activities.

Please note that for some project categories it may be necessary to monitor the implementation of the project activity and/or activity levels for the calculation of emission reductions achieved.

(Please add rows or columns to the table below, as needed.)

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic /paper)	For how long is archived data to be kept?	Comment

D.4 Name of person/entity determining the monitoring methodology:

(Please provide contact information and indicate if the person/entity is also a project participant listed in Annex 1 of this document.)

E. Calculation of GHG emission reductions by sources

E.1 Formulae used:

(In E.1.1 please provide the formula used to calculate the GHG emission reductions by sources in accordance with the applicable project category of small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities.

In case the applicable project category from appendix B does not indicate a specific formula to calculate the GHG emission reductions by sources, please complete E.1.2 below.)

E.1.1 Selected formulae as provided in appendix B:

(Describe the calculation of GHG emission reductions in accordance with the formula specified for the applicable project category of small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities.)

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs due to the project activity within the project boundary: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

E.2 Table providing values obtained when applying formulae above:

F. Environmental impacts

F.1 If required by the host Party, documentation on analysis of the environmental impacts of the project activity: *(if applicable, please provide a short summary and attach documentation)*

G. Stakeholders comments

G.1 Brief description of the process by which comments by local stakeholders have been invited and compiled:

G.2 Summary of the comments received:

G.3 Report on how due account was taken of any comments received:

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

(Please repeat table as needed)

Organization:	
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postcode/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING