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REALISING THE POTENTIAL OF SMALL-SCALE CDM PROJECTS IN INDIA

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Abstract
The report summarises an assessment of the institutional capacity needed to bundle small scale CDM projects in India.

Based on recent national sectoral studies an estimation has been made of the potential for small-scale CDM projects in India. The estimation is split up into individual categories defined by the UNFCCC Executive Board for small scale projects.

The reports analyses the main existing barriers that prevent the realisation of this potential: the financial barriers, the institutional barriers and the lack of capacity in India to identify, develop and implement small scale CDM projects. In addition, several CDM-specific risks that are taken into account by the project developer before the decision is made to develop a CDM project are discussed in the report.

Bundling of projects that reduce GHG emissions may be considered if these projects are too small to warrant the development of a CDM project individually. The report presents an analysis of the potential reduction in transaction costs that can be achieved through bundling of individual projects into a single CDM project. The main conclusion is that for projects generating up to 10,000 tons CO2 reduction per year, the UNFCCC simplified procedures for small-scale CDM projects do not sufficiently reduce transaction costs to make these projects attractive for investors. Bundling of small-scale projects would further reduce transaction costs and would be an attractive option for investors only if the individual projects are metered which reduces significantly the cost of verification.

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SUMMARY

The current design of the CDM is resulting in high transactions costs to individual small-scale projects, even with the simplified modalities and procedures that have been developed specifically for small-scale projects. Small-scale renewable energy and energy efficiency projects are helping to meet the needs of rural people in developing countries, alleviating poverty and fostering sustainable development. However, the low carbon savings per installation for household scale and other small-scale systems is making it difficult for such projects to derive value from participating in the CDM.

The analysis presented in this report aims to assess the feasibility of bundling of small scale projects into a single larger project in order to reduce the transaction costs of small scale CDM projects. The analysis is based on India as a case study. There is a huge potential in India for small scale projects, in particular for solar, mini hydro and biomass power. The main existing barriers that prevent the realization of this potential include the financial barriers, the institutional barriers and the lack of capacity in India to identify, develop and implement small scale CDM projects.

The main conclusions from the study are:

- Small project which generate up to 10,000 ton CO_2 reduction per year (low end category of small-scale projects), the UNFCCC simplified procedures developed for small-scale CDM projects do not sufficiently reduce transaction costs to make these projects attractive for investors. The transaction costs of this type of project are 21% of total CER revenues, well above the 10% threshold.

- Through bundling of small-scale projects that are metered, the share of the transaction costs in total CER revenues decreases to 9.9%. This means that the bundled project becomes an attractive option for investors to bring under the CDM.

- Bundling of small-scale projects without a meter appears to be financially not viable. More than two-thirds of the CER revenues are needed to cover the transaction costs. This is due to the very high annual verification costs of these systems. To make bundling of these systems more attractive, the frequency of verification must be lowered to once every two years (resulting in 36.7% based on price of US$ 4 per ton and 21.0% based on CER price of US$ 7) or once every five years (17.3% price of US$ 4 and 9.9% if the price is US$ 7) or no verification at all (6.6 % and 3.8%).

1. INTRODUCTION

1.1 Introduction

The Clean Development Mechanism (CDM) is an instrument established under the Kyoto Protocol to achieve both sustainable development and contribute to the cost-effective mitigation of climate change. The CDM will allow countries with emission reduction commitments to meet part of their reductions abroad, where greenhouse gas (GHG) abatement costs can be lower. The CDM will also enable developing countries to attract investments in clean energy technology and assist them on a sustainable development path.

However, the current design of the CDM is resulting in high transactions costs to individual small-scale projects, even with the simplified modalities and procedures that have been developed specifically for small-scale projects. Small-scale renewable energy and energy efficiency projects are helping to meet the needs of rural people in developing countries, alleviating poverty and fostering sustainable development. However, the low carbon savings per installation for household scale and other small-scale systems is making it difficult for such projects to derive value from participating in the CDM.

Bundling a number of individual small-scale projects into one larger CDM project has been proposed as one possible solution to overcoming high transaction costs, however there are very few organisations in developing countries that have been able to utilise such an option. In view of this, to build the institutional capacity and enable small-scale CDM Projects in India, this project has been initiated.

1.2 General Objectives

The project aims to build institutional capacity within India to enable the bundling of small-scale CDM projects. Experience and output gained from the project will be of value to other developing countries, particularly in Africa and the ASEAN region. The general objectives are to:

- Contribute to developing a wider awareness and common understanding of the Kyoto mechanisms.
- Enable small-scale projects, which when combined will have a large abatement potential, to gain support under the CDM.
- Promote energy efficiency and renewable energy technologies.
- Provide investment opportunities for European clean energy technology industries.
- Build institutional capacity to develop CDM projects in India.
- Build expertise within EU organizations concerning how to bundle small-scale CDM projects and help stimulate the renewable energy and energy efficiency industries.
- Contribute to the development of the rules and modalities of the CDM, particularly concerning the bundling of small-scale projects.

The objectives of the project correspond to the second main objective of the Synergy Programme, '*Contribution to the Implementation of the Kyoto Protocol*'.

1.3 Target Institutions and Beneficiaries

Target institutions in India will be financial institutions such as Indian Renewable Energy Development Agency (IREDA), the private sector, state level energy development agencies and government agencies such as the Ministry of Environment and Forests, Ministry for Non-Conventional Energy Sources and Ministry of Power at the central level. There are many economic stakeholders in India, such as the energy efficiency and renewable energy industries, local utilities, project developers and financiers who will benefit from participation in the CDM. A key function of the project will be to develop a strategy to provide the maximum benefits to these stakeholders in the long term.

In addition to stakeholders within India, the project aims to guide the development of small-scale CDM projects in other parts of the world, such as Africa and other parts of South East Asia. All project outputs to date and further information regarding the project activities, events and progress can be found on the project website at: www.cdmpool.com.

2. POTENTIAL FOR SMALL-SCALE CDM PROJECTS IN INDIA

2.1 Introduction

It is clear that carbon finance via the CDM offers significant opportunities in India for an array of GHG emission reduction projects, and this section explores the potential specifically for small-scale projects, which could benefit from this additional finance. The type of projects likely to benefit most will depend on country factors, including those that fit within national sustainable development goals, fuel or renewable resources, and additionally issues regarding the commercial status of technologies.

2.2 Definition of Small-scale CDM Projects

Three types of small-scale CDM projects[1] have been defined by the CDM Executive Board: Renewable Energy Projects, Energy Efficiency Improvement Projects and Other Project Activities. The definitions of these three types are presented in Table 2.1.

Debundling of a large project into smaller projects in order to be able to use the simplified procedures is not allowed. A proposed small-scale project activity shall be deemed to be a debundling component of a large project activity if there is a registered small-scale CDM project activity or an application to register such an activity:
- with the same project participants,
- in the same project category and technology/measure,
- registered within the previous 2 years, and
- whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

Table 2.1 *Definition of small-scale project as adopted by the CDM Executive Board*

Project Type	Brief description
Type I	Renewable energy projects with a maximum output capacity of 15 MW.
Type II	Energy efficiency improvement that reduce energy consumption, on the supply and/or the demand side, by up to the equivalent of 15 GWh per year.
Type III	Other project activities that reduce anthropogenic emissions by sources, and directly emit less than15 kilo-tonnes CO_2 equivalent annually.

Each project type is further divided into a number of more specific project categories. Thirteen project categories have so far been identified but more categories may be identified in the future.
Table 2.2 gives an overview of the various project categories.

[1] The CDM EB uses the term ‘project activity’ rather than ‘project’ to indicate that components or aspects of projects that reduce GHG emissions are also eligible for the CDM

Table 2.2 *Project categories for which simplified baseline and monitoring methodologies have been developed*

Project Type	Project Category
Type I: RE projects	A. Electricity generation by the user
	B. Mechanical energy for the user/enterprise
	C. Thermal energy for the user
	D. Renewable electricity generation for a grid
Type II: Energy efficiency improvement	E. Supply side energy efficiency improvements-transmission and distribution activities
	F. Supply-side energy efficiency improvements -generation
	G. Demand-side energy efficiency programmes for specific technologies
	H. Energy efficiency and fuel switching measures for industrial facilities
	I. Energy efficiency and fuel switching measures for buildings
Type III: Other projects	J. Agriculture
	K. Switching fossil fuel
	L. Emissions reduction by low greenhouse emission vehicles
	M. Methane recovery and
	N. Other small-scale projects*

* Paragraph 8 to 10 of the simplified modalities and procedures for small-scale CDM project activities allow project participants to submit a new small-scale project activity category or revisions to a methodology to the Executive Board for consideration and amendment of Appendix B by the Executive Board, as appropriate.

2.3 Sustainable Development Criteria

2.3.1 Sustainable Development and CDM

The traditional definition used for sustainable development from the Brundtland Commission report that states that development is sustainable when it *"meets the needs of the present generation without compromising the ability of future generations to meet their own needs"* [2]

Since the UN Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil in June 1992 there have been numerous attempts to find more operationally useful definitions and indicators of sustainable development. These have been broadly be categorized into three areas, namely:

- economic
- environmental
- social.

The issue of sustainable development indicators has also been examined from different perspectives depending on the needs of the assessment. These have been broadly along the following three levels, namely:

- global level (to allow intercountry comparisons),
- national level, and
- project (or local) level.

There has also been considerable work on the notion of *sustainability*, which has been used in developing future scenarios of (mostly global but also some national level) analysis.

The United Nations have been carrying out a major program for developing indicators of sustainable development. These have been mostly at the national level to enable intercountry comparisons The UNDP's Human Development Index (HDI) is a well-recognized attempt to consider both economic and social indicators (it has not been less successful at incorporating environmental indicators).

[2] World Commission on Environment and Development, 1987

Art. 12 of the Kyoto Protocol defines explicitly a twofold objective. Accordingly, the purpose of the CDM is:

a. to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and
b. to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.

According to the Bonn agreement *"it is the host Party's prerogative to confirm whether a clean development mechanism project activity assists it in achieving sustainable development"*[3]. Hence, the criteria for sustainability will be defined by the host countries. The only exception at the moment is the internationally set requirement that Annex I countries *"are to refrain from using emission reduction units generated from nuclear facilities to meet their commitments"*.

2.3.2 Sustainable Development for CDM Projects in India

Ministry of Environment and Forests (MOEF), GoI has formulated the interim sustainable development criteria, which need to be met for CDM projects to gain approval in India. These are:

- *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; biodiversity-friendliness; impact on human health; and reduction of levels of pollution in general;
- *Technological well-being*: the CDM project activity should lead to the transfer of environmentally safe and sound technologies, with a priority given to the renewable sector or energy efficiency projects that are comparable to best practices.
- The Ministry of Non Conventional Energy Sources (MNES) has undertaken an initiative to develop sustainable development criteria for renewable energy projects in India. This study was undertaken by Development Alternatives, an NGO in Delhi, and the findings of this study have been submitted to MNES for review and comments.

After UNCED in 1992, India prepared national Agenda 21s as part of he World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa in 2002. This is therefore an opportunity for India to develop criteria for compatibility of CDM.

India already has environmental regulations requiring investment projects to carry out Environmental Impact Assessments (EIAs) in place. CDM projects would need to abide by such national legislation and carry out the necessary EIAs.

2.4 Indicators for Assessing Sustainability in CDM Projects

In absence of a clear definition and indicators for SD in India, the following can be used to assess the contribution of small-scale CDM projects to sustainable development in India. In context of sustainable development the three pillars i.e. Economic, Environmental and Social well-being can be quantified for a particular project by using quantifiable indicators to avoid any subjectivity in the decision-making. However, subjectivity cannot be completely overcome while comparing projects for their contribution towards SD. Some of the parameters used to evaluate small-scale CDM projects for contribution towards are mentioned below:

[3] UNFCCC 2001a, p. 8

Table 2.3 *Sustainable Development Indicators*[4]

	Dimension Evaluation	Indicator for Evaluation	Unit	Rationale
Social	Poverty Alleviation	Net Employment Generation	Man-year/ year	Employment provides people with a regular income which helps them to improve their personal economic situation
	Equal Distribution	Ratio of income for poors compared to total income generated by the project	%	Equal distribution is a crucial point for sustainable development.
Economic	Micro Economic efficiency	IRR	%	The IRR measures the microeconomic efficiency of projects. It shows to what extent the flows on the project level produce revenues on the investment
	Contribution to balance of payments	Net foreign currency required / MW installed capacity	USD/MW	This indicator aims at the macro-level. If less foreign capital is needed to implement a particular project the national balance of payment improves.
Environmental	Saving of Resources	Fossil fuel, Water, Soil, Biodiversity, etc	T/year	The most important resource can be chosen and its saving can evaluated.
	Pressure release on local environment	SPM/ SO_2 / NO_x emissions	Tonnes	The most important local can be chosen and its reduction can be evaluated.

2.4.1 Types of Small-scale Projects that meet Sustainable Development Criteria

Contribution of small-scale renewable energy projects to sustainable development is considered to be more than large-scale projects or fossil fuel based CDM projects, however this will vary project-to-project. Examples of small-scale renewable energy projects listed below

- solar home lighting system,
- solar PV and pump,
- wind power,
- small and micro hydro,
- biomass power,
- waste to energy (biomethanation).

Small-scale projects are decentralized in nature and contribute more to local benefit like poverty alleviation and employment generation with IRR between 14% - 19%. Renewable power projects being nonpolluting in nature lead to improvement in local environmental conditions and conservation of natural resources. Small-scale energy efficiency projects in small-scale industrial units like in brick, glass, ceramic and food processing units contributes more towards SD compared to large energy efficiency improvement in large industrial units.

[4] Source: Factor Consulting + Management AG and Dasag Energy Engineering Ltd. 2001.

2.4.2 Small-scale Potential in India

Introduction

The types of projects that qualify as small-scale CDM projects have been defined by the CDM Executive Board, and these have been listed in the previous section in three different groups (Type I, II, and III). This section assesses the potential for these projects in India, of which some may be viable as single small-scale CDM projects, for example a 15 MW biomass plant, whilst others may be potential bundled CDM projects, for example three 5 MW biomass plants. A full quantitative market or investment analysis of small-scale potential in India is an extremely challenging exercise, particularly given the uncertainties surrounding individual projects meeting the 'additionality' test and sustainable development criteria, and is outside the scope of this project. However, it is important to gain some insight into the potential of these small-scale projects for demonstrating the role that CDM and bundling can play.

India, like many developing countries, has considerable potential for small-scale CDM energy projects in a number of sectors where emission reductions can be significant and non-carbon benefits, such as poverty alleviation, can be particularly high. This potential is partly due to the lack of adequate energy services in many rural areas, for example more than 80,000 villages are still to be electrified and 13,500 of these are remote or difficult to reach, but also low energy efficiency within many industries, and the vast under utilisation of available waste products and renewable energy resources. In many cases, due to available resources (both financial and energy), local demand, and low operational efficiency of the power system, small-scale energy projects may well be more appropriate for many applications. Although, many of the first pipelines of CDM projects developed in India have tended to be larger scale (due to high CDM transaction costs), in terms of numbers there are far more potential small-scale CDM projects.

Approach

The assessment carried out here has drawn on a number of recent national sectoral studies assessing the potential and opportunities for greenhouse abatement or market assessments of individual technologies. The main sources for this assessment include:

- the ADB-GEF-UNDP funded ALGAS (Asia Least-cost Greenhouse Gas Abatement Strategy) study which identified India's GHG abatement options for the energy, forestry, and agricultural sectors for 1990-2020 (ADB, 1998),
- a project by the Pembina Institute for Appropriate Development and TERI assessing the CDM project opportunities in India (TERI, 2001),
- reports and data from industry associations including the Indian Wind Energy Association,[5] the Confederation of Indian Industries,[6]
- an assessment of the role of renewable energy technologies by the Indian Institute of Technology,
- IT Power's project database particularly assessing potentials of small hydro, watermills, solar and hybrid technologies.[7]

Although the nature of such studies have not been to assess the potential for small-scale projects, this assessment has where possible identified the potential relevant to the types of small-scale projects considered within this project. It must be noted that many previous studies have been made based on overall resource, such as wind, and it is difficult to further estimate how much of this resource may be utilised as small-scale (e.g. <15 MW) or large-scale (>15 MW). This will depend on a wide range of factors, including market developments in the private sector, government policies and strategies and local factors, all of which are relatively uncertain, and will be important in achieving such potential. Furthermore, as discussed above, although all the types of small-scale potential can be eligible for CDM, not all will necessarily qualify and will have to fulfil all the CDM criteria on a project-by-project basis. Thus, the figures displayed

[5] see http://www.inwea.org/windenergy.html
[6] see http://www.ciionline.org/
[7] see ITP website for further information http://www.itpower.co.uk

in this section are estimates, many of which come from a range of sources and methodologies, however they give a general indication of each individual potential market. Table 2.4 gives an overall estimation of the potential for small-scale projects in India with the results split into the individual categories defined by the Executive Board, and the most recent figures for current applications are also given. A brief description of this potential is given in the section below.

Table 2.4 *Small-scale project Potential in India*

Project type	Project Subtype	Possible small-scale options for India A	Potential	Achievements (Aug 2002 except where stated)
Type I Renewable Energy Products	*I.A Electricity Generation by the User (off-grid)*	Solar home systems	20MW/km^2	256,673 (March 2003)
		Wind power	Included in grid-connected potential	-
		Hydro power (mini, micro, pico)	7,500 MW (incl grid connected)[8]	1340 MW
		Fossil fuel-hybrid systems	n/a (very large)	-
		Biomass power	16,000	2,000 (22 MW)
	I.B Mechanical Energy for the User	Watermills	200,000[9]	n/a (v. small amount)
		Solar electric pumps	~900,000	>5000
		Biomass based pumping projects	1.5 million	n/a
		Wind electric pumps	1 million	>1,000
	I.C Thermal Energy for the User	Solar water heating systems	140 million sq. m collector area	0.70 sq. m million collector area
		Solar dryers	20,000 sq m collector area	N/a
		Solar cookers (community based)	10 million	500,000
		Biogas based plants for cooking	12 million	3.44 million
	I.D Renewable Electricity Generation for the Grid	Grid connected sugar waste cogeneration plants	3,500 MW	474 MW
		Grid connected wind electricity generation	15,000 MW	1,870 MW
		Grid connected biomass based power plants	15,500 MW	292 MW
		Grid connected solar PV plants	20MW/km^2	1.67 MW
		Grid connected hybrid plants	see potentials for wind/biomass/PV	-

8 Based on MNES (2002): figures, which suggest 15,000 MW potential for small hydro up to 25 MW. As 4,096 potential sites had been identified with an aggregated capacity of 10,071 MW for projects up to 25 MW, 5000 MW has been given as an estimate of the potential from projects up to 15 MW in size.

9 IT Power India estimate of traditional mills used in the Himalayas area.

Project type	Project Subtype	Possible small-scale options for India A	Potential	Achievements (Aug 2002 except where stated)
Type II Energy Efficiency Improvement Projects	*II.A Supply side Energy Efficiency Improvements -Transmission and Distribution*	System improvement project by state and private utilities	1.5-2.2% improvement	-
	II.B Supply side Energy Efficiency Improvements - Generation	Improvement in fossil fuel based facility	up to 10% improvement	-
		Energy efficiency improvement in captive power plants (incl. IGCC)	6,500 MW[1]	-
	II.C Demand side Energy Efficiency Programmes from Specific Technologies	Programs on energy efficiency improvement in end use equipment	20-30%+	-
		Energy efficiency improvement through audit	15 MW[2]	
	II.E Energy Efficiency and Fuel Switch Measures for Building	Fuel switch from oil to gas	-	-
		Energy efficiency improvements in hotels	-	-
		Energy efficient building design	-	-
Type III Other Project Activities	*III.A Agriculture*	-	-	-
	III.B Switching Fossil Fuel	-	-	-
	III.C Emission Reduction by Low Greenhouse Gas Emission Vehicles	Change in fossil fuel based vehicle fleet into battery operated vehicle fleet in any industrial / institutional premises	-	-
	III.D Methane Recovery	Landfill gas recovery	4566 MW	1460 MW
		Anaerobic wastewater treatment facility with methane recovery	365 MW	230 MW
		Coal bed methane recovery projects	20,000 MW	-
	III.E Methane Avoidance	Avoidance of methane from biomass or other organic residue	n/a	n/a

[1] Total for all large and small-scale projects
[2] Based on energy efficiency potential in India’s 22 largest industrial sectors (Selman, 2002)

Type I: Renewable Energy Project

I. A ELECTRICITY GENERATION BY THE USER

This group of renewable energy technologies is typically at the smaller end of the small-scale project range, with individual technologies starting from tens or hundreds of watts, and are primarily off-grid. Consequently, they can potentially be, and to some extent are presently, deployed in vast numbers to provide modern energy services for many of the unelectrified rural villages.

Solar Home system

India has a huge solar resource; the potential for solar energy is estimated at 20 MW per square metre. Solar home systems (SHS), often sold with 1, 2 or 4 lighting units, are standalone PV systems usually of very small capacities (tens and hundreds of watts). SHS have considerable potential in providing energy services to rural villages, particularly some of the estimated 13,500 unelectrified villages, which are remote and cannot be reached by the grid. Over 200,000 have already been installed, and with local manufacture and expertise the potential in India is very high.

Wind power (off-grid)

Although the technically realisable potential for grid-connected wind power in India has been estimated at around 15,000 MW, this does not include many other off-grid applications. Off-grid applications, such as hybrid systems, isolated grids, small power and water pumping, has been largely neglected despite a significant range of application, particularly in coastal and mountainous regions. Like SHS they could contribute to energy services in many of the unelectrified villages, such as lighting, desalination, refrigeration and remote communication for fishing communities, and islands and mountain dwellers. There remains a largely untapped potential for off-grid wind, however few estimates have yet to be made.

Small Hydropower

Small hydro projects are generally considered to be below 25 MW, however this study is only concerned with those small hydro projects below 15 MW. Small, mini (100 kW-3 MW), micro (<100 kW), and pico (<5 kW) hydro all have suitable applications in remote and hilly regions (such as the sub Himalayas), particularly where extension to the grid is not possible or is uneconomic. The potential for these technologies is vast and estimated at over 10,000 MW with over 1340 MW currently installed (Banerjee, 2002).

Fossil Fuel-Hybrid system

Stand alone renewable energy based hybrid systems generally involve a combination of a diesel generator with battery inverted sub-system and a renewable energy technology, such as solar, wind, hydro or even biomass (gasifiers) where appropriate. Standalone systems have significant potential, particularly for the electrification of mountainous or other remote regions where grid extension is uneconomic, islands and delta areas many of which currently have diesel grids, and rural households with mini-grids. Like the other technologies in type 1A, hybrid systems can help provide energy services to unelectrified villages and the potential is very large, especially because these systems are reliable and offer a relatively low cost supply option.

Biomass Power System

Biomass systems for off-grid applications have mostly been gasifiers combined with diesel engines saving around 75% of the diesel fuel. However, the largest potential applications for biomass exist in remote areas where customers may still be dependent on diesel fuel if a hybrid is used. However, biomass gasifiers producing power from a few kilowatts to 500 kW have been developed in India that can run on 100% biomass, significantly increasing their potential for providing rural energy serves. To date, around 2000 gasifiers have been installed in excess of 22 MW[10].

I.B MECHANICAL ENERGY FOR THE USER

Watermills

Watermills (or gharats) have been used for many years in the Himalayas as a traditional means of grinding grain. However, many of these low efficient traditional watermills have been abandoned by water millers for better income generating opportunities and existing ones face stiff competition from diesel mills (Parthan and Subbarao, 2001). However, recent improvements in watermill technologies offer substantial opportunities for low cost upgrades and replacements for mill applications. There are thought to be around 200,000 watermills already in India, and potentially many of these could be upgraded to more efficient mills.

Solar PV pumps

Water pumping, especially for irrigation, in rural areas represents one of the largest potential markets for PV. It is estimated that there are already over 13 million electrical pump sets in operation with a potential for 6 million more, particularly for replacing existing diesel fuel pump sets. However, the potential for solar pumping would be limited to medium discharge-low water table applications up to about 2500 m^4 (head multiplied by discharge), therefore only a fraction of this potential, amounting to around 800,000-1,000,000 solar PV pumps, can be realised.

Biomass based pumping projects

As with Solar PV pumps, biomass based systems could be used particularly for agricultural applications where biomass resources, such as crop residues are abundant. Potential applications could include replacements for some of the millions of diesel fuel electric pumps already in use for irrigation purposes.

Wind electric pumps

In the same way as solar PV and biomass, electricity generated from wind can be used to operate an electric pump. The market and opportunities will be the similar although systems will be less mobile than biomass systems.

I.C THERMAL ENERGY FOR THE USER

Solar Water Heating Systems

Solar water heaters, consisting of collectors, storage tanks and, depending on the system, electric pumps, can utilise sunlight to heat water. Solar water heaters can potentially replace electric heaters, which are a relatively inefficient means of water heating and already there are many systems installed in buildings in India representing about 0.70 million square metres of collector area. The potential for solar water heaters in India is considerable and has been estimated at 140 million square metres of collector area.

Solar Dryers

Nearly 70% of the population of India is engaged in agriculture and related activities. Activities include the drying of crops, such as tea, pulses and spices, usually using systems that burn wood or diesel fuel. At present, the processing of pulses consumes an estimated 5 million litres of diesel fuel a year, while tea and cardomon processing need 400,000 tonnes and 50,000 tonnes of fuel wood, respectively. Given the abundant solar resource, solar heating of both air and water represent viable alternatives to the use of fuel wood and fossil fuels. Solar hot-air drying systems can be used on roofs of homes and factories and fitted into existing fossil fuel driven systems.

[10] See www.indiasolar.com for further details

Solar Cookers (community based)
With India's extensive solar resources, solar cookers can potentially be utilised for cooking food with sunlight as their only energy source. Box type solar cookers have been promoted by the MNES since 1982, and along with the community type box/parabolic type cookers there are currently already over 500,000 solar cookers in India. With around 40 manufacturers of various types, the potential demand is estimated at around 10 million[11]. Although there have been some problems with customer adoption of these non-traditional cooking devices, community based systems have significant potential for fuel and cost savings for both rural and urban communities.

Biogas based plants for cooking
Biogas plants using waste products, such as animal slurry, provide a viable alternative for cooking or even a fuel to drive dual fuel diesel engines. The waste is bio-chemically digested by anaerobic bacteria and range from family to community size plants. Around 3.44 million biogas plants are currently in use in India, including over 3,000 community-based systems and the potential market has been estimated at 12 million.

I.D RENEWABLE ELECTRICITY GENERATION FOR THE GRID
This group of technologies is generally larger in capacity than Type 1A technologies and export power to the grid. Applications are therefore not restricted to remote areas and can be utilised for both urban and rural areas where there is a grid. Low capacity factors, therefore can be mitigated through conventional grid supplies, and can help exploit some of India's extensive renewable resources for providing environmentally benign energy services.

Grid connected sugar waste cogeneration plants
Cogeneration using bagasse from the sugar waste of some of India's many sugar factories, is seen as a viable option for producing both electricity and heat/steam. Most sugar factories already utilise bagasse for their own power requirements during crushing season, however many of the turbines used are old, inefficient and steam is generated at low pressures. If steam generation pressures are increased through the use of high-pressure boilers then bagasse cogeneration plants could export significant power surpluses to the grid. Already around 474 MW of plant have been installed and from existing factories (430) up to 3,500 MW of plant could be exported, particularly if efficient condensing extraction turbines and energy efficient options to reduce steam requirements are used.

Grid connected wind electricity generation
An extensive assessment of the wind potential in India was carried out under the Wind Resources Assessment Programme (WRAP) covering around 900 wind monitoring sites and mapping stations in 24 states. The MNES[12] has issued a list of 211 potential sites for wind power projects in the country having wind power densities of more than 200 W/m^2 at 50 m above ground level for nearly 15,000 MW. The overall wind energy potential has been estimated at 45,000 MW (at 50 m above ground level), however, the technical potential is estimated at about 15,000 MW assuming 10% grid penetration (Banerjee, 2002). Despite the trend towards larger wind turbines, a significant amount of this initial technical potential could be from small-scale projects particularly in the 10-15 MW range.

Grid connected biomass power
India has a vast biomass resource with estimates of biomass production in the region of 500-600 million tons per year. Around 150 million tons from crop residues, such as rice straw, wheat straw and plant stalks, are expected to be available for power generation. This could be enough fuel for potentially 16,000 MW of power with plant load factors of 68.5% (6000 hours per year). As fuel sources will be most abundant in rural (farming) areas, a great many grid-

[11] see http:// www.indiasolar.com/solarcookers.htm for further information.
[12] See http://www.windpowerindia.com for further information and details.

connected biomass plants can potentially be built with higher capacity factors than solar or wind and close to many conventional plant.

Grid-connected solar PV
Solar photovoltaic (PV) technology based on solar cells that convert light directly to electricity can take advantage of India's vast solar resources. Grid-connected PV, consisting of several PV cells connected together can provide energy services for rural grid connected areas, but particularly urban domestic and commercial establishments where approximately 25% of the population reside. India is one of the largest markets and manufacturers of PV modules in the world after US, Japan and the EU and can potentially use PV on a large scale, particularly if module costs can be reduced. There are thought to be more than 1.67 MW of installed grid-connected PV, and demand could rise to more than 500 MW per year if at least 2% of the urban market can be reached.

Grid-connected hybrid plant
As with standalone hybrid power systems, grid-connected hybrid systems combining both fossil fuel and renewable resources have potential applications in India. Again, these systems can incorporate wind, solar, biomass or hydro resources. One technology with particular potential for India's desert regions is solar thermal power hybrid plants that produce electricity. Systems such as the 140 MW (35 MW solar, 105 MW fossil fuel - naptha or gas) Integrated Solar Combined Cycle Power project planned for Rajasthan, have a very large potential utilising India's solar resources and combining with fossil fuels to produce despatchable power to the grid.

Type II: Energy Efficiency Improvement Projects
II.A SUPPLY SIDE ENERGY EFFICIENCY IMPROVEMENT - TRANSMISSION AND DISTRIBUTION
System improvement project by state and private utilities
Transmission and distribution (T&D) losses in India are very high at around 20%, compared to those in developed nations of around 8-10%. This is extremely significant where current capacity shortages occur and there are considerable opportunities for system improvements, for example through the upgrading of voltage on transmission lines or replacing transformers. A reduction in T&D losses by 1% would result in capacity savings of more than 800 MW, and could be very significant in meeting the demand and supply balances.

II.B SUPPLY SIDE ENERGY EFFICIENCY IMPROVEMENTS - GENERATION
Improvement in fossil fuel based facility due to supply/demand imbalances
There are a number of possible opportunities for projects that improve the efficiency of existing fossil fuel based power plants, the main ones applicable to CDM will be through the application of technology. For example, the time available for non-critical maintenance of fossil fuel based power plants is relatively limited which reduces the efficiency of plants to well below optimum. The ALGAS study found that there is a good opportunity for improving efficiency through the application of relatively low cost technology, and that average efficiency improvements of 1.5% in thermal plants representing 6,500 MW of capacity are readily attainable.

Energy efficiency improvement in captive power plants
There are considerable opportunities to increase the efficiency of existing or new power plants through the application of improved technology, such as cogeneration, integrated gasification combined cycle plants (IGCC), and improved turbines. Efficiency through this means could potentially be improved by 10%, with significant savings in power and emission reductions. There are numerous opportunities for applying these non-least cost technologies, particularly given India's increasing electricity demand and capacity shortages.

II.C DEMAND SIDE ENERGY EFFICIENCY PROGRAMMES FOR SPECIFIC TECHNOLOGIES

Programs on energy efficiency improvement in end use equipments

End use equipment such as lights and refrigerators account for a significant proportion of the countries total electricity consumption, with electricity demand increasing. The replacement of existing end use applications with more efficient technologies, such as compact fluorescent light bulbs (CFLs) or more efficient refrigeration units can significantly reduce energy consumption, greenhouse gas emissions and energy bills for the end user. A techno-economic study (AIT, 2000) funded by the Swedish International Development Agency (SIDA) estimated that selected efficient appliances would avoid about 10.6% (1567 TWh) of total electricity generation and 15.3% (32,284 MW) of peak load from 1997-2015. There are numerous opportunities for program and projects implementing efficient appliances as part of energy services to residential and commercial customers.

II.D ENERGY EFFICIENCY AND FUEL SWITCH MEASURES FOR INDUSTRIAL FACILITIES

Fuel switch from oil to gas in heaters

Fuel switching from oil to gas boilers in industrial facilities can be achieved through relatively low-cost retrofitting. However, India's gas resources are relatively scarce and extensive fuel switching will require a more extensive gas infrastructure primarily for LNG.

Energy efficiency improvement through Audit

The opportunity for energy efficiency improvements in industrial facilities is vast, with existing industries such as the cement, aluminium and steel industries being particularly energy intensive. Energy audits by facilities can provide a number of options for energy and cost savings, particularly through the implementation of new more efficient processes but also through more minor changes in operation.

II.E ENERGY EFFICIENCY AND FUEL SWITCH MEASURES FOR BUILDING

Energy efficiency in buildings is at poor levels in many countries, including many developed countries. There are many significant opportunities for conserving energy use, with corresponding cost savings and greenhouse gas emissions. Three options for this type are considered below.

Fuel switch from oil to gas

As with industrial boiler retrofitting opportunities there are considerable opportunities for cost and emission savings through switch from oil to gas boilers in buildings, particularly for the commercial and public sectors, such as offices and hospitals.

Energy efficiency improvement in hotels

The growing number of hotels in India consumes significant amounts of energy, and this sector has potential for significant energy efficiency measures. These include replacements of condensers, feet electronic chokes and variable frequency drives with more efficient technology and the installation of improved heating, cooling and control systems. Considerable cost and energy savings can be made for all hotels in India (depending on the types of measures undertaken).

Energy efficient building design

Electricity consumption, on account of heating, ventilating and air conditioning, lighting and water heating in buildings, is about 30%, which constitutes a significant proportion of the total electricity consumption in the country (Mathur and Chand, 2003). Buildings can be designed to meet thermal and visual comfort, whilst reducing levels of energy consumption, for example through incorporating passive solar techniques in building design to minimise the load on conventional systems (heating, cooling, ventilation and lighting). Energy efficient building design could potentially be applied to all new-builds in India in residential, public, commercial and industrial sector buildings with significant savings depending on the design.

Type III: Other Project Activities

III.A AGRICULTURE

Although agricultural projects are eligible for small-scale CDM projects, they are outside the scope of this project.

III.B SWITCHING FOSSIL FUEL

Although switching fossil fuel projects are considered in some of the other project types (IID, IIE), this category may be relevant for some small-scale projects within the limits defined.

III.C EMISSION REDUCTION BY LOW GREENHOUSE GAS EMISSION VEHICLES

Change of fossil fuel based vehicle fleet into battery operated vehicle fleet in any industrial or institutional premises

This offers a potential opportunity for the transport sector, however in the case of battery operated vehicles, although contributing less to local air pollution, greenhouse gas emissions will depend on the type of electricity used for charging. Local air pollution in many of India's cities is very high, and many organisations, such as bus companies may be encouraged to convert their fleets to alternative or cleaner fuels particularly if carbon finance through the CDM can be attracted.

III.D METHANE RECOVERY

Landfill gas recovery

Landfill sites containing municipal solid waste (MSW) release very high levels of methane, for example it is estimated that in 1997, landfills in India released 7 million tonnes of methane into the atmosphere, which are set to increase to 39 million tonnes over the next 50 years[13]. Utilising the methane from these sites offers considerable opportunities for generating grid quality power with already 1460 MW installed. A potential of 4566 MW electricity generations from landfill gas recovery has been estimated for the next 20 years in India's waste plan[14]. However, significant amount of this potential will not be eligible for small scale due to the expected power generation sizes and emissions reductions of methane[15].

Anaerobic wastewater treatment facility with methane recovery

Large amounts of municipal wastewater and sewage are treated in India's cities, through energy intensive aerobic methods resulting in the emissions of carbon dioxide. Despite low BOD levels municipal sewage there is still significant potential for energy recovery from municipal sewage. Currently, 229 MW of energy are recovered from wastewater treatment facilities, and a potential of 446 MW has been estimated[11].

Coal bed methane recovery

India is the third largest producer of coal, and has the sixth largest coal reserves. Extensive mining activities are leading to high levels of methane emissions, which is associated with coal as a by-product of the coal formation process. Methane is usually trapped in coal beds and released during and after coal mining. The methane is potentially explosive and usually allowed to escape into the atmosphere where it has a high global warming potential. Technologies are now available to recover the trapped methane from coal beds and the opportunity for power generation is vast. It is estimated that there is at least 20,000 MW of coal bed methane CBM) potential in India (Pachauri, 2001). As with landfill recovery, a significant proportion of this potential will be for large-scale CBM plants although early applications of this technology have resulted in relatively small plant (1-10 MW), again methane.

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[13] *TERI Information Monitor on Environnemental Science 6(1): 67-75.*

[14] See http: www.indiawteplan.com for further details and IT Power India (2004)

[15] Note: Methane has 21 times the global warming potential of CO_2, and as CO_2 equivalent reductions would need to be less than 15 kilo tonnes to stay within the small-scale criteria, CBD plant would have to be very small.

3. BARRIERS AND RISKS FOR SMALL-SCALE CDM PROJECTS IN INDIA

3.1 Barriers for small-scale CDM projects

Three main financial barriers are identified: the transaction costs, the low carbon price, and the lack of financing of the project.

The Kyoto mechanisms have been established to stimulate a cost-efficient selection of options to reduce greenhouse gas emissions. However, the costs associated with the development of a CDM project[16] are a serious barrier to many small-scale projects, because they can be significant and are to a large extent fixed and independent of the size of the project. Therefore, the larger the project in terms of amount of emission reduction the lower the transactions costs are per unit of emission reduction. This means that investors are interested particularly in large CDM projects with relatively low transaction costs and that smaller projects will have more difficulties attracting investment from commercial international CDM investors.

The consequential choice for large-scale emission reduction projects to avoid financial barriers (transaction costs are lower) and institutional barriers has been perceived as a problem in the Kyoto Protocol follow-up negotiations. The main reason for concern is that small-scale projects have a high potential to contribute to local sustainable development in terms of employment generation and poverty reduction. Small-scale projects therefore are highly valuable from a sustainability perspective, which is one of the objectives of the CDM.

In view of this, simplified regulations and rules have been developed and adopted by the CDM Executive Board for small scale projects with the aim to reduce transaction costs and to make these projects more attractive from an investor's perspective. Because so far only limited experience has been gained with these rules further refinements of the rules may be made in the future. This section presents an overview of the simplified procedures for small-scale projects and gives an assessment of the potential reduction in transaction costs that can be achieved compared to regular CDM projects.

3.1.1 Financial Barriers

Transaction Costs

The main barrier usually mentioned by project developers is the 'transaction costs' of CDM projects. The need for objective judgement on the validity of the CDM credits calls for a process involving extensive and transparent calculations, and a validation process in advance of the project approval. To ensure that the sustainable development criteria of the host country are met, the host country should approve the project, which involves negotiation and legal challenges. The project needs to be validated by an Operational Entity. The public approval is guaranteed by a stakeholder comment procedure in the validation. During the operation of the project, monitoring should give the confidence to the Operational Entity that the emission reductions can actually be verified. They can be sold as CERs as soon as the CDM Executive Board issues them.

All this requires a complicated and costly organisation structure. In many cases, the project developer pays. The first barrier the project developer experience is usually the up-front transaction costs (see Table 3.1). In the early stages of CDM, and also Joint Implementation, the pur-

[16] These costs include the development and validation of the project design document and verification and certification of emissions reduction.

chasing programme sometimes offered a compensation for the up-front transaction costs, either by paying a fee (ERUPT) or by agreeing in the price negotiations on a lower CER or ERU price when transaction costs are covered by the purchaser (PCF). In the future free market of CERs and ERUs, however, when baseline methodologies will have been approved and learning-by-doing has led to lower costs, is it for the baseline calculation, the monitoring plan, or the validator. The up-front transaction costs are expected to decrease significantly in the coming years and therefore, this barrier is expected to become less significant once CDM is more widely implemented. Table 3.1 presents the transaction costs of regular and small scale CDM projects.

Table 3.1 *Transaction costs of normal and small-scale CDM projects*

		Normal-scale (average)	Small-scale (average)	Cost reduction [%]
Up front		71,000	28,400	-60
	1. Project preparation and review	9,000	4,800	-47
	2. Project Design Document	24,000	10,800	-55
	3. Validation	12,000	6,000	-50
	4. Appraisal phase	20,000	3,800	-81
	5. Initial verification (start-up)	6,000	3,000	-50
Operation		132,000	30,000	-77
	6. Periodic monitoring	72,000	12,000	-83
	7. Verification and certification (yearly)	60,000	18,000	-70
Total transaction costs		203,000	58,400	-71

Note: Projects with a crediting time of 10 years are assumed. The small-scale project achieves a yearly reduction of 10 to 30 ktCO_2 eq. The last column indicates the reduction of the transaction costs for small-scale projects with regard to regular procedures.

The operational transaction costs of a CDM project show a different development. Good monitoring takes time and amount up to operational costs that cannot be avoided. In addition, verification will always be required as well. It can be concluded that for normal-scale projects, operational costs dominate the transaction costs. Nevertheless, most project developers seem to fear the up-front transaction costs more than the operational costs. Table 3.1 also shows that most of the transaction cost reduction as a result of simplification of procedures is in the less frequently required monitoring and verification. As these costs are not expected to decline much as a result of increased experience with CDM as a mechanism, there is even a bigger incentive to be eligible for small-scale procedures.

Currently, as the Kyoto Protocol has not entered into force yet, and the market has a monopsonic character (i.e. demand is dominated by a few parties only), the price of CERs is at a minimum. It is unclear whether the price will increase. The price currently offered in Carbon Fund programmes usually does not exceed 5 US$/t$CO_2$ eq, and credits are not seldom sold for 2,5 US$/t$CO_2$ eq or less. This low carbon price is regarded a major barrier to entering the process of offering the CERs generated by the project. This is of course a trade-off with the transaction costs. Especially if the up-front investment costs are significant, the revenues expected in the current price must overcompensate the transaction costs in order for the sale of CERs to be attractive for the project developer. Table 3.2 illustrates the transaction costs as a percentage of the revenues from the sales of CERs under different project circumstances, differing in the CERs sold, the crediting time (10 and 21 years) and whether small-scale procedures can be applied.

Table 3.2 *The ratio of transaction costs/revenues from the sale of CERs*

	Emission reduction [(tCO_2 eq/yr]	Up-front transaction costs [US$]	Operational transaction costs [US$/yr]	CER revenues [US$/y])	Transaction costs/CER revenues [10yr]	Transaction costs/CER revenues [21yr]
Normal-scale high end	150,000	87,000	13,200	600,000	4%	3%
Normal-scale low end	50,000	71,000	13,200	200,000	10%	8%
Small-scale high end	30,000	31,200	3,000	120,000	5%	4%
Small-scale low end/low price	10,000	28,800	3,000	40,000	15%	11%
Small-scale low end/high price	10,000	28,300	3,000	70,000	8%	6%

Note: The numbers in the table assume emission reductions of 150, 50, 30 and 10 $ktCO_2$ eq per year. The ratios are given for crediting times of 10 and 21 years, as both are allowed by the Marrakech Accords. A CER price of 4 US$/$tCO_2$ eq is assumed. As it is likely that for very sustainable, small-scale projects a higher price will be paid, a price of 7 US$/$tCO_2$ eq is assumed in the 'Small-scale low end/high price' project case. The attractiveness of the lower end of the small-scale project window is lowest, calling for additional facilitating procedures for this type of projects to become feasible, or for a higher carbon price.

From the table, it can be concluded that the attractiveness of the project is enhanced by the size of the project, which would justify the design of simplified procedures for small-scale CDM projects, especially in a low carbon price regime. It can also be concluded, however, that these small-scale procedures provide most benefit on the upper side of the small-scale window. A transaction cost/revenue ratio of about 10% is generally regarded the maximum to make submission as a CDM project attractive for the project developer. Apparently, for the small-scale projects in the lower end of the CO_2 reductions generated, another mechanism must be applied. If the price of CERs is increased to about 7 US$/$tCO_2$ eq, these projects could become feasible. Bundling of projects could also be an appropriate answer.

Partly because of the financial reasons mentioned above, but also because of lack of awareness of the emerging carbon market, financing institutions are often not eager to finance small-scale projects, even if the extra revenue from CDM makes a project more feasible. To the project developer, who is often not able to finance the project in-kind, this is a problem.

The finance market is responding slightly slower than project developers. However, the interest of the financing institutions present at the workshops in Delhi, Mumbai and Bangalore, showed that this might be changing. In the purchasing countries, there is even more interest of banks in financing, as recent contracts between governments and banks prove. The Rabobank has been contracted by the Dutch government for the reduction of 10 $MtCO_2$ eq through CDM projects. Also international development banks are setting up programmes for carbon finance.

3.1.2 Institutional barriers

Institutional barriers are defined as barriers that are embedded in the institutional structure of the government or of the international agreement that governs the CDM. Institutional barriers are therefore partly country-specific. This section will concentrate on the Indian situation for CDM.

As in most countries hosting potential CDM projects, India has not yet fully developed the institutional capacity to process and develop CDM projects. However, a great many steps are being made in this direction, with firm Government support and action being taken, as well as a growing pipeline of projects in various stages of development. This section considers the existing institutional arrangements as a prelude to identifying the institutional capacity required to replace or enhance these existing arrangements and overcome any barriers that they entail, particularly for developing portfolios of small-scale CDM projects.

India signed the UNFCCC on 10^{th} June 1992 and ratified it on 1^{st} November 1993. Under the UNFCCC, developing countries such as India do not have binding GHG mitigation commitments, in recognition of their small contribution to the greenhouse problem as well as low financial and technical capacities. The Ministry of Environment and Forests (MOEF) is the nodal agency for climate change issues in India. GoI approved ratification of the Kyoto Protocol in August 2002.

The Government of India has been very active in the climate change negotiations since the inception of the Convention. Although it does not have GHG reduction targets, it has actively taken steps to address the climate change issue. The policy on climate change in India is based on three principles:

- The primary responsibility of reducing GHG emissions is that of developed countries.
- The development needs of developing countries are of prime importance.
- The developed world should transfer resources and technologies at favorable terms to the developing world, thereby facilitating developing countries to move towards sustainable development.

The MoEF made public the interim criteria for CDM projects during early 2002 when the first call of CERUPT (Certified Emissions Reduction Procurement Tender) by the Dutch Government was announced. CDM projects were also submitted in response to the call for tenders by Government of Sweden (Swedish Climate Investment Program) and Finland Government. GoI took initiative to participate in the pilot phase for Activities Implemented Jointly (AIJ), to gain experience with the CDM process.

To strengthen the process of CDM project approval Designated national Authority is established under the aegis of Ministry of environment and Forest, GOI, which is the major step towards implementation of CDM in the country (see section below).

Response of private sector to CDM is encouraging. Indian projects have been submitted to major carbon tenders including CERUPT, the Finnish CDM/JI Programme Tender and the Prototype Carbon Fund (PCF), several of which have been accepted under these tenders and are being implemented.

Two carbon facilities are operating in India with the support of Indian financing institutions namely the Rabo India Bank and Infrastructure Development Finance Corporation (IDFC). While the former has a tie up with the Government of Netherlands, the latter has an exclusive contract with PCF. The positive outcome of the CERUPT call has kick started the CDM process in India encouraging the private sector to embark on CDM project development in the country. Since CERPUT there are number of CDM projects developed in the country and are at different stages of development. Out of 11 projects from India in CDM cycle, six projects are small-scale CDM projects and one bundled project. These projects are mentioned in Table 3.3:

Table 3.3 *Indian CDM Projects*

Sl No	Name	Type	CERs	Buyer
1	Ind-Barath Energies Limited biomass 7.5 MW Power Project in the State of Maharastra	Biomass Co-generation	378,000	CERUPT
2	Kalpa Taru Energy Venture Private Limited KEVPL) 7.5 MW biomass project.	Biomass Co-generation	1,150,000	CERUPT
3	Vestas RRB India Limited 14.45 MW Wind Power Project in Tamil Nadu.	Wind	308,030	CERUPT
4	Suzlon Energy Limited 15 MW grid connected Wind Energy Project in Sankaneri Tamil Nadu.	Wind	360,000	CERUPT
5	Enercon (India) Limited 15 MW Grid Connected Renewable Electricity Supply Project in Nipani, Karnataka	Wind	2,000,000	CERUPT
6	Bagasse/biomass based cogeneration power plant, Karnataka	Cogeneration	696,167	Unknown
7	Haidergarh Bagasse based cogeneration Power Project	Co-generation	936,289	Unknown
8	OSIL - 10 MW Waste Heat Recovery Based Captive Power Project	Waste Heat Recovery	323,061	Unknown
9	18 MW Biomass Power Project in Tamil Nadu, India; submitted to EB	Co-generation	800,000	Swedish Energy Agency
10	Municipal Solid Waste Treatment cum Energy Generation, Lucknow, India	Landfill Gas Recovery	1,018,477	PCF
11	9 Biomass Gasifier based power plants totalling around 2 MW	Gasification	92,550	Govt of Finland

Existing Institutional Framework

The Ministry of Environment and Forests (MoEF), in the Government of India is responsible for climate change related policy and is also the nodal ministry for the UNFCCC and the Kyoto Protocol. The MoEF has a climate change division, which is responsible for CDM. In December 2003, the MoEF has established a Designated National Authority (DNA) for CDM as required by parties to the Kyoto Protocol[17] who would be participating in CDM.

The DNA under the aegis of MOEF is guided and by an inter-ministerial committee consisting of representatives of the Ministry of Finance, Ministry of Power (MOP), Ministry of Non-Conventional Energy Sources (MNES) etc and chaired by the secretary, MOEF. The DNA has continued with the interim approval criteria[18] which has the following features:

- An eligibility criterion has been defined in terms of additionalities- emission, financial and technological.
- Sustainable development indicators have been defined in terms of social, economic, environmental and technological well-being.
- Guidance on baselines has been provided.
- Data requirements for examining the financial, technological, risk of the CDM project and credentials of the project participants have been specified.

The interim approval criteria for CDM projects in India are provided in Annex J and it is expected that the criteria will be improved in due course. The current institutional arrangement has been quite active in providing host country approval for a large number of Indian CDM projects. In order to standardise the data requirements across different emission transaction intermediaries and Annex-I party initiatives, the MoEF has developed a format for submission of Project Concept Notes (PCNs), which is available at Annex K.

[17] India had acceded to the Kyoto Protocol in August 2002.
[18] established.

Institutional Capacity Needs

Capacity can be defined as the 'ability of individuals and institutions to make and implement decisions to achieve registration of CDM projects and perform functions related to the CDM project cycle in an effective, efficient and sustainable manner' (Ecosecurities, 2002).

To build capacity, three components are strictly interrelated. These components correspond to three levels:

- Skill/expertise of the people participating in the CDM. At this level, capacity building refers to the process of changing attitudes and behaviour as well as imparting knowledge and developing skills while maximizing the benefits of participation, knowledge exchange and ownership.
- Institutions that mobilize and use the skills of individuals. This level of capacity building focuses on the overall organizational performance and functioning capabilities as well as the ability of an organization to adapt to new policy agendas. Actions to strengthen institutions, such as the creation of focal points - for example a CDM office - maximize the effectiveness of the skills base (GEF - UNDP, 2001).
- Systemic refers to the policy and legal regime in which actors and institutions operate.

The Marrakech Accords, agreed at the seventh Conference of Parties, 2001, sets out the principles that should guide how capacity building programmes are developed. Capacity building activities should:

- build on work already undertaken in developing countries,
- be a continuous, progressive and iterative process,
- involve 'learning by doing': demonstration projects may be used in identifying and learning about the specific capabilities that need to be further developed in developing countries,
- utilize existing institutions and bodies and build on existing processes and endogenous capacities.

Categories of capacity building actions relevant to the implementation of the CDM include:

- Institutional capacity building, including the strengthening or establishment of national climate change secretariats or national focal points,
- Enhancement or creation of an enabling environment,
- National climate change programmes,
- Assessment of implementation of mitigation options,
- Development and transfer of technology,
- Improved decision-making,
- Education, training and public awareness,
- Information and networking, including the establishment of databases.

Based on the assessment made during the inception worshops conducted at Delhi, Mumbai and Bangalore involving various stakeholders and questionnaire survey conducted, it is clear that there is need for capacity building at various stakeholders' level. It was expressed in the stakeholders Inception workshop of the project that there is clear need for capacity building at three levels:

- policy makers (central and state level),
- financial institutions,
- capacity building of NGOs and community organizations.

Capacity Building Needs at Central Ministry level

It was expressed that there is need to build capacity at central ministry level. It is realized that key ministries like MOEF, MNES, and MOP have been involved in debates on climate change but many other ministries and organizations, which are concerned with the subject of climate change, are not involved in the process. These central ministries are:

- Ministry of Rural Development
- Ministries of Urban Development
- Ministry Commerce
- Ministry of Agriculture
- Ministry of Industry
- Ministry of Chemicals and Fertilizers
- Ministry Petroleum & Natural Gas
- Organizations like Central Pollution Control Board, Central Electricity Authority.

These ministries are not involved in the process and are clueless about the CDM and opportunities offered by CDM.

Capacity Building Needs of State Level Stakeholders
Several state level organizations play an important role in preparation of a CDM project. These organizations are aware of the CDM only at superficial level. Often lack of understanding on CDM lead to one sided decision making by such bodies and institutions, such as made by Karnataka Power Transmission Corporation Limited (KPTCL) where decision to share 30 % of CER revenues with the KPTCL if the project is supplying power to the grid. In a regime where prices of carbon are low (1% increase in IRR with CER revenues) lack of capacity can further discourage CDM projects. Such an arrangement by transmission companies will further add to uncertainty on viability of small-scale CDM projects under present circumstances. Therefore it is inpretive to raise the awareness level of these state level stakeholders on the potential of small-scale CDM projects. Some of the state level institutions involved in the CDM cycle are:
- transmission, distribution companies,
- SERCs in the electricity generation for grid projects,
- municipalities/urban local bodies,
- state urban development ministries for urban solid waste and transport projects, irrigation town planners etc.

Capacity Building Needs of Financial Institutions
The level of awareness of CDM is low and concentrated in a few FIs at present. Many of the institutions like IDFC and its subsidiary IDECK, ICICI Bank, IL&FS, IREDA, HUDCO, PFC as well as a few private banks like Bank of Baroda, were involved in USAIDs Greenhouse Gas Pollution Prevention Project's Climate Change Supplement in the year 1998. However, involvement at higher levels of management is essential for taking any strategic decision. Many banks have begun financing renewable energy and energy efficiency projects, but they still lack awareness about structuring them as CDM projects. However, many banks especially the private banks need to orient to the business of financing CDM type projects.

These financial institutions can play a major role in bundling small-scale CDM project as they are uniquely placed to take on the task. The CDM revenues can cover various uncertainties associated with the small-scale projects and therefore better paying back capacity. The awareness among financial Institution to undertake the task of structuring CDM projects on their own is crucial for lowering the transaction cost.

Capacity Building Needs of NGO
NGO in India are far ahead in many sense compared to various other stakeholders in India on their understanding on CDM. Mainly NGO involved the capacity building exercise and to certain extent the policy research and guidance to GOI. The main NGOs involved in the CDM are:
- Development Alternatives (DA), N. Delhi
- The Technology and Resources Institute (TERI), N. Delhi
- Confederation of Indian Industries (CII), N. Delhi
- Winrock India, N. Delhi
- FICCI, N. Delhi

- Environment Protection Research And Training Institute (EPTRI), Hyderabad.

However, most NGOs lack technical expertise and in-depth technical understanding to take on the work on PDD, Designing Monitoring Methodology and taking the process upto registration. There is need to build the capacity of the NGO to take on such task so that transaction cost can be brought down. NGO also has major role to play in bundling of small-scale projects. If the procedures of bundling and underlying issues associated with the viability are addressed, NGOs can take on the task of bundling. Therefore, there is need for targeted capacity building of NGO in the CDM sector.

Current Capacity Building Efforts in India

The following presents the current CDM capacity building programmes in India:

- National Strategy Study (NSS) on CDM, World Bank, TERI, India.
- Integrated Capacity Building - CDM: Ministry of Environment, Trade and Investment, Japan.
- GTZ - IGEEP CDM Capacity-building Project.
- CDM and Indian Industry, Ecosecurities & FCO, UK.
- Asian Development Bank (ADB) Clean Development Mechanism (CDM) Facility.
- UNDP Capacity-building Programme for Biomethanation Sector, MOEF, Government of India.
- Canada small-scale CDM Projects Facility, Pembina Institute of Technology.

3.1.3 Capacity and awareness

As a new instrument, the CDM (and carbon credits trading in general) lacks broad awareness. In order to make CDM work, all partners involved should be aware of their rights and responsibilities in the project implementation. In addition, certain partners may consider facilitating certain aspects of the mechanism, but are not aware how. Several actors in a CDM project can be identified, with their typical gaps in awareness or capacity:

- On the central government level, the awareness may be quite high and capacity may be available as well. However, if responsibilities are delegated to the state level in a country such as India, the awareness will unavoidably decline rapidly. Also, the capacity to facilitate project developers, to distinguish feasible projects and to make a sound first judgement on whether a project is likely to pass the additionally tests, may well be lacking.
- Many project developers, especially small enterprises, may not be aware that there is a possible additional cash flow for their project. This is especially the case with small renewable energy project developers, but also with larger industries. The latter often regard their energy cost as fixed costs and are not inclined to look for possibilities to reduce energy cost by applying energy efficiency measures, and even get revenues from that through the CDM.
- Financing institutions: as has been highlighted above, financial institutions may refrain from financing CDM projects if the project developer claims that there is an extra revenue flow by selling CERs. This may be due to the lack of awareness, or lack of confidence in the carbon market.
- The transaction costs of a CDM project may be reduced substantially if a local consultant can work on the Project Design Document, the baseline study and the monitoring plan. As many of these consultants are still unaware of this market, they may not yet have developed capacity to deal with this type of questions from project developers, or the host country government. This situation is likely to change, however, since consultants are usually flexible and tend to respond fast to demand for a type of service.

The availability of reliable and accurate data is one of the conditions for the application of a baseline methodology to potential projects. It may become a barrier when due to inaccurate data or unavailability of data the project design document cannot be prepared. The confidential character of data of certain projects might trouble data availability. Data availability has a strong link to capacity and to transaction costs. A good way to decrease transaction costs is to hire a consultant locally. Though there may be consultancies that have the capacity to make a baseline, they may not have access to the data. The costs to retrieve the right information to make a baseline study for the project may contribute excessively to the transaction costs.

There are discussions going on to create standards for data collection and therefore availability. This will be especially helpful to small-scale CDM projects. The government of India can be an important actor in diminishing this barrier by developing a mechanism for data collection and makes this available in public domain. Research institutes can play a major role in this as well.

3.2 CDM-specific risks

In addition to the barriers described above, there are also several risk factors that are taken into account by the project developer before the decision is made to develop a small scale CDM project. These risks can be seen as a major. The main risk factors are discussed below.

3.2.1 Kyoto risk

As of November 2004, 126 parties have ratified the Kyoto Protocol accounting for 44.2% of the carbon dioxide emissions for 1990 of total Annex I group of countries. The Protocol will come into effect only after the Annex I countries that ratify the Protocol account for at least 55% of the 1990 carbon dioxide emissions. As the USA has decided not to ratify the Protocol, the ratification of the Russian Federation is absolutely necessary for the implementation of the Protocol and thus also for the implementation of the flexible mechanisms. As long as the Protocol will not come into force, the CDM EB cannot issue CERs and this, obviously, is a barrier for project developers. To overcome this barrier, most purchasing programmes guaranties a certain price for each ton CO_2 reduction, regardless of whether or not the Protocol will be implemented. The risk then fully lies with the programmes developed by various donor countries.

3.2.2 CDM risk

One of the conditions for approving CDM projects is that the project participants have to show that the project is additional in the sense that the emission reduction generated by the project would not have occurred in the absence of the CDM project. For small-scale CDM projects the additionally can be shown by explaining that the project would not have occurred anyway due to at least one of the following barriers:

- Investment barrier: a financially more viable alternative to the project activity would have led to higher GHG emissions.
- Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.
- Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions.
- Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organisational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Because no small-scale projects have been approved yet and because the additionally requirement appeared to be a major stumbling block for regular CDM projects, there currently is great uncertainty regarding how strict the Executive Board will apply this requirement in their project evaluation process for small-scale CDM projects.

3.2.3 Project risk

The project developer runs the normal risk that the project performs less good than expected. As a result of fluctuating electricity demand, for instance, the amount of electricity delivered may be disappointing, which results in less CO_2 reduction and therefore less revenues from the CDM project. In addition, technical performance may be low. In the case that the monitoring results show a higher fall-out of systems (for instance PV systems) than initially estimated, the CDM-related revenues are less as well. This risk is actually reduced if a portfolio of projects is submitted as one CDM project, as in a bundled project, the risk is spread over a large number of activities.

4. ENABLING SMALL-SCALE CDM PROJECTS

4.1 Introduction

The Kyoto mechanisms have been established to stimulate a cost-efficient selection of options to reduce greenhouse gas emissions. However, the costs associated with the development of a CDM project[19] are a serious barrier to many small-scale projects, because they can be a significant portion of overall project investment and are to a large extent fixed and independent of the size of the project. Therefore, the larger the project in terms of amount of emission reduction the lower the transactions costs are per unit of emission reduction. This means that investors are interested particularly in large CDM projects with relatively low transaction costs per emission reduction and that smaller projects will have more difficulties attracting investment from commercial international CDM investors.

Consequently, the more attractive choice of large-scale emission reduction projects that avoid financial barriers (i.e. transaction costs are lower) and institutional barriers has been perceived as a problem in the Kyoto Protocol follow-up negotiations. The main reason for concern is that small-scale projects can potentially contribute significantly to local sustainable development in terms of employment generation and poverty reduction, particularly in rural areas. Small-scale projects therefore are highly valuable from a sustainability perspective, which is one of the objectives of the CDM.

In view of this, simplified regulations and rules have been developed and adopted by the CDM Executive Board for small-scale projects with the aim to reduce transaction costs and to make these projects more attractive from an investor's perspective. Because so far only limited experience has been gained with these rules, further refinements of the rules may be made in the future. This section presents an overview of the simplified procedures for small-scale projects and gives an assessment of the potential reduction in transaction costs that can be achieved compared to regular CDM projects.

Transaction costs of small-scale CDM projects can be reduced significantly by:
1. Applying the simplified procedures and rules for small-scale CDM projects adopted by the CDM Executive Board.
2. Bundling of a group of individual small-scale projects into a single large CDM project that does not exceed the project limits as given in Table2.1.

4.2 Simplified Procedures and Modalities

The structure of the CDM Project Design Document (PDD) for small-scale projects is the same as for regular CDM projects but the CDM EB has adopted simplified and standardised procedures for the following components of the CDM project cycle for small-scale projects:
Baseline development: the amount of CERs generated by a project is determined by a comparison of emission levels with and without the project. The CDM Executive Board has provided simple and clear methodologies for each of the thirteen project categories presented in Table 2.2 to determine the energy baseline and the estimated emission reduction resulting from the implementation of the project. These rules can be found at http://cdm.unfccc.int.

- *Monitoring requirements*: simplified monitoring rules are provided for each of the thirteen project categories. For bundled projects a monitoring plan may be proposed based on a

[19] These costs include the development and validation of the project design document and verification and certification of emissions reduction.

sample survey. Furthermore, a single designated operating entity may validate the PDD as well as verify and certify the emission reductions.
- *Additionally:* project participants should use a predetermined list of barriers to show that the project would not have occurred without the support from the CDM.
- *Project boundary*: the project boundary is limited to the physical, geographical site where the project is located.
- *Leakage:* for Type 1 and 2 projects leakage calculation is required only if the technology is equipment transferred from another activity. For Type 3 projects no leakage calculation is required. Only in the case of projects activities using biomass, a leakage calculation is required.

4.3 Bundling

Bundling of projects that reduce GHG emissions may be considered if these projects are too small to warrant the development of a CDM project individually. Bundling may offer a viable possibility for small-scale projects to participate in the CDM. A bundled project has a single project owner (e.g. bundling organisation) and includes a large number of legally independent actors who are responsible for the investment decisions. In Burki and Grutter (2001) the following merits and drawbacks have been identified for bundled projects:
- A large number of small projects will have a more significant impact on small and medium sized enterprises and, consequently, will contribute more to the local economy than one single large project. Therefore, if bundling could enhance the participation of small enterprises in the CDM this would contribute positively to the political acceptance and general attitude in non-Annex I countries towards the climate change process.
- Because the bundled project consists of many small projects, the risk that the bundled project will produce less emissions reduction than expected is smaller compared to a single large project. The risk is spread over a large number of small activities. The disadvantage, however, is that the owner of the bundled project has only limited control over the individual investment decisions.
- Because an intermediate organisation is needed for bundling the individual projects, the transaction costs are likely higher than for individual projects. The initial costs of contractual arrangements that need to be made with each individual small project may form a barrier for private parties to take on the role of bundling organisation.

Figure 4.1 shows the flow of CER rights from small CER suppliers, via the bundled project, to the buyer of the CERs.

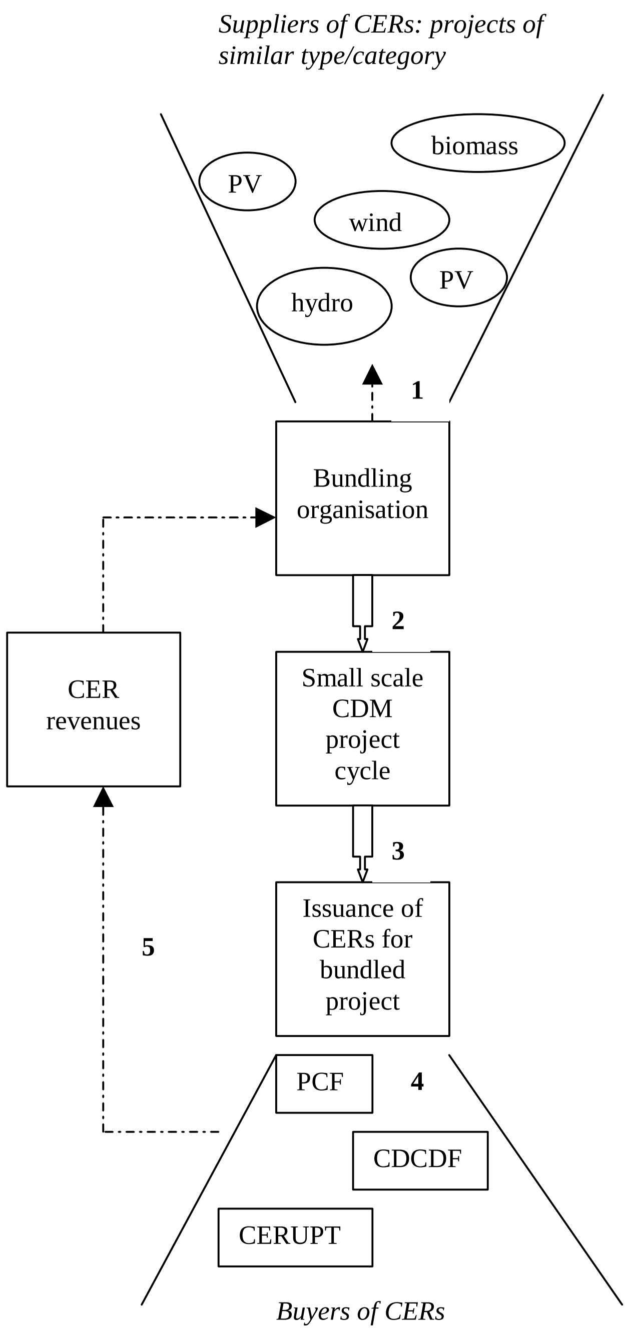

Figure 4.1 *Flow of CER revenues from individual suppliers to buyers*

Small-scale projects that reduce GHG emissions can claim CERs if brought under the CDM. To reduce the transaction costs, individual small projects can be bundled together into a single CDM project, provided the projects in the bundle have a similar project context and the bundled project does not exceed the small-scale CDM project limits (see Table 2.1). The bundling process may involve several steps. For example, in the first step the systems sold by an equipment supplier can be bundled by the retailer. Next, a bundling organisation puts together the bundles from the various retailers into one single CDM project. To facilitate bundling, the owners of the individual projects need to assign the right to claim CERs to a registered agent (e.g. equipment supplier) or to a bundling organisation. In that case the bundling organisation needs to obtain a written approval (comparable to a contract) from the owners. In return, the owners may receive part of the benefits generated by the CERs.

The bundling organisation will put the bundled project in to the CDM project cycle. This cycle involves the design of the project (preparation and validation of the PDD and registration with the CDM Executive Board) and the implementation of the project (monitoring emissions reduction and verification of monitoring report). The CDM Executive Board has adopted a set of simplified procedures for the small-scale CDM project cycle in order to reduce the transaction costs.

Once the bundled project has been implemented and the verification report on the amount of emissions reduction is approved, the CDM registry administrator issues the CERs. Upon issuance the CERs are registered in the CDM registry with the bundling organisation as the owner of the CERs.

The CERs can be either banked or sold to a potential buyer. The CDM registry is responsible for clearing and settling of the trade between the buyer and the seller. Clearing is the process before the trade in which it is verified that buyers and sellers have the cash and the securities to do a trade.

In exchange for the CERs, the buyer will pay the bundling organisation for the delivered CERs. To reduce the price uncertainty, the bundling organisation could sell all CERs via a forward contract. The CER revenues are used to cover the cost of the bundling organisation and are partly transferred to the individual project owners.

4.4 Estimation of Transaction Costs for Small-scale Bundled CDM Projects

The aim of this section is to provide a first indication of the reduction in transaction costs that can be achieved through bundling of individual projects into a single CDM project. An estimation of the various components of the transaction costs of a single small-scale CDM project is given in Table 3.1 There are differences in upfront transaction costs and running transaction costs between an individual small-scale project and a bundled CDM project.

4.4.1 Upfront transaction costs

For a bundled project, the establishment of the body responsible for the bundling of individual projects is an additional up front cost component and includes cost related to:

- The development of an administrative system to register the projects included in the bundle. The registry contains information in a clear and structured way such as the name of the owner of the system, type, capacity, serial number and date of sale and is meant to facilitate validation and verification process.
- Building of capacity: staff of the bundling organization needs to be trained to ensure successful operation of this body.
- General cost such as office rental, communication costs and reporting.

Once projects are bundled together into a single project, the CDM project cycle for the bundled project is similar to the one of individual projects and, consequently, the project cycle costs of a bundled project are to a large extent comparable to the project cycle costs of a single project. However, because bundled projects generally are more complex compared to individual projects, the various cost components of the CDM project cycle are assumed to be slightly higher for the bundled project.

4.4.2 Running transaction costs

Periodic verification after the project has been implemented is the key component of the running transaction costs. Verification costs to a large extent are determined by whether or not the projects in the bundle are metered.[20] If the projects are metered verification can be done simply by reading the meter and the verification costs therefore are comparable to the costs of a single small-scale CDM project. If the bundle consists of technologies without a meter, the CDM EB guidelines stipulate that verification must be done by means of an annual check of the operational status of a representative sample of the systems included in the bundle. This, however, involves much more effort than simply reading the meter and verification costs therefore are substantially higher.

In the table below, cost estimates are given for both grid connected and off grid bundled CDM projects. The cost estimates are based on the following assumptions:

- The figures for the transaction costs for the individual small-scale low end CDM project are taken from Section 3.1.1 and are used as the starting point for calculating the transaction costs for bundled projects.
- It is assumed that the emission reduction of the bundled project (both metered and non metered) is 30,000 CO_2 eq. per year.
- It is assumed that the bundle consisting of non-metered technologies includes 120,000 very small projects (average emission reduction per system is 250 kg CO_2 per year). Verification costs of this bundle are based on a sample of 1,200 projects (1% of total population). Based on experience from China, the verification costs of these systems are assumed to be USD 65 per system.[21]
- The ratio of the present value of the transaction costs and the present value of the CER revenues is used as a criterion for evaluating whether the transaction costs are too high. A threshold of 10% is usually applied;[22] if transaction costs are higher than 10% of the CER revenues, costs are considered too high to make participation in the CDM interesting.
- The discount rate applied is 8% and the present value calculations are based on a crediting period of 10 years.
- The assumed CER price is 4 USD per ton CO_2 eq. emission reduction. For non-metered projects based on renewable energy technologies a slightly higher price may be paid. The result for a CER price of 7 USD is given in Table 4.1

[20] The Project Categories I.A, I.B and I.C in Table 2 are off grid projects without a meter. The other Project Categories can be monitored by reading the meter.

[21] Van der Linden et al: Analysis of the feasibility of inclusion of decentralised renewable electricity systems into a mandated market share mechanism for China. Cost estimate is based on verification through a survey of installed systems implemented by an independent verification team. This approach involves randomly visiting households to check the operational status of the system purchased by the household. As long as certain statistical requirements regarding the sample size are taken into account, this approach will deliver reliable results.

[22] Research conducted by Ecosecurities on transaction costs for the CDM revealed that investors will not support transaction costs that are more than 7% of the revenues generated by selling the carbon credits created by the project (Financing and financing mechanisms for joint implementation projects in the electricity sector: Ecosecurities, 2000)

Table 4.1 *Indicative CDM transaction costs for single small-scale low-end projects, bundled metered projects and non-metered bundled projects (in US$).*

	Single small lowend project	Bundle of metered projects	Bundle of projects without a meter
Establishment of bundling organisation			
Upfront Costs			
- Development of registry		4,500	4,500
- Building of capacity		9,000	9,000
- General Costs		3,000	3,000
CDM Project Cycle			
Up front Costs			
- Project preparation	4,800	5,400	5,400
- Project Design Document	10,800	12,000	12,000
- Validation	6,000	7,200	7,200
- Appraisal phase	8,000	13,000	13,000
- Initial verification	3,000	3,600	3,600
Yearly running costs			
- Verification	1,200	1,800	78,000
- Certification	3,000	3,000	3,000
- Personnel costs bund. org.			
PV Transaction Costs as % of PV CER revenues	21.0%	9.9%	69.1% (price US$ 4) 39.5% (price US$ 7)

Main observations from the analysis results presented above are:

- For projects generating up to 10,000 ton CO_2 reduction per year (low end category of small-scale projects), the simplified procedures developed for small-scale CDM projects do not sufficiently reduce transaction costs to make these projects attractive for investors. The transaction costs of this type of project are 21% of total CER revenues, well above the 10% threshold.
- Through bundling of small-scale projects that are metered, the share of the transaction costs in total CER revenues decreases to 9.9%. This means that the bundled project becomes an attractive option for investors to bring under the CDM.
- Bundling of small-scale projects without a meter appears to be financially not viable. More than two-thirds of the CER revenues are needed to cover the transaction costs. This is due to the very high annual verification costs of these systems. To make bundling of these systems more attractive, the frequency of verification must be lowered to once every two years (resulting in 36.7% based on price of US$ 4 per ton and 21.0% based on CER price of US$ 7) or once every five years (17.3% price of US$ 4 and 9.9% if the price is US$ 7) or no verification at all (6.6 % and 3.8%).

5. EVALUATION OF THE IMPACT OF SMALL-SCALE CDM PROJECTS

5.1 Introduction

It is clear from section 2 that there is enormous potential for small-scale projects in India, both in terms of numbers of projects but also there aggregate affect on energy service provision. However, as discussed in Section 3, the prospects for a significant proportion of this potential being realised through CDM is severely hindered by numerous risk and barriers that discourage investment in small-scale projects. Many of these exist for small-scale projects, but the additional burden of high CDM transaction costs threaten to undermine exploitation of this potential, and some of India's vast renewable resources. Bundling could have a significant role in overcoming some of these barriers, leading to a significant increase in investment for small-scale projects contributing valuable emission reductions, poverty alleviation, and other socio-economic aspects.

5.2 Impact on investments

It is clear that CDM finance can potentially bring considerable additional foreign investment to enable many of India's small-scale projects. However, it is very uncertain what the global investment potential itself is, let alone the proportion of that total that India will be able to attract. Furthermore, it is difficult to estimate how much of India's CDM investment small-scale projects will be able to attract even with bundling, as much of the lowest cost abatement projects will be of a large-scale nature. The latter projects are those that are most attractive in terms of CDM investment at the present time, however this may change particularly with the prospect of bundling making small-scale investments more attractive.

There has been a wide range of estimates of the global CDM investment potential, and most of these have estimated a significant share of investment flowing to India. These estimates have generally been carried out using a top down approach to answer the following questions:

- What is the total volume of emissions reductions required by Annex B countries to meet their Kyoto targets?
- Of that, how much will be achieved through mitigation either domestically, or via emissions trading and JI between Annex B countries?
- What is the estimated price of carbon (to convert the volume of emissions to dollars)?
- Of this amount, how much will flow to India, given Annex B corporations will be 'shopping around' developing nations looking for CDM projects with the lowest cost and risk profiles?

Table 5.1 summarises results of a World Resources Institute study (WRI, 2000) that used this approach. The study estimated that India could receive between 7-14% of these CDM investment flows or US$360 million to US$2.4 billion per year.

Table 5.1 *Estimates of CDM Capital Flows to India, 2010*

Item	OECD[1]	G-Cubed[2]	SGM[3]	EPPA[4]
Model Developers	OECD, Paris	Univ. of Texas; US EPA	Batelle Pacific Northwest Lab	MIT
Annex B reduction via CDM [MMt C]	397	400	503	723
Average Permit Price [$/ton]	19	13	26	24
Annual CDM Flows [2010, $ billion]	7.5	5.2	13	17.4
CDM Flows to India [% of 2010 flows]	11	NA	7	14

Note: [1] (Van der Mensbrugghe, 1998)
[2] (Mc Kibbin, 1998)
[3] (Edmonds, 1998)
[4] (Ellerman, 1998)

As mentioned earlier, it is likely that initially a larger proportion of these CDM flows will be for larger scale projects, however this should change as CER prices rise and the vast opportunities for small-scale projects in India are realised. It can be estimated that small-scale projects can potentially account for an initial 20% of CDM flows to India or US$ 70-480 million per year rising to 70% of CDM flows to India or US$ 250 million to US$ 1.7 billion per year by 2010. These rough estimates have been made using the top-down approach, however, the investment potential can also be calculated using the bottom up assessment used to estimate the potential for small-scale projects. These results of annual CER revenues based on $ 4/tCO2 are given alongside emission reductions in Table 5.4.

5.3 Impact on emission reductions

Evaluating the impact of small-scale projects on emission reductions requires not only an assessment of greenhouse gas emission reduction potential, which is one of the main goals of CDM. But also small-scale projects, such as biogas cookers or cleaner vehicles, will have significant local emission reductions, in these cases, reducing indoor air and urban pollution. These local emission reductions may contribute significant sustainable development benefits to developing countries, which is the second goal of CDM. This section will discuss these potential emission reductions for small-scale projects in India.

As with the estimation of investment potential for CDM projects, any estimation of greenhouse gas reduction potential for India has been carried out in a number of modelling studies. Again, with so many undetermined factors, predicting greenhouse gases from CDM projects in India is difficult, particularly as it is still unclear how well India may be able to attract CDM investment. To some extent this can be estimated by greenhouse gas abatement costs for CDM opportunities in India, and also by risk levels for CDM investments as viewed by the market. Using the investment potential shown in Table 5.2 the range of CDM abatement potential amounting to 37 and 102 MMtC by 2010.

Table 5.2 *Preliminary Estimates of Abatement Activity in India, 2010*

Model name	*OECD*	*G-Cubed*	*SGM*	*EPPA*
Annex B reduction via CDM (MMt C)	397	400	503	723
% of Annex B reductions estimated for India	11	-	7	14
India reductions via CDM (MMt C)	45	-	37	102

This top-down approach gives some insights into the scale of emission reduction potential for India, however these are aggregate figures and do not consider small-scale projects in isolation. For such an estimate the bottom-up approach taken in the assessment of small-scale potential in Chapter 2 would be more useful. Emission reductions from such an approach, shown in Table 5.3 should be treated with caution would be extremely difficult to estimate particularly given the differences in the baseline of project activities in different regions of India. Local emission reductions can be taken for small-scale project potential. For this, the indicators shown below were used to evaluate the emission reduction potential of each project activity. For international/national emission reductions, indicators are derived from the calculations of individual projects that have already had baseline and emission reductions calculated carried out (projects in the CDM pipeline or studies) scaled up by the assessment of their potential given in Chapter 2.

Table 5.3 *Small-scale potential estimated emission reductions and CER revenue*

Project subtype	Possible small-scale options for India	Potential	Achievements (Aug 2002 except where stated)	Yearly electricity production [MWh]	Potential in yearly CO_2 reduction [million tonnes][1]	Yearly revenues at $4/tCO2 [million US$]
1.A Electricity Generation by the User (off-grid)	Solar home systems	20MW/km^2	256,673 (March2003)	91,250[2]	0.08	0
	Wind power	Included in grid-connected potential	-	10,074,000[3]	9.07	36
	Hydro power (mini, micro, pico)	15,000 MW (incl grid connected)	1340 MW	26,980,800	24.28	97
	Fossil fuel-hybrid systems	n/a (very large)	-			
	Biomass power	16,000	2,000 (22 MW)	770,880	0.69	3
1.B Mechanical Energy for the User	Watermills	200,000	Very few more efficient	438,000	0.39	2
	Solar electric pumps	900,000	>5000	14,581,130[4]	20.41[5]	82
	Biomass based pumping projects	1.5 million	n/a	24,424,413[6]	34.19[7]	137
	Wind electric pumps	1 million	>1,000	16,337,400[8]	22.87	91
1.C Thermal Energy for the User	Solar water heating systems	140 million sq. m collector area	0.70 sq. m million collector area			
	Solar dryers	20,000 sq m collector area	N/a			
	Solar cookers (community based)	10 million	500,000		9.5[9]	38
	Biogas based plants for cooking	12 million	3.44 million		8.56[10]	34
1.D Renewable Electricity Generation for the Grid	Grid connected sugar waste cogeneration plants	3,500 MW	474 MW	21,206,208[11]	18.45	74
	Grid connected wind electricity generation	45,000 MW	1,870 MW	94,454,700	82.18	329
	Grid connected biomass based power plants	15,500 MW	292 MW	106,577,664	92.7	371
	Grid connected solar PV plants	20MW/km^2	1.67 MW	194,906	0.17	1
	Grid connected hybrid plants	see potentials for wind/biomass/PV	-			
II.A Supply side Energy Efficiency Improvements - Transmission and Distribution	System improvement project by state and private utilities	1.5-2.2% Improvement		881,499[12]	0.77	3
II.B Supply side Energy Efficiency Improvements - Generation	Improvement in fossil fuel based facility	up to 10% I improvement		38,576,100	41.66	167
	Energy efficiency improvement in captive power plants (incl. IGCC)	6,500 MW*		37,011,000[13]	39.97	160

Project subtype	Possible small-scale options for India	Potential	Achievements (Aug 2002 except where stated)	Yearly electricity production [MWh]	Potential in yearly CO_2 reduction [million tonnes][1]	Yearly revenues at $4/tCO2 [million US$]
II.C Demand side Energy Efficiency Programmes from specific technologies	Programs on energy efficiency improvement in end use equipment	20-30%+		Find domestic consumption		
	Energy efficiency improvement through audit	15 MW**		85,410	.07	0
II.E Energy Efficiency and Fuel Switch Measures for Building	Fuel switch from oil to gas	-	-			
	Energy efficiency improvements in hotels	-	-			
	Energy efficient building design	-	-			
III.A Agriculture	-	-	-			
III.B Switching Fossil Fuel	-	-	-			
III.C Emission Reduction by low Greenhouse gas emission vehicles	Change in fossil fuel based vehicle fleet into battery operated vehicle fleet in any industrial / institutional premises					
III.D Methane Recovery	Landfill gas recovery	4566 MW	1460 MW		1,6[14]	6.4
	Anaerobic wastewater treatment facility with methane recovery	230 MW	365 MW		0.2[15]	.8
	Coal bed methane recovery projects	20,000 MW	-		n/a	n/a
III.E Methane Avoidance	Avoidance of methane from biomass or other organic residue	n/a	n/a	n/a	n/a	n/a

[1]Based on potential (subtracting existing) and national or standardised baselines where applicable.
[2]Assuming 10,000 villages, 100 50MW systems per household, 5hrs per day
[3]Load factor = 23%
[4]Assumes replacement of 5hp diesel pump (50% load factor)
[5]Emission Factor from table IId from UNFCCC procedures and modalities for small-scale CDM projects
[6]Same EF as solar electric pumps
[7]25% Load factor
[8]80% Load factor
[9]Same assumption as biogas
[10]Based on each $2m^3$ biogas plant mitigating $1tCO_2/yr$
[11]80% Load factor
[12]Total generation 2001-2002: 476485.8 GWh (MNES baseline) using efficiency improvement of 1.85%
[13]Assuming 65% load factor (incl. cogen)
[14]ITPI (2004) MoEF/UNDP Report on CDM and Biomethanation, and the India Waste Plan.
[15]ITPI (2004) as above.

Based on the analysis presented in Table 5.4 and on the experience with small-scale CDM projects in the Indian CDM portfolio, it is estimated that annual emission reductions possible from small-scale energy CDM projects in India are nearly 5 MtCO2. Based on current market statistics, this could generate an annual financial inflow of nearly $20 million.

The assessment so far has only considered the impact of small-scale projects on global greenhouse gas emission, however the local emission reductions of such a project should also be taken into account. There are considerable benefits to local emission reductions, which can contribute significantly to sustainable development. A qualitative assessment of these local impacts are estimated in Table 5., with the following indicators used for categorising impacts:

NEGATIVE HIGH: emissions of local pollutant are doubled
NO=no change in emission level of the selected pollutant
LOW=up to 50% of avoidance of the local pollutant
MEDIUM= over 50% of avoidance of local pollutant
HIGH= total avoidance of local pollutant

Table 5.4 *Impacts of small-scale projects on local emission reductions*

Project Type	Project Subtype	Possible small-scale options for India	Impact on local pollution	Reduction in local pollutants (e.g. SO_2, NO_x, Ozone, CO)
Type I Renewable Energy Products	1.A Electricity Generation by the User (off-grid)	Solar home systems	HIGH	No air pollution (e.g. from kerosene)
		Wind power	HIGH	No air pollution (e.g. from diesel)
		Hydro power (mini, micro, pico)	HIGH	No air pollution (e.g. from diesel/kerosene)
		Fossil fuel-hybrid systems	LOW/MEDIUM	Reduced air pollution (e.g. from diesel)
		Biomass power	MEDIUM	Reduced air pollution (e.g. from diesel)
	1.B Mechanical Energy for the User	Watermills	HIGH	No air pollution (e.g. from diesel)
		Solar electric pumps	HIGH	No air pollution (e.g. from diesel)
		Biomass-based pumping projects	MEDIUM	Reduced air pollution (e.g. from diesel) & solid waste
		Wind electric pumps	HIGH	No air pollution (e.g. from diesel)
	1.C Thermal Energy for the User	Solar water heating systems	HIGH	No air pollution (e.g. from wood)
		Solar dryers	HIGH	No air pollution (e.g. from diesel)
		Solar cookers (community based)	HIGH	No air pollution (e.g. from wood)
		Biogas based plants for cooking	MEDIUM	Reduced air pollution (e.g. from wood) & solid waste
	1.D Renewable Electricity Generation for the Grid	Grid connected sugar waste cogeneration plants	MEDIUM	Reduced air pollution (e.g. from diesel) & solid waste
		Grid connected wind electricity generation	HIGH	No air pollution (e.g. from coal)
		Grid connected biomass based power plants	MEDIUM	Reduced air pollution (e.g. from coal) & solid waste
		Grid connected solar PV plants	HIGH	No air pollution (e.g. from coal)
		Grid connected hybrid plants	LOW/MEDIUM	Reduced air pollution (e.g. from diesel)
Type II Energy Efficiency Improvement Projects	II.A Supply side Energy Efficiency Improvements - Transmission and Distribution	System improvement project by state and private utilities	NO	No change to local air pollution
	II.B Supply side Energy Efficiency Improvements - Generation	Improvement in fossil fuel based facility	LOW/MEDIUM	Reduced air pollution (e.g. from coal)
		Energy efficiency improvement in captive power plants (incl. IGCC)	LOW/MEDIUM	Reduced air pollution (e.g. from coal)

Project Type	Project Subtype	Possible small-scale options for India	Impact on local pollution	Reduction in local pollutants (e.g. SO_2, NO_x, Ozone, CO)
	II.C Demand side Energy Efficiency Programmes from specific technologies	Programs on energy efficiency improvement in end use equipment	NO	No change in local air pollution or
		Energy efficiency improvement through audit	NO/LOW	Possible reduction in local air pollution (e.g. from industrial processes)
	II.E Energy Efficiency and Fuel Switch Measures for Building	Fuel switch from oil to gas	MEDIUM	Reduction in local pollution (e.g. from oil)
		Energy efficiency improvements in hotels	NO	No change in local air pollution
		Energy efficient building design	NO	No change in local air pollution
Type III Other Project Activities	III.A Agriculture	-		
	III.B Switching Fossil Fuel	-		
	III.C Emission Reduction by low Greenhouse gas emission vehicles	Change in fossil fuel based vehicle fleet into battery operated vehicle fleet in any industrial / institutional premises	HIGH	Reduced local pollution (e.g. from petrol, diesel)
	III.D Methane Recovery and Avoidance	Landfill gas recovery	MEDIUM	Reduced local pollutants (e.g. methane, solid waste)
		Anaerobic wastewater treatment facility with methane recovery	MEDIUM	Reduced local pollutants (e.g. methane)
		Coal bed methane recovery projects	MEDIUM	Reduced local pollutants (e.g. methane)

LOCAL - AVOIDED EMISSIONS OF LOCAL POLLUTANT (E.G. CO, NO_X)

NEGATIVE HIGH = Emissions of local pollutant are doubled
NO = No change in emission level of the selected pollutant
LOW = Up to 50% of avoidance of the local pollutant
MEDIUM = Over 50% of avoidance of local pollutant
HIGH = Total avoidance of local pollutant (but <100%)

5.4 Impact on poverty alleviation and other socio-economic benefits

As described in chapter 2, interim sustainable development criteria have been formulated by the GoI. These include criteria for social well being in which projects 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. Each small-scale project may well have a number of these benefits and the impact of these, particularly considering the potential for small-scale projects in India can be considerable. Depending on how and where the project is implemented, these impacts will differ greatly on a project-by-project basis. However, a general assessment of poverty alleviation impacts is useful, and this was carried out (Table 5.7) using a number of criteria developed by a UK Department for International Development funded project (University of Surrey, 2003) (Table 5.6).

Table 5.5 *Criteria for assessing poverty alleviation and other socio-economic benefits*

Criterion	Definition
Natural Resource Conservation	
Food	The effect of the project on the ability of the community to produce sufficient food or produce crops to sell or animal grazing in terms of irrigation, availability and degradation of the land. It can be assessed in terms of volumes or qualitatively.
Forests	The effect of the project on forests as wood resource and natural product resource. This can be expressed in kilograms of wood conserved and amount of natural products conserved if available.
Habitats	The effect of the project on flora and fauna. What are the activities and effect of the activities? This criterion does not deal with the effect on wood supply from forests.
Water supply	The effect of the project on water supply for washing, drinking, and cooking, particularly its quality for the future. This can be expressed in l/day if available and any contamination of water supply. Consider the sources, quantity and possible contamination routes.
Resource depletion	This is the effect of the project on the depletion of resources required for its manufacture or operation.
Social and Human	
Marginal groups	What activities and capacity building associated with the project have affected women, the weak, marginalized and given them voice.
Wider base	The effect of the project in terms of the new external connections to information on other project activities, training and people able to help.
Social networks	The effect of the project on social networks in terms of terms of institutions and families etc in the community. This can be expressed as for example, no. of new institutions, more social occasions.
Security	The effect of the project on crime prevention.
Jobs	The effect of the project on number of diversity of jobs and raising quality of jobs: no. and type of job but in relation to purpose.
Freed time	The quality of life effect of the project on local human health of outdoor and indoor air pollution, preventing diseases, acute respiratory inhalation, burns, backache etc, and the provision of health services.
Health	The effect of the project on local human health or outdoor and indoor air pollution, preventing diseases, acute respiratory inhalation, burns, backache etc and provision of health services.
Education	The effect of the project on opportunity to improve level of education & literacy for all ages of children.
Skills	Effect n building up more and or new skills e.g. mechanical management.
Financial and physical	
Income generation	The effect of the project on income generation or trade activities from the project including access to markets. This not the same as jobs. It is about more opportunities to increase income as long as markets exist and access is possible e.g. extending hours of opening. It relates to effect on number and diversity of jobs and raising quality of jobs.
Energy	The effect of provision by the project of a level of energy service on total energy needs of community, i.e. does it bring people up the ladder to sufficient energy resource to meet their needs? This an overall assessment of how the project contributes to their existing general need to increase access to energy services.
Affordability	Cost to the community of the service provided by the project as a percentage of income, i.e. is the service providing an economic burden or not. Can the poor have access?
Infrastructure	The effect of the project on infrastructure increases. The extra benefits delivered by a project e.g. for

Criterion	Definition
	transport, water, sanitation and shelter and health services.
Dwelling	The effect of the project on shelter in terms of new houses or improved quality of houses or improved quality of houses and whose houses are improved.
Supply chains	Effect of the project in simulating local supply chains for spares, maintenance and manufacture.
Local equipment	Amount of locally manufactured equipment.

Table 5.6 *General assessment of poverty alleviation impacts of small scale CDM projects*

Project subtype	*Possible small-scale options for India*	*Impact on poverty allevation*	*Comments*
1.A Electricity Generation by the User (off-grid)	Solar home systems	HIGH	Freed time, Health, Affordability, Education etc.
	Wind power	HIGH	Freed time, Health, Affordability, Education etc.
	Hydro power (mini, micro, pico)	HIGH	Freed time, Health, Affordability, Education etc.
	Fossil fuel-hybrid systems	HIGH	Freed time, Health, Affordability, Education, Income generation etc.
	Biomass power	HIGH	Freed time, Health, Affordability, Education, Income generation etc.
1.B Mechanical Energy for the User	Watermills	HIGH	Income generation, Jobs, Affordability etc.
	Solar electric pumps	HIGH	Affordability, Water supply, Infrastructure etc.
	Biomass based pumping projects	HIGH	Affordability, Water supply, Infrastructure etc.
	Wind electric pumps	HIGH	Affordability, Water supply, Infrastructure etc.
1.C Thermal Energy for the User	Solar water heating systems	LOW	Dwelling, Energy, Affordability etc.
	Solar dryers	MEDIUM/HIGH	Income generation, Jobs, etc.
	Solar cookers (community based)	MEDIUM	Energy, Resource depletion, Social networks
	Biogas based plants for cooking	MEDIUM	Energy, Resource depletion, Local Manufacture etc.
1.D Renewable Electricity Generation for the Grid	Grid connected sugar waste cogeneration plants	MEDIUM	Energy, skills, etc.
	Grid connected wind electricity generation	MEDIUM	Energy, Infrastructure etc.
	Grid connected biomass based power plants	MEDIUM	Energy, Infrastructure etc.
	Grid connected solar PV plants	MEDIUM	Energy, resource depletion etc.
	Grid connected hybrid plants	MEDIUM	Energy, resource depletion etc.
II.A Supply side Energy Efficiency Improvements - Transmission and Distribution	System improvement project by state and private utilities	LOW	Less energy wasted, increased power sales (i.e. income generation) to meet increasing demand etc.
II.B Supply side Energy Efficiency Improvements - Generation	Improvement in fossil fuel based facility	LOW	Fuel savings/increased sale of power etc.
	Energy efficiency improvement in captive power plants (incl. IGCC)	LOW	Fuel savings/increased sale of power/heat etc.
II.C Demand side Energy Efficiency Programmes from specific technologies	Programs on energy efficiency improvement in end use equipment	MEDIUM	Lower energy bills to end users for profit or reinvestment etc.
	Energy efficiency improvement through audit	MEDIUM	Lower energy bills for better profit or reinvestment etc.
II.E Energy Efficiency and Fuel Switch Measures for Building	Fuel switch from oil to gas	LOW	Lower energy bills (greater efficiency) etc.
	Energy efficiency improvements in hotels	LOW	Low energy bills etc.
	Energy efficient building design	LOW	Lower energy bills & demand etc.
III.A Agriculture	-		
III.B Switching Fossil Fuel	-		

Project subtype	*Possible small-scale options for India*	*Impact on poverty allevation*	*Comments*
III.C Emission Reduction by low Greenhouse gas emission vehicles	Change in fossil fuel based vehicle fleet into battery operated vehicle fleet in any industrial / institutional premises	LOW	Health, resource depletion etc.
III.D Methane Recovery and Avoidance	Landfill gas recovery	LOW	Energy, jobs etc.
	Anaerobic wastewater treatment facility with methane recovery	LOW	Energy, jobs etc.
	Coal bed methane recovery projects	LOW	Energy, jobs etc.

6. CONCLUSIONS AND RECOMMENDATIONS FOR STAKEHOLDERS

6.1 Introduction

The report so far has summarised the existing institutional framework and identified capacity building needs that can aid the development of portfolios of small-scale projects for CDM. It is clear that there are numerous capacity building activities already taking place in India, particularly with funding from donor countries, such as Germany, Japan, Canada, Switzerland, UK and the Netherlands. Furthermore efforts from the Government, for example setting up a DNA, and other national and state level organisations are building up some of the required capacity. Although the lack of institutional capacity is no doubt constraining the development of small-scale project portfolios, transaction costs still remain a significant barrier. The report examined the impact of simplified small-scale procedures and modalities approved by CoP-8 in 2002 and the bundling process itself on high transaction costs, and showed the viability of certain projects through application of both of these. Overall, it is clear that at current market prices for CERs, transaction costs will still remain a significant barrier, and there remain some gaps in capacity building activities that are presently taking place and a number of recommendations, particularly for focusing on capacity needs for bundling will be useful.

6.2 Recommendations to stakeholders and Government Authorities

There are a number of recommendations that can already be made at this stage of the project, based on the interaction the project team has had with stakeholders and through the research work carried out under the project, however further recommendations will evolve through the experience with pilot bundling projects, capacity building of identified bundling organisations and the completion of the whole project. Many of these recommendations are applicable to the CDM in general, such as the development of the DNA and sustainable development criteria which are already being undertaken, and others are more specific to developing portfolios of small-scale projects. General recommendations are:

- *Clear policy and guidance on CDM at the national level* - it is important that India has coherent policy towards CDM and that this is communicated clearly to all stakeholders. This includes making sure that CDM linkages with other Government plans and strategies, for example on rural electrification or waste, are taken into account so that policies, such as subsidies or feed-in tariffs are not detrimental to the development of CDM projects and attracting carbon finance. This is being done by the Government for CDM projects in the biomethanation sector but needs to include other sectors as well.
- *Coordination of current capacity building activities* - it is abundantly clear that donor funding from a number of countries is providing significant capacity building opportunities in India, motivated by the large CER market that India may provide. However, there is no national coordination of these activities to ensure their effectiveness, limit overlap, and maximise knowledge transfer within the country but also between projects. The National CDM authority is on the steering committees of the WB and UNDP capacity building projects and the similar institutional mechanism should be extended to other capacity building initiatives as well.
- *Small-scale CDM capacity building plan* - As India is currently in the process of identifying capacity building needs under UNFCCC under the National Capacity Self Assessment (NCSA) funding from UNDP/GEF, the effort should also focus specifically at capacity building needs for small-scale CDM at the human and institutional levels. The NCSA report on UNFCCC should also attempt to develop a roadmap for capacity building for small-scale CDM projects.

- *Framework for institutional development*: It is becoming evident that local capability to discharge institutional roles such as operating entities, bundling organisations does not exist. Based on the experience so far and considering the prevailing market environment the business viability of such institutional roles is also unclear. The government - MoEF may consider creating an enabling framework for CDM institutions such as bundling organisations, OEs etc. similar to what was done in the past in India for exporters and software companies.
- *Access to data* - accessing data for baseline development can be a significant barrier to CDM project development. A great deal of relevant data is not always in the public domain, is incomplete or difficult to locate. CDM knowledge and resource centres at the national and state level could also hold such data. This could include the developed of further standardised or national and regional baselines. The attempt by MNES to develop national baseline approaches for grid connected renewable energy projects is one such step in the right direction.
- *Consider removal of the small-scale cap* - the report has shown that for projects that provide only small quantities of CERs (e.g. up to 10,000 in total) transaction costs are still likely to be constraining. The opportunity to spread the transaction costs through bundling is limited by the cap on the bundles, which follows the small-scale CDM project eligibility rules as specified in Marrakech accords. It is therefore seen that allowing that small-scale CDM projects be bundled is probably not going to have the desired effect of helping the small-scale CDM projects achieve a critical mass.

All these actions will directly or indirectly benefit the development of portfolios of small-scale projects. These projects also have the significant potential to provide socio-economic benefits including poverty alleviation. However immediate actions to facilitate small-scale CDM needs to be made by the policy makers and specific recommendations in this direction based on the work carried out under this project include:

- *Awareness raising program targeted for small industries/project developers* - although CDM has had a fairly high profile in India since COP8 in New Delhi, little of this has, however has targeted small-scale industries/project developers.[23] This should be coordinated at the national level but implemented by state level organisations or sectoral and industry organisations (solar energy or wind energy associations, hotels associations etc.) as relevant target audiences may vary from region to region and sector to sector.
- *Development and provision of specific training services* - for developing portfolios of small projects most organisations, such as NGOs or ESCOs, lack certain skills and expertise required. These include: knowledge and expertise of CDM process; understanding of methodological issues; contract and portfolio management; risk/financial assessment and management; and understanding of Carbon markets. Although organisations may have some of these skills, they may not have others and may well be constrained by resources in obtaining the others. The development and provision of tailored training, such as risk management and marketing, methodological issues and process targeted at potential bundling organisations or consortia will be particularly important.
- *Development of a small-scale network* - some potential bundling organisations have good access to potential projects, for example industry associations, however others may find it more difficult to access viable projects to develop portfolios. Developing a network of small project developers and bundling organisations will be useful for further development of small-scale project portfolios. This could also serve as a platform to lobby for small-scale projects at the national or international level.

[23] Except for the Japanese capacity building initiative, which targets policy makers and small-scale industries.

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