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CDM Implementation in India

The National Strategy Study

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CDM Implementation in India

The National Strategy Study

The Energy and Resources Institute

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FOREWORD

The National Strategy Study for CDM implementation in India has been completed at an opportune time, when the Kyoto Protocol has come into force and there is a renewed enthusiasm for CDM.

The proactive approach of the Government of India combined with the high level of activity exhibited by the Indian industry, has positioned the country as a leading supplier of CERs. A large number of projects have been submitted to the National CDM Authority for approval and more than 50 projects have received host country approval.

The technical skills and know how available in the country, and the institution of National CDM Authority and its functioning in the past one year have stimulated the development of CDM in the country. However, there is still a need to intensify capacity building for CDM across sectors and institutions.

The National CDM Authority is also broadening its scope of work as suggested by the National Strategy Study. In the meantime India has become a member of the CDM Executive Board. This shall enable us to present our perspective on CDM in this international forum and also draw on international perspectives to develop our project portfolio.

I sincerely thank the efforts of the study team in carrying out this study and acknowledge the support provided by the State Secretariat for Economic Affairs (seco), Government of Switzerland, and the World Bank to this Study.

Prodipto Ghosh
Secretary
Ministry of Environment and Forests
Government of India
New Delhi

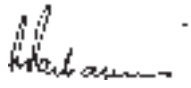
18 March 2005
New Delhi

PREFACE

The Kyoto Protocol to the United Nations Framework Convention on Climate Change comes into force on 16 February 2005, after seven years of rigorous negotiations. With this, there is a renewed vigour for mechanisms such as the CDM, which will not only help Annex 1 Parties to meet their binding emission reduction commitments, but also provide for implementing projects that contribute to sustainable development in non-Annex 1 countries. It thus becomes important for developing countries, particularly India, to explore various possible opportunities for emissions reduction, which align with our development priorities as also provide an enabling environment for implementation of CDM in the country.

The NSS (National Strategy Study) for CDM implementation is an important effort in this context, and has provided an outline of a strategy that India should adopt to capitalize on the opportunities that CDM offers. It has given due recognition to the current vibrancy in CDM project development in the country, new national and international developments, and the need to channelize and synergize all efforts to maximize the benefits to India and Indian project promoters. The NSS has also made immense contribution in outreach and capacity building through various means such as workshops and conferences across the country, stakeholder consultations and surveys, and web-based information dissemination, thus making it a truly participative exercise.

I sincerely thank all those who have contributed to this significant study, especially our partners IDFC, INFRAS AG, Ernst Basler + Partners Ltd, LASEN-EPFL, and all the national and international reviewers including the members of the Technical Advisory Group and the Steering Committee set up for the project. The support and guidance provided by the World Bank, the State Secretariat for Economic Affairs (seco), Government of Switzerland, and the Ministry of Environment and Forests, Government of India, has ensured that this very relevant project was undertaken for India and its timeliness needs no underscoring.



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Composition of the Steering Committee

Chairman
Secretary, Ministry of Environment and Forests

Members
- Additional Secretary, Prime Minister's Office
- Joint Secretary, Ministry of Environment and Forests
- Joint Secretary, Ministry of Non-conventional Energy Sources

- Joint Secretary, Ministry of Power
- Additional Secretary, Department of Economic Affairs
- Joint Secretary, Department of Science and Technology
- Joint Secretary, Ministry of Coal
- Joint Secretary, Ministry of Petroleum and Natural Gas
- Representatives from CII/FICCI/ASSOCHAM
- Joint Secretary, Ministry of Commerce
- Advisor, Planning Commission
- Joint Secretary, Department of Industrial Policy and Promotion
- Joint Secretary, Ministry of External Affairs
- Consultants (representative from the World Bank and the Embassy of Switzerland)
- Coordinator NSS
- Coordinator Technical Advisory Group – Member Secretary

Composition of the Technical Advisory Group

Chairman

Joint Secretary, Ministry of Environment and Forests

Members

- Mr R K Sethi, Director, Ministry of Environment and Forests, Coordinator
- Director, Ministry of Non-conventional Energy Sources
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We thank the reviewers for providing comments on the draft final report and enabling the finalization of this document. In particular we would like to thank Dr Anne Arquit Niederberger, Policy Solutions, who helped in sharpening the focus of the report. We are also grateful to Dr Ajay Mathur, Senergy Global, Dr Axel Michaelowa, Hamburg Institute of International Economics, and Mr Kirtan Sahoo, the World Bank, for providing comments on the PDDs.

Finally we acknowledge the inputs provided by the different units at TERI for the successful completion of the project. These include the Centre for IT Applications, TERI Press, and the Event Management Cell.

ABBREVIATIONS

AAU	Assigned amount unit
ADB	Asian Development Bank
AE	Applicant entity
AIJ	Activities Implemented Jointly
AIM	Asian Pacific Integrated Model
AIT	Asian Institute of Technology
ALGAS	Asia Least-cost Greenhouse gas Abatement Strategy
APDP	Accelerated Power Development Programme
BEE	Bureau of Energy Efficiency
BOF	Basic oxygen furnace
BOV	Battery operated vehicle
BSES	Bombay Suburban Electric Supply Company
CDCF	Community development carbon fund
CDM	Clean development mechanism
CEA	Central Electricity Authority
CER	Certified emission reduction
CERT	Certified emission reduction trade
CERUPT	Certified Emission Reduction Unit Procurement Tender
CF-Assist	Capacity building and technical assistance for carbon finance
CNG	Compressed natural gas
CO_2	Carbon dioxide
CO_{2eq}	Carbon dioxide equivalent
CoP	Conference of the Parties (to the United Nations Framework Convention on Climate Change)
DBC	Divided blast cupola
DNA	Designated national authority
DNVCert	Det Norske Veritas Certification Ltd
DOE	Designated operational entity
DSM	Demand side management
EA	Electricity Act
EB	Executive Board
ECN	Energy Research Centre of the Netherlands
EE	Energy efficiency
EET	Economies in transition of Eastern Europe
EIA	Environmental Impact Assessment
EIT	Economies in transition
ESCO	Energy service company
ET	Emissions trading
ERU	Emission reduction unit
ETS	Emissions trading system

EU	European Union
FCO	Foreign Commonwealth Office, United Kingdom
FDI	Foreign Direct Investment
FI	Financial institution
FoIR	Forum of Infrastructre Regulators
FSU	Former Soviet Union
GCSI	Global Change Strategies International Company
GDP	Gross domestic product
GFL	Gujarat Fluorochemicals Ltd
Gg	Giga gram
GHG	Greenhouse gas
GTEM	Global trade and environment model
GTZ	German Technical Cooperation
GWh	Gigawatt hour
GWP	Global warming potential
HCA	Host country approval
HFCs	Hydrofluorocarbons
HCFC	Hydrochlorofluorocarbon
ICA	International rules of commercial arbitration
ICFRE	Indian Council for Forestry Research and Education
ICS	Integrated Capacity Strengthening for the Clean Development Mechanism
IDFC	Infrastructure Development and Finance Corporation
IEA	International Energy Agency
IGCC	Integrated gasification combined cycle
IGES	Institute for Global Environmental Strategies, Japan
IPAC	Integrated policy assessment model for China
IREDA	Indian Renewable Energy Development Agency
JCF	Japan Carbon Fund
JI	Joint implementation
JQA	Japan Quality Assurance Organisation
KERC	Karnataka Electricity Regulatory Commission
KP	Kyoto Protocol
KPTCL	Karnataka Power Transmission Corporation Limited
LASEN-EPFL	Laboratory of Energy Systems, Swiss Federal Institute of Technology
LPS	Large point source
LULUCF	Land use, land use change, and forestry
M&P	Modalities and procedures
MAC	Marginal Abatement Cost
MNES	Ministry of Non-conventional Energy Sources
MoEF	Ministry of Environment and Forests
MoP	Ministry of Power
MOP	Meeting of the Parties (to the Kyoto Protocol)
MOU	Memorandum of Understanding

MRTS	Mass rapid transport system
MSW	Municipal solid waste
MT	Million tonne
$MTCO_{2eq}$	Million tonnes of carbon dioxide equivalent
MTOE	Million tonnes oil equivalent
MW	Megawatt
N_2O	Nitrous oxide
NABARD	National Bank for Agriculture and Rural Development
NATCOM	National Communication of India
NC	National Communication (i.e. NATCOM)
NCA	National CDM Authority
NEDO	New Energy and Industrial Technology Development Organisation
NGO	Non-governmental Organization
NO_x	Oxides of nitrogen
NSS	National Strategy Study
ODA	Overseas development assistance
ODS	Ozone depleting substances
OECD	Organization for Economic Cooperation and Development
O&M	Operations and maintenance
PCF	Prototype Carbon Fund
PCN	Project concept note
PDD	Project design document
PFBC	Pressurized fluidized bed combustion
PFCs	Perfluorocarbons
PIAD	Pembina Institute for Appropriate Development
PIN	Project information note
PP	Project proponent
PPA	Power purchase agreement
R&M	Renovation and modernization
RE	Renewable energy
RPS	Renewable portfolio standards
SC	Steering Committee
seco	State Secretariat for Economic Cooperation, Government of Switzerland
SGS	Societe Generale de Surveillance UK Ltd
SICLIP	Swedish International Climate Investment Programme
SIDBI	Small Industries Development Bank of India
SME	Small and medium enterprise
SO_2	Sulphur dioxide
SPM	Suspended particulate matter
SSC	Small-scale CDM
T&D	Transmission and distribution
TAC	Transaction cost

TAG	Technical advisory group
TERI	The Energy and Resources Institute
TOR	Terms of Reference
TUV	Industrie Service GmbH TUV
UNEP	United Nations Environment Programme
UNEP-FII	United Nations Environment Programme - Financial Institutions Initiative
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States dollar
VER	Verified emission reduction
WEO	World Energy Outlook
WTE	Waste to energy
WSSD	World Summit on Sustainable Development
WTO	World Trade Organisation
WWF	World Wide Fund for Nature

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CHAPTER 1

Introduction

The NSS (National Strategy Study) for India was launched with the aims of assessing the issues and opportunities presented by potential international markets for GHG (greenhouse gas) offsets through the CDM (clean development mechanism), and evaluating processes and methodologies to facilitate the CDM project cycle.

The specific objectives, as provided in the ToRs (Terms of References), were to

- provide a strategic overview of the CDM opportunities for India and the international demand for GHG offsets
- facilitate the estimation of the potential and the costs of CDM-based GHG emission reductions from India and supply-demand synthesis
- identify the key sectors and develop pipelines of potential CDM projects at sectoral levels where these projects can provide synergy with local and national sustainable development priorities
- develop a CDM project cycle, sectoral methodologies, and the guidelines to facilitate implementation of projects
- identify key institutional, legal, financial, and regulatory prerequisites to facilitate the development and implementation of CDM projects
- build human and institutional capacity to identify, develop, implement, and process CDM projects in India, and to exploit the global opportunities in these areas

- support the analysis and assessment of such issues as may be considered important in the process of CDM project development and implementation
- disseminate the results of the study, and the experiences gained to the targeted audience.

At the inception of the study itself, it was recognized that significant developments were already taking place nationally and internationally, as the CDM evolved from idea to fruition. In this context, the study was designed to build up on the considerable body of existing knowledge on the subject, and to focus more on facilitating the operationalization of the CDM in India through strategic analysis, capacity building, and development of CDM projects. As the study progressed, it attempted to keep pace with the developments in the real world, and to provide relevance and value to discussions at the research, business, and policy levels.

This chapter discusses the context in which the NSS was developed and conducted, and describes the process and structure of the study itself.

1.1 CDM policy developments

In 1997, the Kyoto Protocol established the CDM with the dual objective of promoting sustainable development, and reducing the costs of GHG mitigation. It enables the entities in Annex I countries[1] to count GHG reduction through projects in the developing countries towards meeting their Kyoto Protocol targets. As a result, carbon has become a tradable commodity with an associated value. One tonne of CO_2 (carbon dioxide) reduced through a CDM project, when certified by a designated operational entity, is known as a CER (certified emission reduction), which can be traded. The CDM is supervised by an Executive Board, which is responsible to the CoP (Conference of the Parties) to the UNFCCC (United Nations Framework Convention on Climate Change).

The Kyoto Protocol entered into force on 16 February 2005. The withdrawal of the US (United States) in 2001 and the subsequent uncertainty about Russian ratification had threatened to derail the CDM process, but the decisive policy and institutional developments have kept the interest in the CDM alive. Some of these developments are outlined below.

- Accreditation of consultants as operational entities for the validation, verification, and certification of credits from CDM projects

[1] Developed countries and economies in transition listed in Annex 1 of the UNFCCC (United Nations Framework Convention on Climate Change)

- Establishment of the process for approval by the executive board of both the small scale and large scale projects, which propose to use new methodologies. Approved methodologies help build the body of 'case law' which can be drawn upon by similar projects
- Establishment of the process for approval by the executive board of the afforestation and reforestation projects, which propose to use new methodologies
- Discussion on the set-up of the CDM registry, in which parties hold accounts for CERs, and which is a prerequisite for linking up the CDM to the ETS (emissions trading system) (UNFCCC 2004)
- Clarification on the registry for non-Annex I parties.

At the start of the NSS project, the global GHG market was dominated by multilateral buyers like the World Bank's Prototype Carbon Fund, and bilateral buyers such as the Government of Netherlands. The year 2003/04 saw the emergence of Japan as a large player in the market, as well as the steady development of the ETS of the European Union. Hasselknippe (2003) lists a total of 43 voluntary and mandatory systems for GHG trading and transfer, including

- Credit purchase funds,
- Government CDM/JI (joint implementation) tenders,
- National and regional trading schemes,
- Corporate trading systems, and
- Domestic or state-level programmes in non-parties like the US and Australia.

This number has increased in 2004. The pace of developments has also found reflection in the growing activity among the Indian private sector. Even before the formal establishment of the Designated National Authority in December 2003, the Indian project developers submitted projects for approval from the MoEF (Ministry of Environment and Forests) for participation in the Dutch and Finnish carbon tenders. Several international donors (Canada, Germany, and Japan) have also for example, implemented extensive capacity building programmes on CDM, in the course of which the emphasis moved from general awareness to actual project development.

1.2 Structure and organization

In view of the status of CDM policy developments, the NSS-India study is oriented in line with the new World Bank capacity building programme, CF-Assist (capacity building and technical assistance for carbon finance). The CF-Assist programme builds on the World Bank experiences from the ongoing capacity building programme and the implementation of CDM/JI projects. It focuses on (i) providing capacity building to selected host countries to support the development, financing, approval, and negotiation processes under CDM or JI

mechanisms, and (ii) providing technical assistance related to CDM and JI projects developed by the various actors in the market. The new approach of the World Bank allows for the sharing and assimilation of the previous developed experience, and aims to ensure that capacity building and technical assistance efforts facilitate project development and preparation.

1.2.1 Structure and interlinkages

The study was divided into five tasks, of which the first three explored the opportunities for India's participation in CDM, while the latter two were geared towards facilitating implementation.

Task 1 Review of existing studies on the national CDM potential
Task 2 International demand for GHG offsets
Task 3 Sectoral CDM potential and technological options
Task 4 Pipeline of potential projects and methodological guidelines
Task 5 Recommendations on institutional, legal, financial, and regulatory issues.

The interlinkage between different tasks is outlined in Figure 1.1. In view of the evolving nature of the NSS programme as also the level of CDM-related activity in India, the emphasis of NSS-India is primarily on Tasks 2, 4, and 5. Tasks 1 and 3 did not involve any ab initio assessment, and relied primarily on previous work on the subject.

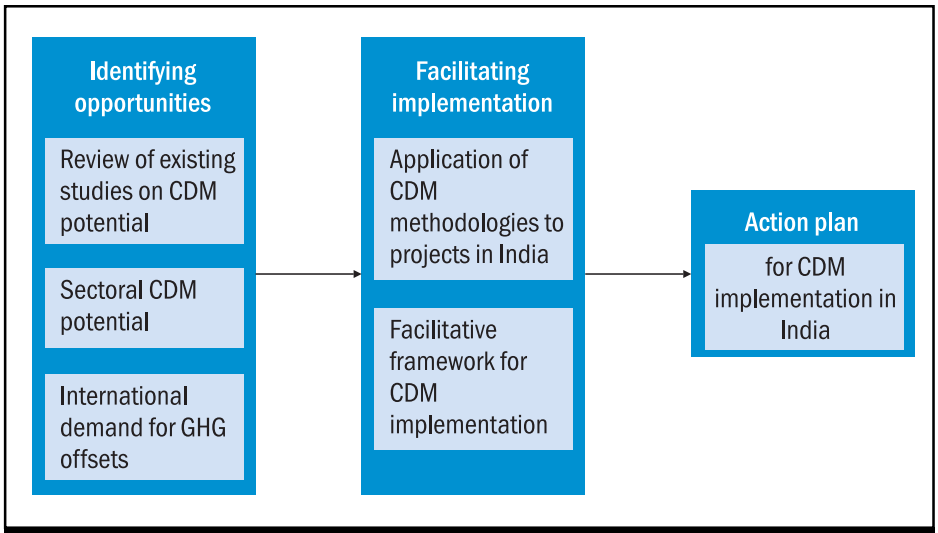

Figure 1.1 Interlinkage of different tasks

Chapter 2 focuses on the demand side and examines the prospects for India's participation in the global market for CDM. This analysis lends insights for developing the possible scenarios for India's participation in the CDM. Chapter 3 of this report presents the combined assessment of Tasks 1 and 2 to ascertain the broad potential

for GHG emissions mitigation in key sectors. It also discusses sector-specific barriers to the implementation of identified CDM project opportunities. Chapter 4 highlights the issues and concerns related to CDM project development, both from the international perspective, and the national perspective. Chapter 5 takes this analysis further, and outlines the key messages learnt from the development of five PDDs (project design documents). The five PDDs are provided in a CD-ROM along with this report. The five projects presented in chapter 5 have a high replication potential and complement the CDM potential sectors listed in chapter 3. These also provide insights for developing a facilitative framework for CDM in the country which is described in chapter 6. Further, chapter 6 explores ways to facilitate India's participation in the CDM market through the creation of an appropriate framework – regulatory, institutional, administrative, and financial – that will help minimize the costs of identifying, developing, and implementing CDM projects. For this purpose, it addresses the barriers related to both the international drivers of CDM (identified in chapter 2), as well as the lack of human and institutional capacities (identified in chapters 3 and 4). It specifically examines the role of the government in this regard.

Chapter 7 presents a plan of action for CDM implementation in India. It draws on the recommendations of the preceding chapters to identify practical policy proposals for the effective operationalization of CDM in the country.

The duration of the NSS-India project was one year, with the formal launch of the study in October 2003.

1.2.2 Organization

The organizational structure of NSS-India is shown in Figure 1.2. The study team was led by the Study Coordinator from TERI who was responsible for

- preparation and organization of the study,
- coordination of the study team to meet the objectives and scope of the NSS, regarding the expected depth and the timely completion of all tasks,
- compilation of the final report and its overall quality,
- meeting the agreed budget framework, and
- liaison between the study team and the Steering Committee.

IDFC provided a strategic partnership in this study and legal expertise was sought from an expert of the National Law School, Bangalore. In addition, the Study Coordinator also invited national and international experts to act as advisors and reviewers for specific tasks. The Swiss partners led by INFRAS AG provided an international perspective to the work being undertaken, and were actively engaged in all the aspects of the project.

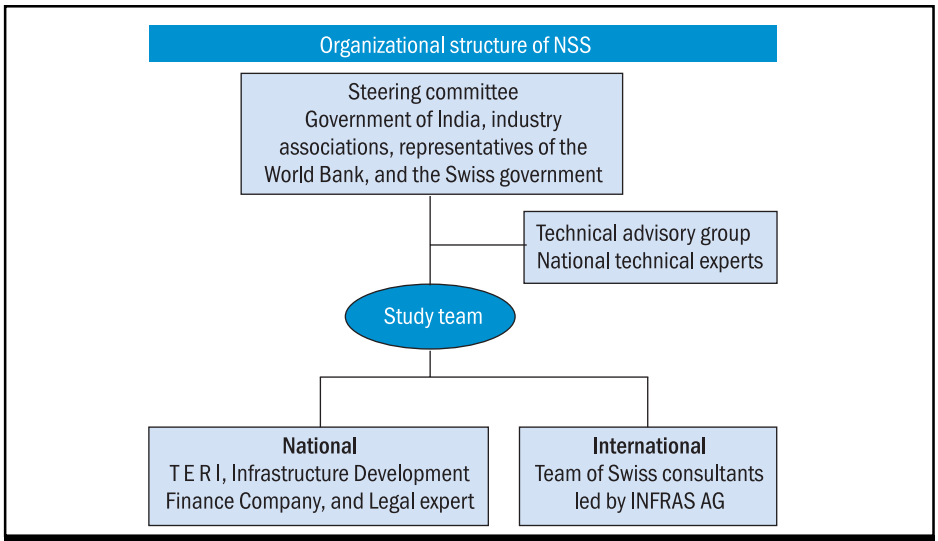

Figure 1.2 Organizational structure of NSS-India

The team of the appointed Swiss experts participated in each of the tasks as defined in the specific terms of reference, with the objectives of

- providing international experience on conceptual, methodological, and other related matters to the study as appropriate
- providing specific contributions and covering the selected areas/ issues of the NSS within the specific tasks as required
- assisting in the preparation and review of the draft final report.

The project also had a formal Steering Committee and a TAG (technical advisory group) to guide the research and other activities. The main objectives of the Steering Committee for the NSS were to

- approve major elements of the study,
- monitor the execution of the study,
- provide comments on the study reports, and
- supervise the agreed disbursement of the government's contribution to the NSS.

The committee comprised members of an inter-ministerial group on CDM, representatives of the participating ministries, relevant associations, and research institutions and representatives of the Swiss government, and the World Bank. The committee was chaired by the Secretary, MoEF.

The TAG comprised national experts, with the objective of providing the Steering Committee and the Study Coordinator with ad-hoc advisory support with regard to the management and organization of the study, and selected methodological, and other issues. The members of the TAG also peer reviewed the draft outputs of the study team. The TAG was chaired by the Joint Secretary, MoEF, and its meetings were

coordinated by the Director, MoEF. The Coordinator of the TAG was also the Member Secretary for the Steering Committee.

1.3 Stakeholder involvement and outreach process

In keeping with the CF-Assist orientation of capacity building and technical assistance, and to disseminate the findings of the study to a wide-ranging audience, a number of outreach activities were undertaken as part of the NSS-India exercise.

The NSS team primarily used four forms of outreach.

1 Participation in workshops and other events
2 Electronic communication
3 Interaction with individual stakeholders
4 Technical inputs and consultancy.

Each of these is discussed below. In addition, the NSS-India website <www.teriin.org/nss/>, designed as a part of the study (see Figure 1.3), also made significant contribution in reaching out to stakeholders.

Figure 1.3 NSS-India website

1.3.1 Participation in workshops and other events

Despite a limited number of 'official' events scheduled under the NSS project, the study team was able to effectively promote it through other workshops and events. A calendar of events is given in Annexe 1 to this chapter.

Participation in the capacity building workshops was initially an open process, which was then narrowed down to target the important stakeholders and prospective project proponents for focussed training and capacity building, resulting in generation of CDMable projects. These workshops were supplemented by outreach in forums like CoP side events, and through publications and web-based dissemination.

Apart from the launch event, the CDM round table in November 2003, and the IETA South Asian Forum in February 2004 helped publicize the NSS project in the early stages of gathering CDM project

ideas. Subsequently, the NSS team was able to dovetail its outreach activities with those of other capacity building efforts in India, such as the Canadian, Japanese, and German initiatives. Importantly, this enabled reaching out to new participants in the southern, western, and eastern regions of the country. At the international level also, effective use was made of the key forums such as CoP-9 and the Carbon Expo.

At the same time, it was appreciated that while workshop participation was useful for informing the larger public about the study, more targeted activities were needed to take on board the concerns of specific stakeholder groups. Few examples are the regulatory authorities: a beginning was made to sensitize these officials through a meeting of the FoIR (Forum of Infrastructure Regulators) and the IGES–ICS (Institute for Global Environmental Strategies–Integrated Capacity Strengthening) workshops about the critical role that the policy makers can play in promoting CDM. Also a brainstorming session was held for deliberating on the policy recommendations and action plan for India's participation in the CDM. In this session select government representatives and the CDM experts discussed key technical, financial, institutional, and legal issues that could enable the operationalization of CDM in India. The call for PINs (project idea notes) and a small-scale industry focussed workshop in Coimbatore were able to bring in new industry participation.

Partnership and participation in various events (such as those organized under the programmes of IGES–ICS, and the Confederation of Indian Industry-Resource Futures International) and collaboration in new initiatives like the Canada Natsource PDD development facility is a testimony to the impact of NSS-India.

1.3.2 Electronic communication

Electronic forms of communication have been used both for ensuring maximum participation in workshops, and for inviting project ideas. Further, they were used to survey specific groups of stakeholders and elicit their concerns and priorities. The examples include

- web-based survey of consultants on PDD experience
- web-based survey of Indian industries on key institutional, financial, and legal issues.

Finally, the technical contributions of the NSS team were disseminated more widely, for instance through inputs posted on the UNFCCC CDM Executive Board website and the recommendations on standardized renewable energy baselines (TERI 2004) posted on Climate-L. In the final stages of the study, select experts and stakeholders were invited to debate the NSS issues and recommendations on a web discussion forum.

1.3.3 Interaction with individual stakeholders

The workshop participation and electronic communication have been supplemented by one-to-one interaction with policy-makers, financial institutions, and consultants. Questionnaires were also used to elicit participants' views immediately following the workshops. The concerns and proposals put forward by these stakeholders and experts have been incorporated into the final report and action plan.

1.3.4 Technical inputs and consultancy

Throughout the duration of the project, TERI continued to provide technical information and services to engage the private sector and enhance the level of working capacity with regard to CDM. The specific achievements include

- Preparation of report on standardized baselines for renewable energy CDM projects: prepared for MNES for use by the private sector
- PDD development for a 300 MW wind power project sponsored by GTZ: CDM India
- PDD (project design document) development for a wind power project for a private project promoter
- PDD development in the poultry sector for a private promoter is underway
- Discussions with promoters in biomass power, bio-diesel, fuel-switching and MSW to energy sectors are underway
- Expression of interest for project identification in steel and gas sectors was received
- Providing advisory services to the Canada Natsource PDD development facility for India, in the evaluation and selection of CDM PINs for PDD development
- Inputs to the CDM Executive Board were provided on CDM registry, consolidated methodologies, consolidated tools for additionality and through comments on the PDDs from India via the open process soliciting stakeholder comments
- Three members of the team are on the CDM roster of experts.

The NSS-India has been an open and participative process, and has helped forge an informal alliance among different stakeholders in the country.

1.4 Exclusions

At the outset it needs to be underscored that the study framework excluded the consideration of LULUCF (land-use, land-use change, and forestry) CDM projects.

Also, the selection of five projects developed as PDDs was undertaken in consultation with the TAG. The selection reflects an emphasis on small-scale projects, which is not an indication of the Government of India's intent to promote projects in this sector only. Rather, it is an indication of the importance TAG accorded to using such public funding to analyse issues and garner new knowledge in the area

and projects that would not normally be selected. A case in point is the case study on rural electrification and its modulation into a PDD. Further, the PINs that were submitted to this open call had an overwhelming representation from the small-scale sector, skewing the final selection of projects.

It may further be added that some international developments will overtake the analysis presented in this study by the time it comes into print.

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CHAPTER 2

International demand for CDM

From the adoption of the Kyoto Protocol in 1997 to its entry into force on 16 February 2005, political uncertainty has marked every step of the evolution of the global climate change regime. The CDM (clean development mechanism) concept has itself undergone tremendous changes in design as well as implementation. In recent years a small, albeit fragmented, market for carbon has started to emerge, and the institutional superstructure for CDM is being set up both internationally and nationally. Early transactions in this market have been marked by experimental moves and dominance by a few large players. The non-Annex I countries like India have to choose between seizing the early mover advantage or playing a wait-and-watch game till the payoffs become clearer. This chapter examines the prospects for India's participation in the evolving global market for CDM.

2.1 Approach

The analysis of the global carbon market in this chapter is based on the application of a carbon market equilibrium model CERT (carbon emission reduction trade). CERT was developed by Grütter Consulting together with the ETH Zürich on behalf of the World Bank in 2001 (Grütter 2002c) responding to the needs emerging under the NSS programme. It is a partial equilibrium model which uses inputs of GHG (greenhouse gas) emission projections and marginal abatement cost curves from other models to estimate the share of different regions in the

carbon market, equilibrium carbon prices, and the possible carbon trade (Annexes 2 and 3).

The next section uses the model to analyse the global demand for carbon emission reductions. CERT-based projections are, however, severely limited in their ability to simulate specific market conditions anticipated to prevail in the short or long terms. This is because the marginal abatement cost curves do not appropriately reflect the favourable cost structure in the non-CO_2 (carbon dioxide) market segment and assume a market equilibrium, which, for reasons of supply-side constraints, is unlikely to be established within the short time span left up to 2010. For instance, the model is not equipped to handle the impact of the time lag of project implementation on CER (certified emission reduction) supply, quality of CERs, differential prices for different types of emission reductions, and institutional barriers. Post-2012 projections are not feasible as the future commitments are not known yet. The range of model results can be strongly skewed by the abatement cost data used and the emissions scenario chosen.

Consequently, the CERT-based analysis is supplemented by market observations and results derived from other recent studies. In light of this dual approach, the last section explores the implications and strategies for India's participation in CDM.

2.2 Demand for carbon emission reductions

Annex B countries to the Protocol have to collectively reach a targeted reduction of 713 $MTCO_{2eq}$ (million tonnes of carbon dioxide equivalent) from their 1990 emission levels in the first commitment period. A review of the National Communications submitted by Annex I countries reveals that the total demand for Annex I countries is 846 $MTCO_{2eq}$ per year, with an uncertainty range of 415–1250 $MTCO_{2eq}$ per year (Grubb *et al.* 2003). This estimate takes into consideration the emission trajectories of these countries and the domestic action to reduce emissions since 1990. The supply potential for hot air and JI ERUs (joint implementation emission reduction units) is estimated to be in the range of 365–1070 $MTCO_{2eq}$ per year (Grubb *et al.* 2003). This implies that the global CDM market size could be between 50 $MTCO_{2eq}$ and 180 $MTCO_{2eq}$.

India faces a potential CDM market that has become but a fraction of its originally envisaged size, primarily due to the rejection of the Kyoto Protocol by the US (United States), which is the largest emitter of GHGs in the world, accounting for over a third of all Annex I CO_2 emissions, and would have had significant demand for offsets to meet its Kyoto target. The significant existence of huge amounts of 'hot air', mainly from Russia and Ukraine (now possibly also from Kazakhstan), and the rules concerning the inclusion of sinks in the Marrakesh Accords have further exacerbated the situation. In fact, discussions summarizing different market projections (Ellermann, Jacoby, and Decaux 1998;

Grubb *et al.* 2003) focus on the issue of whether to expect a low or high surplus scenario (Annexe 4).

2.2.1 CERT-based analysis of international demand

Since projections of the evolving carbon market under the Kyoto Protocol regime are characterized by multiple, partially independent, and partially dependent uncertainties, the likely ranges of prices, volumes, and market shares are explored by defining the lower bound and upper bound scenarios in terms of market volumes (Table 2.1). The reference scenario constitutes a likely scenario which lies between the lower bound, characterized by a low rate of CDM project development, high CDM transaction costs, unrestricted sales of hot air by Russia, and no demand from the US (details of these market parameters are explained in Annexe 2), and the upper bound, characterized by price leadership by Russia, and some level of federal and state action in the US.

Table 2.1 Parameters defining lower bound, upper bound, and reference scenarios

Parameter	*Lower bound scenario*	*Upper bound scenario*	*Reference scenario*
CDM implementation rate	10%	50%	30%
US (United States) voluntary participation rate	0%	10%	10%
Supplementarity rate EU	50%	0%	50%
Transaction costs CER	2 USD/TC	1 USD/TC	2 USD/TC
Transaction costs ERU (emission reduction unit from joint implementation projects)	1 USD/TC	0.5 USD/TC	1 USD/TC
Adaptation fund contribution	2%	2%	2%
Stackelberg solution for FSU (former Soviet Union)/price leadership	No	Yes	Yes

CERT results (Annexe 2) show that in the lower bound scenario for the global CDM market the entire Annex I demand could be met through supply of hot air from EET (Economies in transition of Eastern Europe) and FSU (former Soviet Union). Market realities, however, show that even in anticipation of the entry into force of the Kyoto Protocol, several carbon funds, CDM tenders, and emission trading schemes were launched. As a result of these activities, in 2004, 127.2 $MTCO_{2eq}$ were contracted, of which the share of CDM was 82 $MTCO_{2eq}$ at an average weighted price of 4.2 euros/TCO_{2e} (Point Carbon 2005). This indicates that the demand for CDM may not necessarily be limited by the theoretical availability of surplus GHG offsets.

2.2.1.1 Expected Annex I demand for CERs

The EU ETS (European Union emissions trading system), which became operational in January 2005, creates a significant market for CDM as a result of its Linking Directive (European Commission 2004). Nine of the EU 15 countries have declared that they plan on using CDM/JI for reaching their Kyoto commitment (Annexe 6). Estimates of the annual compliance demand by the trading sectors in 2010, range from 45 $MTCO_{2eq}$ (Sijm *et al* 2000) to 243 $MTCO_{2eq}$ (Criqui and Kitous 2003 as cited in Haites 2004) Of the total allowances allocated, 16% correspond to industry purchases of 91 $MTCO_{2eq}$ per year. Member state governments would purchase an additional 117 $MTCO_{2eq}$ per year. According to Criqui and Kitous (2003), in an open EU emission trading system with increased competition and no limits on the use of CDM and JI credits, the volumes of globally acquired CDM credits could increase to 300–360 $MTCO_{2eq}$ by 2010, with a corresponding market price of allowances of 12.40 euros/TCO_{2e}.

If the use of CERs and ERUs (emission reduction units) is capped at 6% of the allowances allocated, the price of EU allowances rises to 14.50 euros/TCO_{2eq} and the international price of CERs and ERUs drops to 12.00 euros /TCO_{2eq} (Criqui and Kitous 2003 as cited in Haites 2004).

Alongside the EU trading system, many EU member states and other OECD (Organization for Economic Cooperation and Development) governments are in the process of establishing domestic emission trading systems and/or CDM/JI programmes (also see Annexe 5). Table 2.2 sums up the current announced government commitments and plans to purchase CERs and ERUs and the minimum demand by industry in Europe. The lower bound figures (Natsource 2003 as cited in Haites 2004) are more realistic given the assumption of low MACs (marginal abatement costs) for China[1] assumed by Criqui and Kitous (2003). Further, the increase in oil prices since 2003, assuming these remain high, makes domestic action in Annex I countries more cost-effective, and may reduce the demand for CDM.

Table 2.2 Estimates of government and industrial demand $MTCO_{2eq}$ for Kyoto units in 2010

	Government demand (2003)		*Industry demand (2003)*	
Country	*Natsource*	*Criqui and Kitous*	*Natsource*	*Criqui et al.*
Australia and New Zealand	–	12	–	23
Canada	12.0–81.8	74	22.4	20
European Union 25	53.9–462.8	113	45.0–173.7	111
Japan	17.7–217.6	26	34.8–92.4	34
Norway and Switzerland	–	16	–	10
Total demand	83.6–762.2	241	102.2–288.5	198

Source Haites (2004)

[1] Subsequently revised in the China CDM Study (World Bank 2004)

Annexe 1 contains the entire range of GHG emission projections and MAC curves used for the CERT simulations. Table 2.3 shows the results of the CERT simulations using inputs from two bottom-up models, which are considered more realistic than the inputs from top-down models (Annexe 2).

Table 2.3 Results of CERT simulations for India's participation in CDM market

Scenario	*Global market carbon price* (USD/TCO_2)	*CDM volume* ($MTCO_2$/yr)	*Volume of Indian CER exports* ($MTCO_2$/yr)	*India export revenue* (million USD)	*Share of India in CDM* (%)
Upper bound, medium growth GTEM (global trade and environment model) bottom-up CO_2	4.0	264.0	26.4	106.6	10
Upper bound, IPAC–AIM (integrated policy assessment model – Asian Pacific integrated model) bottom-up CO_2	4.4	216.3	13.2	58.3	6
Reference scenario, medium growth GTEM bottom-up CO_2	1.3	37.8	3.7	4.8	10
Reference scenario, IPAC–AIM bottom-up CO_2	6.1	165.0	10.3	62.2	6
Promoting implementation, Medium growth GTEM bottom-up CO_2	1.3	39.6	5.9	7.5	15
Promoting implementation, IPAC-AIM bottom-up CO_2	5.9	169.0	16.5	98.1	10
Split market, medium growth GTEM bottom-up CO_2	3.8	37.8	3.7	14.0	10
Split market, IPAC–AIM bottom-up CO2	8.4	165.0	10.3	86.5	6

2.2.1.2 India's share in CDM

Under both the GTEM (global trade and environment model) bottom-up as well as IPAC-AIM (integrated policy assessment model for China – Asian Pacific integrated model) scenarios, India's CER revenues increase by roughly half, if India is able to promote the implementation of CDM projects at a higher rate than its competitors (assuming CDM implementation rate of 50% for India, compared with 30% in the reference scenario).

Currently, the process of CDM project approval is characterized by a high degree of complexity and long lead times. Further, the stringent monitoring and verification requirements add to the lifetime transaction

costs associated with CDM projects and put these at a disadvantage relative to JI (joint implementation) and ET (emissions trading). In such a situation, the only way India can gain an edge over other CDM suppliers is to increase the number of CDM projects being developed, approved, and registered. Moreover, the attractiveness of India as a CDM host will depend on many factors, not necessarily the aggregate marginal abatement cost or incremental cost of individual projects or a theoretical market-clearing price as estimated by CERT.

2.2.1.3 Competition from JI and hot air

With the integration of eight new countries with an economy in transition[2] into the EU, the use of cheap hot air and the implementation of JI projects have become available to EU member states struggling to achieve compliance (Langrock and Sterk 2004). Several MoUs/contracts on JI have already been signed between the EU member states, and also with other non-EU member states in Eastern Europe (Bulgaria and Romania). However, it is expected that the EU members with tighter emission caps will renounce the purchase of 'cheap' credits from 'hot air' out of ecological integrity reasons, at least during the first phase.

CDM will have an advantage over JI in the EU ETS, as CERs will be bankable from 2005 itself, while ERUs will not be allowed until the second phase of the EU scheme starts in 2008. To rule out problems of double counting, the linking directive excludes ERUs from JI projects in the acceding if they are generated from sectors included in the EU scheme. Further, some accession countries have pointed out the lack of eligible JI projects due to the relatively stringent EU-standards based baseline applied to such projects (Energy Argus 2004).

More critical, however, is the fact that the draft linking directive does not allow the exchange of AAUs (assigned amount units) for EU allowances. This increases the market potential for CDM because the surplus AAUs held by Russia and Ukraine cannot be used for compliance by participants in the EU emission allowance trading programmes. In other words, the draft linking directive reduces the potential market for hot air and thus increases the potential market for the CDM (Haites 2004).

2.2.1.4 Restriction of hot air sales

The use of the CERT model suggests that Russia and Ukraine can raise their profits from the sale of Kyoto units by restricting the sales to about 40% (range 10% to 75%) of their surplus units. That would raise the market price for Kyoto units to about 11.40 dollars/TCO_{2eq} in 2010 (range 1.00 dollars to 33.00 dollars/TCO_{2eq}). Under these assumptions the models estimate a market potential for CERs of up to 250 $MTCO_{2eq}$ (range 50 to 500 $MTCO_{2eq}$) and the CDM would represent 5% to 35% of the international trade in Kyoto units (Haites 2004).

[2] Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia

Apart from this, Russia and the Ukraine might not meet the eligibility conditions to participate in international emissions trading, and hence be restricted to the sale of ERUs from JI projects implemented under the international review process.

2.2.1.5 Price differentiation

While the main CERT assumption of a global competitive carbon market with one equilibrium price may have been reasonable in the period right after the Kyoto Protocol was signed, it is questionable under the current prospect of a marginal market. Instead it seems likely that other than pure least cost criteria will determine the share of the various mechanisms, as well as their corresponding prices.

There is already some evidence for a likely price differentiation between the project-based mechanisms JI and CDM on the one hand, and emission trading on the other, and even across credits from different kinds of projects in various countries. Prices of VER (verified emission reduction) trades reported during 2003/04 (Table 2.4), suggest that the risk of non-registration commands a large premium.[3]

Table 2.4 Prices of VER trades in 2003/04 (USD/TCO_{2eq})

Type of ER	*Price range* (USD/TCO_{2eq})	*Weighted average by volume* (USD)
Not for Kyoto compliance	0.37–3.00	1.34
For Kyoto compliance, registration risk on buyer	3.00–4.25	3.85
For Kyoto compliance, registration risk on seller	3.00–6.37	5.52

Source Lecocq (2004)

There are barriers in the hot air market as well, which may be one factor that explains why the investor interest in CDM projects in India observed during the recent months exceeds the level projected by economic modelling.

The argument for a price-wise split market is based on the following arguments.

- Price would not be the only consideration deciding government purchases of Kyoto units; gaining experience in the use of CDM, with a view to later commitment periods, may be viewed by the private sector as a goal in itself.
- Trading schemes such as the EU ETS allow purchase of carbon offsets from project-based mechanisms only. Even carbon funds and corporate buyers may demand CERs and track 2-based ERUs that are perceived as being 'greener' and 'higher quality' than ETUs. The

[3] Figures are highly sensitive to USD-euro exchange rate

WWF (World Wide Fund for Nature) has proposed a 'gold standard' for screening CDM projects.[4]

Since CERT is unable to model differential prices for CERs and ETUs, or for different quality CERs, the split market situation had to be artificially simulated. Were hot air in the system to be ignored, the world price would go up from USD 1.3/TCO_2 to USD 3.8/TCO_2 under the GTEM bottom-up scenario, and from USD 6.1/TCO_2 to USD 8.4/TCO_2 under the IPAC–AIM scenario. If CDM credits can command these higher prices, under the reference case India can almost triple its CER revenues under the GTEM bottom-up scenario (Table 2.3).

2.2.1.6 Summary

Table 2.5 summarizes the range of CER volumes and prices estimated by CERT. These indicate that India is likely to capture 10% of the global carbon market during the first commitment period. The country's volume of CER exports in 2010 may range between 3.7 CO_{2eq} and 26.4 $MTCO_{2eq}$, bringing in revenue in the range of 5–100 million USD per year.

Table 2.5 Summary of CERT-based analysis

Total carbon offset demand (Annex B)	415–1250 $MTCO_2$/year
Global market carbon price range	1.3–6.1 dollars/TCO_2
CDM volume	37.8–264.0 $MTCO_2$/year
Volume of Indian CER exports	3.7–26.4 $MTCO_2$/year
India's export revenue	4.8–106.6 million dollars/year
Share of India in CDM	10%

These results correspond reasonably well with other global carbon market studies (Annexe 2). However, comparing the projected volume of Indian CERs with the pipeline of projects already developed in the country (chapter 5) again reinforces the limitation of CERT in reflecting the non-CO_2 projects in MAC curves.

2.3 Implications for India's participation

The current early CDM market is a buyers' market. Accordingly, prices reflect the buyers' willingness to pay, project type, type and size of transaction, transaction costs, risks and modalities for sharing them between buyers and sellers, premium for sustainable development contribution, and other factors. Besides the reduction requirements of Annex B parties and the emerging market opportunities, there are institutional and methodological factors influencing the pace at which

[4] Details available at <http://www.panda.org/about_wwwf/what_we_do/climate_change/our_solutions/business_industry/finance_investment/gold_standard.cfm>

the global carbon market and – more specifically – the demand for CERs develops. These factors are highly relevant in understanding the prevailing market incentives and barriers, and accordingly develop an appropriate strategy for India's participation in the CDM.

Taking stock of the current market context, however, it is difficult to justify a recommendation in favour of a very aggressive CDM participation strategy without also critically assessing the possibility of an enhanced carbon market.

2.3.1 Enhanced carbon market

The two main factors that come into play are the early entry into force of the Kyoto Protocol and the national implementation strategies of the parties committed to follow Kyoto even in the absence of ratification (Canada, EU, and Japan).

Price leadership of EE and the FSU and hence the Russian ratification of the Kyoto Protocol is the main factor leading to a significant CDM market size as well as carbon offset price in the projected range of 4–6 USD/TCO_{2eq}.

The Kyoto Protocol entered into force on 16 February 2005. In an optimistic scenario all ratifying countries would move towards the full potential of the Kyoto Protocol through mandatory or voluntary arrangements. Formal entry into force would encourage the Canada, EU, and Japan to be compliant; particularly causing the EU to take on more ambitious commitments in the second phase and treat hot air more stringently.

This scenario could, in the mid-to long run, put pressure for greater GHG reduction action on the US. Possibly under a new government, federal legislation like the McCain Lieberman Act would come into force, forge links with other trading systems like the EU ETS, and encourage project development in non-Annex I countries. Pizer and Kopp (2003) estimate that the implementation of the McCain Lieberman Act will require reductions of 860 $MTCO_2$ in 2010 and 2900 $MTCO_2$ by 2020, a significant jump over the levels described in Table 2.3.

Another decisive factor for a CDM market will also be second commitment period targets, if any, which will influence banking decisions and thereby affect the demand for carbon offsets during the later parts of the first commitment period.

Beyond the first commitment period, the trading volumes estimated by CERT as an upper bound are likely to materialize (Table 2.6), if the Kyoto regime is extended and adjusted. By this medium term period, implementation rates are likely to rise with the non-Annex I countries gaining familiarity with developing CDM projects, and with the availability of a large body of case law from the first commitment period. Transaction costs are likely to decline with experience and competition

among operational entities. Most importantly, hot air in the system would significantly decrease.

Table 2.6 Upper-bound scenarios relevant for a post-Kyoto period (derived from Table 2.3 results for GTEM bottom-up and IPAC–AIM)

Volume of Indian CER exports	13.2–26.4 $MTCO_2$/year
India's export revenue	58.3–106.6 million dollars/year
Share of India in CDM	10–15%

2.3.2 Meeting the demand

CERT results consider potential CER volume and price, but not crucial enabling factors such as institutional arrangements, project preparation and technical capacity, related transaction costs, risk profile of a country/project, transaction types and contractual arrangements, or host country CDM policies, which determine the relative competitiveness of a host country. These factors seem to make India quite attractive at present, particularly with respect to China.

The investors perceive India as an important CER supplier, when deals are transacted in the form of CER purchase agreements (as opposed to investment deals). High ratings by independent rating services like Point Carbon reflect the fact that a significant number of transactions have already taken place and basic CDM infrastructure is operational in the country. Furthermore, India has a potentially large supply of CERs and a good number of proactive market participants with the capacity to implement viable projects.

Currently it is difficult to put a value to CERs and ERUs generated by projects beyond 2012 under the post-2012 climate regime. Given the long lead time involved in developing projects from identification to financing, construction, and operation, and the time required for CDM approval, projects which aim to deliver a significant proportion of their achievable CERs by 2012, need to become operational by 2006 or 2007 at the latest. For meeting a CER supply level of 15 $MTCO_2$ by 2010, a few large and several medium- to small-size projects would need to be in operation in India by 2007.

At present the demand is preferably channelled to renewable energy projects where additionality can be justified comparatively easily and where the project size in the range of 5–50 MW is associated with significantly lower project risks as compared to larger fossil fuel-based power generation projects. However, such projects constitute only a small fraction of the emission abatement potential in India (chapter 3). While small-scale projects may have better chances of getting through by pointing to the barriers preventing their implementation, CDM project risks are generally perceived as higher and more sensitive in large-scale projects due to the uncertainty on project completion dates. Demonstration of additionality in sectors with significant GHG

abatement potentials but complex CDM methodological issues (transport, small-scale industry, commercial, and residential buildings) is quite demanding. As long as the CER-based revenue stream is associated with a significant project risk, the financial sector prefers investments in highly profitable projects only. But for these projects demonstration of additionality becomes even more demanding. In contrast, with an approved methodology and very high global warming potentials, HFC (hydrofluorocarbon) destruction projects are fast emerging as a source of large volumes of cheap CERs.[5] In 2003/04, HFC23 destruction projects accounted for the largest share of the emission reductions produced, with 35% of the total volume supplied through only two projects (Lecocq 2004). With the PDD for afforestation and reforestation projects likely to be finalized soon, energy sector projects in India could start facing stiff competition from LULUCF credits from Africa, Latin America, and south-east Asia. A comparison of different project types with respect to sustainable development benefits is provided is chapter 7.

2.3.3 Conclusions

The conclusions of this study, under the formulated assumptions and scenarios are discussed below. India faces a potential CDM market that has become but a fraction of its originally envisioned size. As summarized in Table 2.5, India's sale of CDM credits could range from 3.7–26.4 $MTCO_{2eq}$ per year during the first commitment period. CER exports from India closer to 20–25 $MTCO_{2eq}$ per year range could be achieved, if India takes a proactive approach towards the CDM, and if prospects for an extension of the Kyoto regime beyond 2012 emerge in the coming years. Currently, the emphasis is on contractual obligations of purchases for the first commitment period only. Moreover, as long as the CER-based revenue stream is associated with a significant project risk the financial sector prefers investments in highly profitable projects only. But demonstration of additionality for such projects is very difficult. Chapters 4, 6, and 7 discuss innovative financial models to support CDM project development, and extended forms of the CDM itself.

Although the expected low market price for CERs means that the CDM will not generate Indian export revenues with relevance on a national economic scale, there are still some arguments for why participation in the CDM is in India's interest.

- In the short term also a small revenue stream may still trigger the adoption of cleaner and more efficient energy production systems
- Over the first commitment period, however, there may be avenues for certain types of projects to command a price premium (such as those demonstrating high sustainable development contribution

[5] HFCs (hydrofluorocarbons) have global warming potentials of the magnitude of 150–11700 times that of CO_2.

according to internationally accepted criteria). On the other hand, such projects would have to compete with potentially low-priced CER resulting from the HFC sector

- More important is the mid-term perspective: in any possible upcoming second commitment period – potentially with a higher level of US participation – the CDM could play a more significant role in terms of volume and revenues. It will pay off to invest into the acquisition of experience with CDM projects, to set the necessary local institutions in place and establish an internationally competitive levelled playing field.

To assess the effectiveness of CDM concept at the global and country level, and in particular with a view to a post-Kyoto period, a significant research and development effort would still be required. A reliable analysis of the global carbon market for the post-Kyoto period is an absolute necessity to facilitate the related political process.

India's policy-makers thus need to strategically assess opportunities in the emerging carbon offset market at the macro and micro levels. The potential supply for CERs from India, priority areas for carbon finance investments (especially in the energy-related sectors), and how best to bring Indian CERs to the market are the issues addressed in chapters 3, 6, and 7 of the study.

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CHAPTER 3

Potential for CDM in India

3.1 Introduction

The previous chapter analysed the international demand for the share of CDM in the global GHG (greenhouse gas) offset mechanisms and the market share and benefits that India can realize. This chapter presents the broad potential for GHG emissions mitigation in key sectors by reviewing and summarizing existing studies that analyse India's GHG emissions profile and their mitigation options.

3.2 GHG emissions in India

The Government of India has submitted a comprehensive national GHG inventory as part of its first NC (National Communication) to the UNFCCC, in April 2004. This inventory has been prepared for the base year 1994. Prior to the NC, the most widely-cited national GHG inventory available was that prepared for base year 1990 under the ALGAS (Asia least-cost greenhouse gas strategy) study of the Asian Development Bank (ADB-GEF-UNDP 1998). A GHG inventory for India for base years 1990 and 1995 was also estimated by Garg and Shukla (2002).

According to the ALGAS inventory, total CO_2-equivalent emissions in 1990 were 1 001 352 Gg (giga grams), which was approximately 3% of global emissions (ADB-GEF-UNDP 1998). The energy sector was the largest emitter of CO_2, contributing 55% of national emissions. These also included emissions from road transport, coal mining, and fugitive emissions from oil and natural gas. Agriculture was the second largest

source of GHGs in India; methane emissions from enteric fermentation in domestic animals, manure management, rice cultivation, and burning of agricultural residues constituted 34% of national GHGs. The net uptake and emissions from the LULUCF (land use, land use change and forestry) sector were almost equal, resulting in negligible emissions from this sector (ADB-GEF-UNDP 1998).

For the base year 1994, the NC inventory reports total CO_2-equivalent emissions of 1 228 540 Gg, with per capita emissions of about 1.3 tonnes. The largest share of 61% in the national total was contributed by the energy sector, followed by the agriculture sector at 28%, industrial processes at 8%, and waste at 2%. Emissions from LULUCF are 1% of national emissions (MoEF 2004).

Table 3.1 presents a comparison of the NC inventory with the ALGAS and Garg and Shukla (2002) figures.

The difference in results can be attributed to divergent methodologies employed by the authors. For instance, the studies use different emissions coefficients for CO_2 emissions from the energy sector, different figures for waste generation per capita per day, and different biomass consumption estimates.

The NC inventory, in particular, used more precise (higher tier) methodologies for key source categories, and country-specific emission coefficients were developed for Indian coal, road vehicles, and agriculture (MoEF 2004). The NC prepared a bottom-up sector-wise (rather than top-down fuel-wise) estimate of emissions from different activities as presented in Figure 3.1.

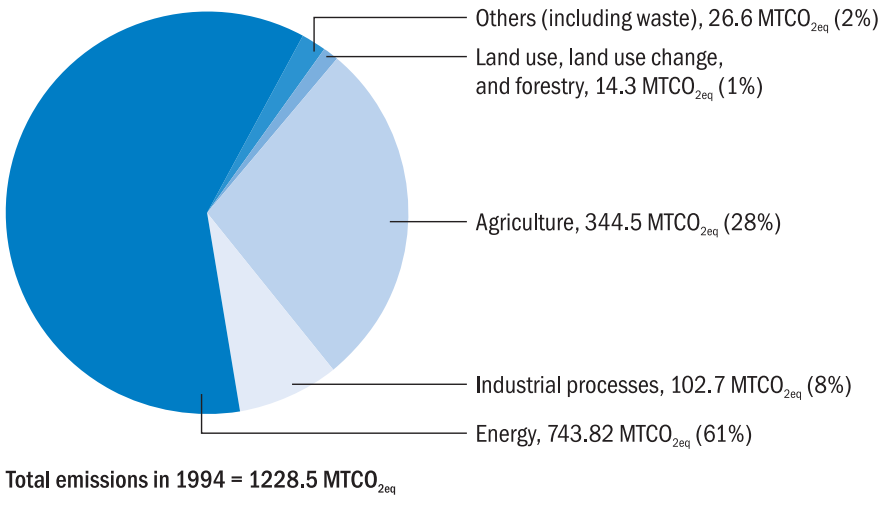

Figure 3.1 Sectoral GHG emissions in 1994
Source NATCOM (2004)

Table 3.1 **Comparison of recent GHG inventory exercises for India**

Emission source	CO_2 equivalent emissions (Gg)			
	ADB-GEF-UNDP (1998) Base year 1990	*Garg and Shukla (2002) Base year 1990*	*Garg and Shukla (2002) Base year 1995*	*NC (2004) Base year 1994*
1 Energy				
A Fuel combustion	–	–	–	717549
1 Coal	328400	410242	535134	
2 Oil products	–	162700	141378	188730
3 Natural gas	17500	18793	23074	
4 Traditional biomass	36569	59304	60375	
B Fugitive emissions from fuels				
1 Solid fuels	6930	6867	7875	13650
2 Oil and natural gas	13146	15120	16674	12621
Total emissions from energy sector (fuel combustion + fugitive)	**565245**	**651704**	**831862**	**743820**
2 Industrial processes[1]	24510	25777	36291	102710
3 Agriculture				
A Enteric fermentation	158823	148604	155807	188412
B Manure management	19005	7392	8400	20176
C Rice paddy cultivation	85470	84441	84231	85890
D Agricultural soils	74400	51150	60140	45260
E Field burning of agricultural residues	3366	9908	11316	4747
Total emissions from agricultural sources	**341064**	**301495**	**319894**	**344485**
4 Waste				
A Solid waste disposal on land	7014	29862	38157	12222
B Domestic and commercial waste water	1029	630	672	7539
C Industrial waste water	61005	7497	8211	1302
D Other waste		–	–	2170
Total emissions from waste	**69048**	**37989**	**47040**	**23233**
5 Land use change and forestry				
A Change in forests and other woody biomass stock	-6171	–	–	-14252
B Forests and grassland conversion	52385	–	–	17987
C Abandonment of managed lands	-44729	–	–	-9281
D Trace gases from biomass burning	–	–	–	150
E Emissions and removals from soils	–	–	–	19688
Total emissions from land use change and forestry	**1485**	–	–	**14292**
TOTAL NATIONAL EMISSIONS AND REMOVALS	**1001352**	**1016634**	**1234799**	1228540

[1] For breakdown of industrial emissions sources see Garg and Shukla (2002), 60–64 pp. ALGAS basically includes emission from cement production in this category

Note CO_2 emissions from biomass consumption are not included in the national totals; CO_2 equivalents are based on GWP of one for CO_2, 21 for CH_4 and 310 for N_2O

Source ADB-GEF-UNDP (1998), Garg and Shukla (2002), MoEF (2004)

A comparative analysis of GHG emissions from the energy sectors (fuel combustion in different sectors) in 1994 with the IEA (World Energy Outlook 2004) estimates for 2000 shows an increase from 744 $MTCO_2$ to 922 $MTCO_2$ as shown in Figure 3.2.[1] Bulk of this increase is in the energy and transformation sector.

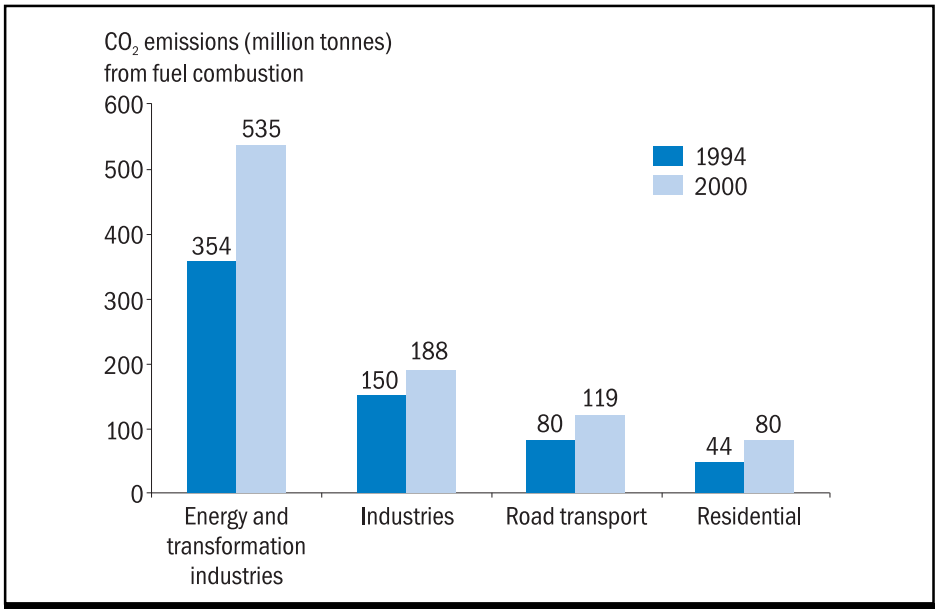

Figure 3.2 GHG emissions from combustion of fuel
Sources NATCOM (2004), World Energy Outlook (2004)

3.3 GHG mitigation potential

The ALGAS study also made projections for sectoral GHG emissions from India for the period 1990–2020 in order to identify the key areas for developing an abatement strategy for the country. The energy sector projections for India are summarized in Table 3.2. The baseline scenario represents the most likely situation. Rather than projecting past trends, it includes some carbon abatement technologies and energy efficiency improvements that are likely to occur in the future, irrespective of the concerns for CO_2 emission reduction.

Table 3.2 The energy sector CO_2 emissions in the baseline scenario (Tg CO_2)

	1990	*2010*	*2020*
Baseline	532	1555	2308
Coal	327	895	1336
Oil	178	553	777
Gas	27	107	198

Source ADB-GEF-UNDP (1998)

[1] Figure 3.2 shows only the major sectors

The inventory presented above shows a major increase in emissions over the next 20 years in the energy sector. Further, the composition of India's GHG emissions reveals a number of sectorally concentrated emissions sources. In 1995, the 100 largest LPS (Large Point Sources) alone emitted more than 440 million tonnes CO_2, which amounts to 57% of national CO_2 emissions (Garg and Shukla 2002). The 100 largest LPS include 73 power plants, 7 steel plants, 16 cement plants, 3 fertilizer plants, and a petrochemical plant. The five largest are all coal-fired generators and contribute 11% of all CO_2 emissions. Table 3.3 lists the highest emitting sectors and thus highlights those areas that hold the greatest potential for emissions reductions. The first category of LPS represents highly concentrated emissions sources which might lend themselves to larger and more cost-effective mitigation efforts. However, preference in actual selection of CDM projects may depend on other factors as well, such as low per tonne of carbon costs, ease of baseline calculation, and relatively low risk.

Table 3.3 Main contributors to India's CO_2 equivalent GHG emissions: 1995

Source characterization	*Source categories*	*Share* (%)
LPS (major)	Fossil power (94)	29.6
	Steel (11)	8.8
	Cement (85)	5.0
	Landfills (14)	1.2
Many small but concentrated sources	Transport	9.5
Many small and dispersed sources	Livestock	12.6
	Paddy cultivation	6.8
	Biomass consumption	5.4
	Synthetic fertilizer use	4.1
	Total	**83.0**

Source Garg and Shukla (2002)

Analysis of key technological and management options to mitigate GHG emissions was undertaken in the conventional power, renewable energy, industry and transport sectors. The sectoral GHG mitigation options in the power, renewable energy, industries, transport and municipal waste sector are discussed in the following sections.

3.3.1 *Power sector*

3.3.1.1 Background

The installed generation capacity of India is 111 152 MW (megawatt) as of March 2004, yet there are peaking shortages of 12.2% and energy deficit of 8.8%. The Government of India has set a target of 215 804 MW power generation capacities by March 2012 (Table 3.4), requiring a capacity addition of 104 652 MW in the next eight years.

Table 3.4 India's perspective plan for electric power

Power generation	*Thermal (coal and lignite)* (MW)	*NG/LNG/ diesel* (MW)	*Nuclear* (MW)	*Hydro* (MW)	*Total* (MW)
Installed capacity as on March 2004	65142	NG: 12104 Diesel: 1173	3105	29556	111152
Addition of capacity till March 2012	49276	18148	8995	28233	104652
Total capacity as on March 2012	114490	31425	12100	57789	215804

Source Planning Commission (2002)

The future capacity additions in the power sector are expected to be largely in the thermal sector with coal being the predominant and most cost effective fossil fuel in the country.

This being the case, the emission of GHGs from the power sector is likely to increase significantly in the future. Any strategy for mitigation of emissions of GHG from the power sector should centre around the following.

- Improvement in efficiency of the fossil fuel-based power plants by technology upgradation both for the existing plants as well as for the plants to be established in future
- Prevention / reduction in the losses in the process of supplying power from the generating units to the consumers
- Efficiency improvement in the end use application
- Adoption and promotion of non-fossil fuel-based power generation like those based on hydro and other renewable sources of energy.

These options have been briefly described below.

3.3.1.2 Clean coal technologies

Pressurized fluidized-bed combustion

PFBC (pressurized fluidized-bed combustion) is a clean and efficient technology for coal-based power generation which can increase the efficiency of plants up to 43% in a combined cycle arrangement. PFBC technology has the ability to burn low quality fuels, offers fuel flexibility, can remove more than 90% SO_2 (sulphur dioxide), and results in NO_x (oxides of nitrogen) emissions that are between 100 and 200 parts mer million.

The CO_2 reduction from per unit of power supplied at busbar using PFBC, over the conventional technology is estimated to be 0.18 kg. Replacing a conventional plant of 500 MW capacity with a PFBC plant will result in estimated CO_2 reduction of 0.58 MT (million tonnes) a year.

Integrated gasification combined cycle power plant

The efficiency of the IGCC (integrated gasification combined cycle) power plant is the product of the gasification system efficiency and

combined cycle efficiency. These plants are expected to have a net efficiency of 46%, compared to an average of 36% for existing plants. Although IGCC technology is more efficient and environmentally less polluting than ordinary pulverized coal plants, its application requires high investment as compared to conventional pulverized coal technology, making its implementation difficult in a country like India.

It is estimated that IGCC technology will result in CO_2 emission reductions of 0.25 kg/kWh. Replacing a 500 MW conventional plant with an IGCC plant will result in CO_2 emission reduction of 0.69 MT. The proposed IGCC power plant will reduce the emissions of CO_2, SO_2, NO_x, and SPM (suspended particulate matter). It will also reduce solid waste disposal by nearly 70% compared to direct coal-fired plants.

Renovation and modernization of power plants

R&M (renovation and modernization) of power plants can improve the efficiency and reduce GHG emissions at a lower cost without additional infrastructure requirement. However, constraints of the nature of resources, lack of public and government determination, and the absence of stringent environmental laws have always acted as a barrier towards the move.

The APDP (Accelerated Power Development Programme) of the Ministry of Power, launched in 2000/01, provides financial assistance to the states for undertaking R&M programmes and also for strengthening of T&D (transmission and distribution) works.

3.3.1.3 Transmission and distribution loss reduction

In India, average T&D loss reduction have been officially indicated as 25% of the electricity generated. The major reasons for high technical losses in India include overloading of the distribution system, haphazard growth of sub-transmission and distribution system, too many stages of transformations, improper load management, inadequate reactive compensation and poor quality of equipment used in the rural as well as urban areas. Thefts and pilferage also account for a substantial part of the high T&D losses.

It is estimated that the upgradation of the agricultural distribution system can reduce the distribution losses in the sector by 5% to 6%, which is equivalent to an annual energy saving of 6.75 billion units. The upgradation will also improve the quality of power supply in rural feeders, which will act as a catalyst for farmers accepting to pay higher price for the electricity. The financial health of the utility will improve considerably as the improvement is done in the highly subsidized sector. Finally, commercial losses will also be reduced, as pilferage from high-tension circuit is difficult.

3.3.1.4 Demand-side management

DSM (demand-side management) represents a revolutionary approach to planning at electric utilities. Essentially, it broadens the scope of planning to integrate the customer's needs and desires with the utility's goal. DSM activities are designed to influence the electricity demand, for the mutual benefit of the utility and the customer.

In an evaluation undertaken of the expected technologies for thermal power generation including the scope for R&M, it is estimated that in the period 2007–12 about 1980 MW of super critical capacity may be installed and 28 000 MW of existing capacity may be covered under R&M leading to a potential abatement of about 102 MT of CO_2 (Table 3.5).

Table 3.5 Technologies expected in thermal power projects

Option	*Million rupees/MW*	*Efficiency (%)*	*2002–07* *Tenth Five-year Plan*	*2007–12* *Eleventh Five-year Plan*
Sub-critical steam cycle	40.0	35.00	Base technology	Base technology
Super critical steam cycle (240 ata, 540 °C / 565 °C)	44.0	37.10	Not expected to materialize	1980 MW
Ultra-supercritical steam cycle (300 ata, 600 °C / 600 °C)	48.0	40.00	Not expected to materialize	Not expected to materialize
IGCC	75–80	41–42*	Not expected to materialize	Demonstration project expected (500 MW)
Renovation and modernization	10–15	5 to 8	28332 MW	28000 MW

* The Indian power sector is more conservative on the efficiency of IGCC (integrated gasification combined cycle), as compared to international estimates of 46% efficiency

It is important to note that in spite of the tremendous scope and existence of technology options for mitigating the emission of GHGs the efforts in this direction have not been significant. The reason for this is the lack of capital for undertaking such measures. It is expected that CDM will provide the much needed financial resources for undertaking some of the GHG reduction measures.

In a recent study undertaken by TERI for the Ministry of Power (see Box 1), two technological options were considered and examined in the context of CDM, viz., adoption of super critical power plants, and the R&M of existing plants.

Box 1

Clean development mechanism: application to the power sector in India. Report to the Ministry of Power

In recognition of the fact that the power sector has a predominant share in the CO_2 (carbon dioxide) emissions from India, and there are significant opportunities to mitigate these emissions, this project examined select interventions which could be developed as CDM (clean development mechanism) projects.

The two options that were examined related to an advanced power generation technology (super critical thermal power plant) and R&M (renovation and modernization).

The analysis of the super critical thermal power plant establishes the improved efficiency and consequently the emission reduction potential has been estimated to the tune of 654 000 tonnes of CO_2 during the Eleventh Five-year Plan. The additionality issue is based on the fact that the IRR of the advanced technology is lower than the conventional technology due to an additional investment to the tune of 1660 million rupees, and hence may be a deterrent to investors. However it was also observed that the revenues from the CERs generated may not be adequate enough to improve the financial returns of the project substantially. The reasons attributed for the same are that only the two and a half years crediting period is available for the project (as it is expected to start its operation only during mid 2010) and uncertainties associated with the future of CDM beyond 2012.

The R&M of an old thermal power plant not only helps in improving efficiency but also the plant load factor. It also proffers a remedy in a power starved situation, in a shorter time frame compared to Greenfield projects. While R&M has been regarded as an important option by power planners, and incentives have been given for such investments, the drive has not been particularly successful due to the lack of capital and fiscal incentives. This situation could be altered by CDM revenues.

While these two options are significant for the power sector in the country, there is hesitancy in the international scenario for purchasing credits from coal based power plants, even though they represent a relatively 'clean technology'. This being the case, should the government encourage PSUs in the country such as NTPC to develop CDM projects in such areas. What should be the underlying objective for this- to test their case with the Executive Board for approval of methodologies; and to develop a portfolio of such projects and take an early advantage if and when the market desists from cherry picking projects.

3.3.2 *Renewable energy*

3.3.2.1 Background

The renewable energy technologies offer a centralized as well decentralized supply side option. With policy, financial and infrastructural support from the MNES (Ministry of Non-conventional Energy Sources), Government of India, many of the renewable energy technologies have reached near commercialization stage. The status of different renewable energy technologies and their respective potential is given in Table 3.6.

Table 3.6 Potential and achievements for renewable energy technologies

Source/system	*Approximate potential*	*Cumulative physical achievements (as on 31st March 2004)*
Wind energy	45000 MW	2483 MW
Small hydro power	15000 MW	1603 MW
Biomass power / cogeneration	19500 MW	613 MW
Waste-to-energy	1700 MW	41.5 MW
Biomass gasifiers		58 MW
Solar photovoltaic systems		151* MWp
Solar water heating (collector area) sq. m	140 million sq. m	0.8 million sq. m
Biogas plants (nos.)	12 million	3.65 million
Improved cook stoves (nos.)	120 million	33.9 million

* 75 MWp export; MW – megawatt

Source MNES Annual Report 2003/04

For realizing the energy supply options offered by the renewable energy technologies in meeting the energy demands of the rural and remote areas, the Government of India has set an ambitious target in the Tenth Five-year Plan to be implemented from 2003 to 2007 (Table 3.7).

Table 3.7 Renewable energy targets in Tenth Five-year Plan

Renewable energy source	*Target*
Wind	1500 MW
Small hydro power	600 MW
Biomass power/cogeneration	700 MW
Biomass gasification	50 MW
Waste-to-energy	80 MW
Solar photovoltaic power	5 MW
Solar thermal power	140 MW
Total	**3075 MW**

Source Planning Commission (2002)

3.3.2.2 Technology options for CO_2 emission reduction

Depending upon the application, the various renewable energy technologies can be broadly classified into three groups.

- Grid-connected power generation,
- Off-grid power generation, and
- Renewable energy projects for thermal energy and mechanical use.

Considering an additional capacity addition of 10 000 MW by 2012 as projected by the MNES, and power generation from various applications, the cumulative GHG abatement potential from grid-connected RE (renewable energy) power projects, up to 2012 has been estimated. The PLF considered for biomass, wind, small hydro and WTE

(waste-to-energy) are 80%, 25%, 35%, and 70% respectively. Out of annual capacity addition in the WTE sector, around 80% is assumed to come from MSW (municipal solid waste) and methane from the sewage liquid waste and industrial wastes are not considered.

The cumulative GHG abatement potential up to 2012 from RE power projects is 154 MT and from the MSW to energy about 65 MT.

The investment required to implement RE projects to the tune of an additional capacity of 10 000 by 2012 (MW) is estimated to be about 9628 million USD.

3.3.3 *Industrial sector*

3.3.3.1 Background

The CO_2 emissions from the industrial sector can be broadly categorized into two heads: (a) process related emissions and (b) emissions due to fuel combustion in the industries. Of the total estimated 250 MT of direct CO_2 emissions from the industry in 1994, nearly 60% were accounted for due to energy use only (NATCOM 2004). Accordingly industrial processes related emissions account for about 8% of the total GHG emissions.

The process related emissions are a result of non-energy related activities that result in the emission of CO_2. Of the various industrial processes, the two largest sources of CO_2 emissions in India under this category are the cement and steel industry, accounting for nearly 75% of the total process related CO_2 emissions. The other major processes that result in CO_2 emissions are soda ash use, ammonia production, lime production and limestone use, and processes in the ferroalloys industry.

The emissions due to energy use in the industry can be attributed mainly to (a) use of coal, oil or natural gas directly for combustion purposes so as to provide heat for process use (for example, in boilers and furnaces) or for captive power generation and (b) electricity required for running various equipment in the plants and for lighting. In addition, certain industries like metal production (for example aluminium) require large amount of electricity during electrolysis and for electric heating (for example electric arc melting in steel industry).

To meet the growing demands of the teeming millions in the country, the focus would continue to remain on increasing the industrial production in both large as well as smaller units and this sector in the coming decades, thus providing great opportunities for reducing the CO_2 emissions.

3.3.3.2 Mitigation potential

Detailed analysis of the industrial energy-use pattern reveals that around 60%–70% of the total energy consumption in the industrial sector is accounted for by seven sectors namely (1) cement, (2) pulp and paper, (3) fertilizer, (4) iron and steel, (5) textiles, (6) aluminium, and (7) chemicals and petrochemicals. Most of the plants in these sectors are large units, many of them operating under the public sector. In addition to these sectors, there are a few energy intensive sub-sectors operating

under the small scale where energy cost accounts for a major share of the operating cost. Some of the examples of energy intensive small-scale industries are ceramics, glass, foundry, forging, brick manufacture, etc.

Energy efficiency programmes across all industrial sectors hold the promise for cost-effective CO_2 abatement, as a large number of plants in India operate well below the world energy efficiency standards. The CO_2 mitigation projects in the industrial sector could be broadly grouped under four major heads.

(a) Sector-specific technological options,
(b) Cross-cutting technologies,
(c) Fuel-switch options, and
(d) Recycling and use of secondary materials.

Figure 3.3 gives a general classification for the types of projects that could be considered under the above four heads. The following paragraphs briefly describe some of the mitigation options under each of these heads.

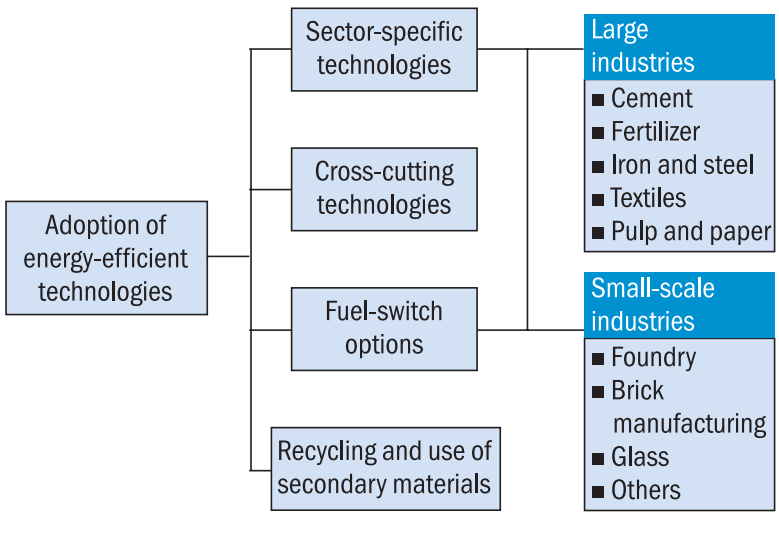

Figure 3.3 CO_2 mitigation options: energy-efficient technologies in industry sector

Cement

GHG mitigation potential in the cement sector lies in bringing down specific power consumption and specific thermal energy consumption. There lies a large scope for improving energy efficiency in the relatively older installations. The possibility for energy saving in different plants varies from 10% to as high as 30%. In addition, there also exists about 160 MW of cogeneration potential in the Indian cement industry.

Iron and steel

Most emissions from the steel industry are emissions related to processes such as quenching, gas recovery, casting, and rolling. In addition, the use of different types of furnaces and fuels also determines the emissions. The CO_2 intensity in the Indian steel industry was about 3.6 tonnes CO_2/tonne of steel, which translates to about 75 MT of CO_2 for the year 1995 (Lynn, Ernst, and Dian 1999). According to an estimate from CII, even updating the open hearth process plants can contribute to about 0.8 million metric tonnes of carbon emissions reduction annually.

Aluminium

The aluminium manufacturing process is electrical energy intensive. The major energy saving opportunities in this sector lie in the switchover to gas suspension calciners (as against rotary kilns), and waste heat utilization and in converting the smelters from Soderberg systems to pre-baked systems.

The other operational improvements include current efficiency improvements and reduction in operating voltage.

Fertilizer

Of the four types of fertilizers – nitrogenous, phosphate, potash, and complex fertilizers – the nitrogenous fertilizer production is highly energy intensive and is one of the largest consumers of petroleum-based fuels. Many of the older ammonia/urea manufacturing plants use liquid fuels (naphtha, furnace oil) as the feedstock but in newer plants, natural gas is the preferred feedstock.

The Indian fertilizer industry has witnessed many changes in the feedstock and technology during the last few decades, resulting in substantial reduction in the overall energy-use efficiency. However, by switching over from fuel oil/naphtha to natural gas and by adopting other energy conservation schemes potential for CO_2 mitigation exist in older plants.

The various energy saving options as described above have been summarized in Annexe 9.

Industrial gases

In the industrial gases category the options considered are HFC (hydrofluorocarbon) waste stream incineration, and N_2O (nitrous oxide) emission reduction.

HFC 23, a GHG under the Kyoto Protocol, is inevitably generated as a by-product in the production of HCFC22 (hydrochlorofluorocarbon). HFC 23 is used in a specific fire fighting application, ultra low temperature application, and in the processing of semi-conductors, but the volume of use is limited.

The Gujarat Fluorochemicals Ltd, in its HCFC production plant in Ranjitnagar, district Panchmahal, Gujarat, is introducing thermal oxidation of HFC 23, the by-product of HCFC 22, as a CDM project.

N_2O emission reduction is possible through thermal and catalytic destruction processes in adipic acid production. A N_2O emission reduction project from India is under the consideration of PCF (Prototype Carbon Fund).

3.3.4 *Transport*

Transport accounts for 10% of India's GDP, and also for a rapidly growing percentage of overall GHG emissions. Though theoretically a very attractive sector in terms of mitigation, individual projects might be too large-scale for CDM and include such activities as road-to-rail modality shift, replacement of 2-stroke by 4-stroke two-wheelers and greener fuels [for example, CNG (compressed natural gas)].[2]

3.3.4.1 Mitigation options

Mitigation of GHG emissions in the transport sector can be achieved through a combination of the following measures. There need to be attractive transportation options that include energy-efficient automobiles, motorized two-wheelers, efficient and affordable public transport, minicars, and 4-stroke engines in two-wheelers. In addition to this, policies should address externalities caused by vehicles and force drivers to face the full social cost of their use through permits and fees to enter cities, parking fees, road tolls, and in general, raising public awareness. Finally, the government should attempt to make available to users an alternative to fossil fuel consuming vehicles by subsidizing bicycles, linking rail and bus services, and rewarding the car sharing programmes. The studies list a number of mitigation areas including BOV (battery-operated vehicle), MRTS (mass rapid transport system), CNG bus, CNG car, and the efficient two-wheeler.

In two AIT (Asian Institute of Technology) case studies on Delhi and Mumbai, the following mitigation options were analysed: CNG for buses and cars, shift from 2-stroke to 4-stroke two-wheelers and BOVs. Of these BOVs had limited technological potential whereas the CNG option actually led to a slight rise of CO_2 emissions. Nevertheless other local air pollutant emissions were also reduced in most cases. The Delhi case study revealed that without GHG reduction targets the cumulative transport system would cost USD 15.1 billion (in 2000 prices) and would emit a total of 30 MT during 1997–2000. Under a GHG constrained scenario Delhi's MACs would range from USD 36 to USD 116 per tonne of CO_2 (USD 17 to USD 24 for Mumbai) and would involve the introduction of CNG buses, CNG cars and 2-stroke to 4-stroke shift for two-wheelers.[3]

[2] Pew Centre transport study
[3] AIT 2002

3.3.5 Municipal waste disposal

Though MSW projects are often seen as low-hanging fruits, ideally suitable for early CDM projects, none of the reports investigate this area in great detail. Arguably the validity of projects generated in this area is dependent on the absence of legislation mandating the flaring of landfill gas. There is also the possibility that even in metropolitan areas waste is not compacted enough to generate the anaerobic conditions needed for optimal methane generation. Moreover there is little waste collection taking place in Indian towns, which means that much waste in cities decomposes aerobically, generating lower methane.

3.3.5.1 Emissions profile

In 1990, methane emissions from MSW disposal were 1.2 MT and grew to 1.82 MT by 1995. Indian methane emissions have their origins mainly in emissions from livestock (42%), paddy cultivation (23%), and biomass burning (16%). The 10% attributable to waste is more easily measurable and thus provides the easiest baseline estimation for CDM projects. The hotspots for methane generation from MSW disposal are above all the metro-districts of Ahmedabad, Bangalore, Chennai, Calcutta, Delhi, and Greater Mumbai (Garg and Shukla 2002).

Based on the targets and plans of the Government of India regarding capacity additions in power and renewable energy sectors and the energy efficiency and technological upgradation being adopted by different industries, the GHG mitigation potential in key sectors till the first commitment period that is, till 2012 has been estimated and presented in Figure 3.4.

This potential aggregates to 417 $MTCO_2$. In contrast, the IEA has projected emissions on the order of 1263 $MTCO_2$ from the fuel combustion sector in 2010, with power sector emissions of 684 $MTCO_2$ from India.

The sectoral potential described above is only the technological potential based on various interventions that are at different stages of planning and implementation. The economic evaluation and CDM eligibility of these mitigation options needs to be analysed in detail. Thus

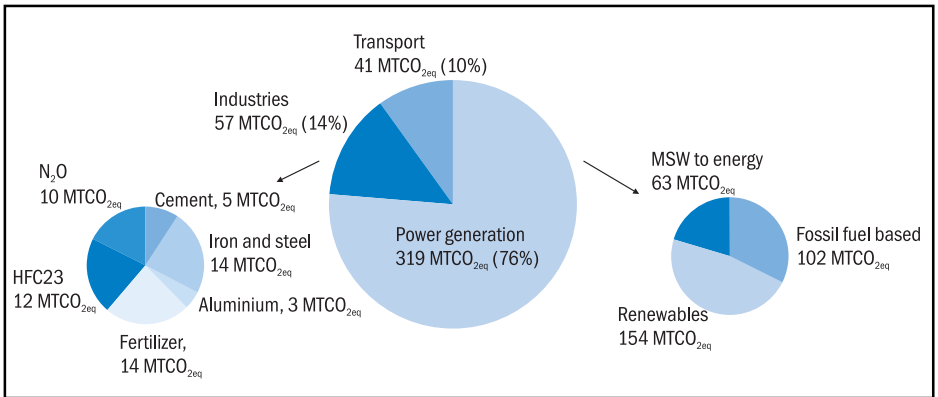

Figure 3.4 GHG mitigation potential in key sectors till 2012

these may at best represent a theoretical short-term potential for CDM. The long-term mitigation potential is significantly larger 865–1018 $MTCO_2$ as identified by ALGAS.

3.4 Conclusion

India has been involved in the international efforts for GHG mitigation not only through three projects undertaken under the AIJ pilot phase, but also through some projects supported by UNDP-GEF. Under the CDM also the Indian industries have shown great enthusiasm by developing a number of CDM projects and the National CDM Authority of the Government of India by according approval to 54 projects as of February 2004.

From the discussion in this chapter it is evident that the potential for reducing GHG emissions in different sectors is significant. There are, however, some technical, financial, and policy barriers that inhibit wide scale adoption of these measures. These are discussed at length in chapter 4. CDM can perhaps help alleviate some of these barriers. The projects and case studies selected for further detailing into PDDs under the NSS, provide an exposition of how some of these opportunities can be developed as CDM projects.

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CHAPTER 4

Issues and concerns in CDM implementation in India

4.1 Aim and approach

Chapter 2 estimates the potential for India for implementing CDM (clean development mechanism) projects to reach a significant 15–25 $MTCO_{2eq}$ (million tonnes of carbon dioxide equivalent) per year target. However, at this relatively early stage of market development, several demand and supply barriers stand in the way of translating this potential into reality.

This chapter assesses the state of preparedness to implement CDM in India by analysing the CDM related activities going on in the country and the prevailing issues and concerns related to the CDM methodologies, approval and implementation as identified by key stakeholders.

This has been achieved through a comprehensive approach including

1 extensive desk review of available literature and learnings from other countries' experiences,
2 hands-on experience while working with the business sector in India,
3 expert consultations, and
4 stakeholder consultations and expectation assessment conducted electronically, during workshops and through personal interactions.

4.1.1 Level of CDM PDD development in India

The first step in the project cycle is the preparation of a PCN (project concept note) and the PDD (project design document). Project developers are often unsure if the proposed activity meets CDM eligibility conditions, and hence hesitate to undertake the costs of project

development. There are differing views among stakeholders whether prioritization of sectors by the government can benefit potential project developers. A section of stakeholders is of the opinion that there should be no such prioritization and all innovative project ideas should be welcomed to take an 'early lead' advantage. However others feel that guidance on preferred sectors, which have large CDM potential and match the government's sustainable development goals, can reduce uncertainties related to HCA (host country approval) and boost the confidence of project developers.

4.1.1.1 Indian National CDM authority approved CDM project activities

The NCA (National CDM Authority) of India has accorded HCA (host country approval) to 54 CDM PDDs, as on February 2005. The PDDs submitted to the NCA belong to the following sectors.

- Renewable energy (biomass power, cogeneration, small hydro, waste-to-energy, and wind energy),
- Industrial energy efficiency including waste heat recovery (iron and steel, hotel, and fertilizer),
- Industrial processes, and
- Municipal solid waste.

The distribution of the projects, and their sector-wise break-up is shown in Figure 4.1. The geographic distribution and description of projects are given in Annexe 10.

The projects approved by the NCA overall represent the sectoral project development in the country with renewable energy sector taking the lead. Off late, two methodologies for projects in the power sector have been submitted to the CDM EB (Executive Board), however, they have not applied for HCA so far.

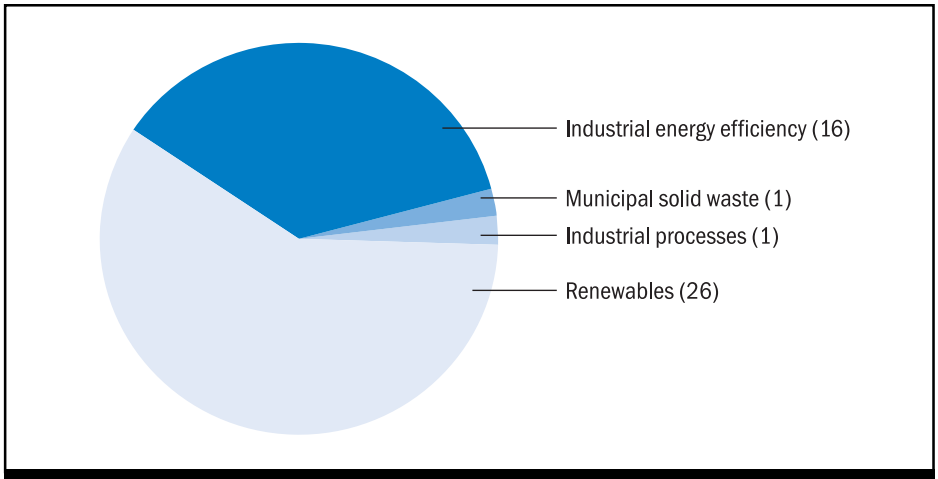


Figure 4.1 Sectoral distribution of projects approved by NCA (as in December 2004)

4.1.1.2 Review of existing pipeline of potential CDM projects at the sectoral level

India's active participation in CDM has largely been driven by consultants who are playing a crucial role in convincing the promoters of the project for CDM opportunities. Projects are being developed in unconventional sectors viz., fluoro-chemicals and aluminium industries too (apart from the intense activity in the renewable energy sector), which exhibits increasing understanding and competence in identifying a diverse CDM portfolio.

The implementation of capacity building initiatives by several international donors in close association with Indian institutions is one of the major motivating factors for the enhanced participation of the private sector in CDM. The outreach activities included awareness workshops, conferences, business meets, and training programmes targeting the Indian private sector. Such initiatives had propagated awareness and the benefits of project development. A few donor initiatives built the capacity of the private sector by facilitating funding for developing CDM PDDs. The rationale behind such initiatives was to demonstrate the CDM ability of projects in the targeted sectors and understand critical issues and challenges while developing the PDDs. The sectors in which PDDs are being developed under several donor programmes in India are provided in Table 4.1. The various donor programmes going on in the country are given in Box 4.1.

Box 4.1 Donor programmes in India

The Prototype Carbon Fund operated by the World Bank is being implemented by the IDFC (Infrastructure Development Finance Company) in India. IDFC has processed over five projects of different sizes in the infrastructure and energy sectors. These include projects that IDFC shall consider for financing, in addition to facilitating CDM (clean development mechanism) transaction.

Rabo India, owned by the Rabo Bank of the Netherlands, launched the carbon advisory services in India (in February 2003). The bank will arrange the sale of CERs (certified emission reductions) under the CDM from projects in India to the Dutch government. Winrock International India is the official CDM specialist to the Rabo India carbon advisory services. Details of the PDDs developed under this carbon fund are not available in the public domain.

MGM International Ltd, an international private company, invited project ideas from the Indian private sector to fund the development of PDDs.

Natsource LLC, through its Canadian subsidiary GCSI (Global Change Strategies International Co.), and in partnership with the Government of Canada, has launched a Canada–Natsource PDD development facility. They have invited PINs, (project idea notes) for extending zero interest loans to fund around eight to ten PDDs in India. The facility received 43 PINs, and selected a few for PDD development and has announced the second call for PINs.

Japan Carbon Finance Ltd has recently launched the JCF (Japan Carbon Fund), to the tune of 140 million USD. JCF has teamed up with TERI (The Energy and Resources Institute) for sourcing CDM projects in South Asia, including India. TERI and JCF shall be evaluating the projects, qualified for purchase of CERs.

Table 4.1 Project design documents funded by international donors in India

Sector	Donor agency							Under call for CDM tenders		
	GTZ India	Canada: PIAD	FCO, UK, eco securities	Japan: NEDO	EU: IT power: ECN	IDFC: PCF	Rado India	CERUPT	SICLIP (Sweden)	Finland
Renewable energy					■					
Wind power	■	■					■	■		
Small hydro	■	■								
Biomass		■					■	■	■	■
Cogeneration						■				
Waste-to-energy	■					■				
Solar		■								
Energy efficiency	■	■	■	■		■				
Transport	■			■						
Fuel-switch	■					■				
Coal-bed methane	■									
Power sector	■									

GTZ – German Agency for Technical Co-operation; PIAD – Pembina Institute for Appropriate Development; FCO – Foreign Commonwealth Office, United Kingdom; NEDO – New Energy and Industrial Technology Development Organisation; EU – European Union; ECN – Energy Research Centre, The Netherlands; IDFC – Infrastructure Development Finance Company; PCF – Prototype Carbon Fund; CERUPT – certified emissions reduction units procurement tender; and SICLIP – Swedish International Climate Investment Programme

4.2 Issues and concerns in CDM project cycle

The CDM project cycle, as agreed in the Marrakesh Accords (2001) is presented in Figure 4.2. At each step of the cycle, there continue to be ambiguities in interpretation, unresolved issues, and lack of clear-cut guidance.

Table 4.2 highlights major issues related to specific steps in the CDM project cycle. The chapter also discusses other generic issues related to CDM such as transaction costs, and unilateral projects.

The issues related to ownership and sharing of CERs, taxation, etc. have been covered in chapter 6 as a part of the facilitative framework for CDM implementation.

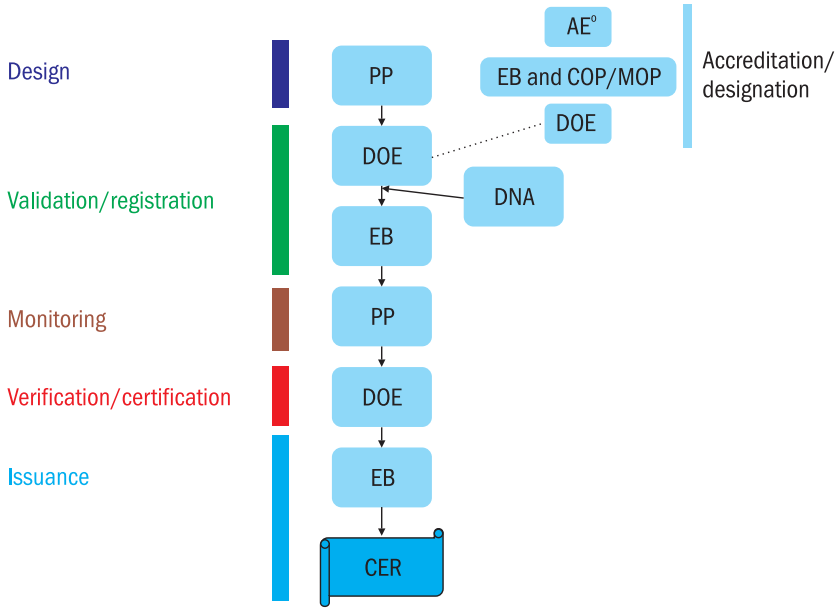
Some of the issues identified above are further discussed in detail.

4.2.1 *UNFCCC guidance on baseline methodologies*

Article 12.5 of the Kyoto Protocol requires that a CDM project activity lead to 'real, measurable, and long-term benefits' related to the mitigation of climate change, and result in 'reduction in emissions that are additional to any that would occur in the absence of the certified project activity'.

This requires defining a baseline (the business-as-usual scenario) against which the emission reductions are calculated, and monitored at regular intervals.

Project participants interested in registering a CDM project activity are required to use baseline and monitoring methodologies previously approved by the EB, or propose a new methodology to the EB for consideration and approval. Project developers are often not clear up to



AE – applicant entity; CER – certified emission reduction; CoP – Conference of the Parties, DNA – Designated National Authority; DOE – Designated Operational Entity, EB – Executive Board; MoP – Meeting of Parties; PP – project proponent

Figure 4.2 CDM project cycle

Source http://cdm.unfccc.int

Table 4.2 CDM project cycle-related issues

Project steps	*Key issues*
Project conceptualization	The project developers are often not sure whether a project being undertaken by them will be eligible for CDM
Host country approval	The MoEF (Ministry of Environment and Forests) has brought out interim approval criteria,* but greater clarity is required to understand the application of these criteria
PDD (project design document) preparation	▪ Availability of limited number of approved methodologies is a bottleneck ▪ Consolidated methodology approved by the EB (executive board) may be difficult to comprehend and apply in a developing country context due to data constraints ▪ Demonstrating additionality crucial yet difficult
Validation of PDD by DOE (designated operational entity)	▪ Choice of validator function of mutual consent of buyer and seller, but buyer may exercise his preference for an internationally renowned DOE, which may lead to higher transaction costs ▪ Government of India keen on a national DOE due to a perception of higher charges by international DOEs** ▪ However, the liabilities attached to the accreditation as a DOE may pose a barrier in emergence of national operational entities

Continued...

Table 4.2 CDM project cycle-related issues (*Continued...*)

Project steps	*Key issues*
Registration with the CDM EB (Executive Board)	■ Only one project has been granted registration by the EB until now, which is being perceived as a protracted international process for registration*** ■ Request for reviews by the EB on projects that have cleared all requisite stages for registration may dampen the project submissions
Project implementation	■ Integration of CDM revenues in project financing lacking; most financial institutions do not yet know how to properly value the CER revenue stream in carbon purchase transactions ■ Risk of non-delivery of CERs due to non-performance necessitates risk management measures
Monitoring	Rigorous monitoring and verification contribute to transaction costs, which can make smaller projects financially unviable, although rules for small-scale projects provide some relief
Verification and certification of emissions reduction	Lower frequency of verification, as suggested by some stakeholders, lowers transaction costs but may reduce the current market value of CERs, as the buyers would provide a discounted price for such CERs
Issuance of CERs	Once the request for issuance of CERs is submitted to the EB, the only issue remaining may be the time taken for actualization of revenues from CERs

* Details available at <http://www.envfor.nic.in/cc/cdm/criteria.htm>, last accessed on 14 February 2005

** ICFRE (Indian Council for Forestry Research and Education) is preparing its application for DOE status for the LULUCF sector

*** According to one estimate, the CDM EB must approve about 1700 projects by 2010 to meet annual global demand for CDM credits of 428 $MTCO_{2eq}$ (RFF 2004)

what activity they should fix up the project boundary and account for the emissions and leakages. It is believed that the learning from the newly approved methodologies will provide additional guidance on this issue.

4.2.1.1 Approval of new baseline methodologies

Of the 86 new methodologies submitted to the CDM EB by February 2005, 19 methodologies from nine sectors are from Indian projects (Annexe 11). Out of these, two methodologies in the municipal solid waste and bagasse cogeneration sectors have been approved by CDM EB and two are under reconsideration. One methodology from the bagasse cogeneration was withdrawn and four were rejected. These belong to four different sectors namely, biomass power, bagasse cogeneration, steel sector, and municipal water utilities. The decision on one grid-connected bagasse power project is kept pending by the CDM EB due to the METH Panel's suggestion of applying the consolidated methodology proposed by the latter.

The high rate of failure of the submitted new baseline methodologies surprised some market observers. The major shortcomings of the submitted methodologies relate to data inconsistencies, missing reference and units, and inadequate documentation. Further choice of baselines that inflate CERs and inadequate treatment of leakages are some other shortcomings of the submitted methodologies.

Many new methodologies failed to provide documented and verifiable data on barriers, such as that on prevailing practice or investment barriers, but relied solely on 'anecdotal evidence', which is not sufficient to demonstrate additionality. Given the project-wise approach to developing methodologies (as requested by the parties), it is understandable that many project proponents submit less conservative methodologies, to probe the lowest limit of acceptability of the EB.

The approval and consolidation process of new baseline and monitoring methodologies in the EB is a slow process due to limited resources at the disposal of the CDM EB. This results in delays between the submission of methodologies and the final decision of the CDM EB on its approval, reconsideration, or rejection of submitted new baseline methodologies. With the pipeline of CDM projects increasing over time, the situation may exacerbate in the coming months. With this, PDD developers run the risk of their methodology being obsolete during the process of development and its approval, necessitating its update and adding to the transaction costs.

The window of opportunity for CDM within the first commitment period is closing fast. Activities to draft robust new methodologies for all relevant sectors and project types should be increased by both project participants and the EB.

4.2.1.2 Demonstration of approved methodologies on projects in India

The list of approved methodologies under the SSC (small-scale CDM) and the new methodologies by the METH/CDM EB has influenced the sectors in which the PDDs are currently developed. This is evident from the PDDs developed under various international donor programmes, tenders and validation. A brief of the replication potential of few of the approved methodologies for sectors in the country is given in Table 4.3. For example, the CDM EB's first approved methodology for destruction of HFC (hydrofluorocarbon) (AM0001) had a positive impact for Indian HFC destruction projects. As a result, one project promoted by GFL (Gujarat Fluorochemicals Ltd) adopting the approved methodology, completed the validation and applied to the CDM EB, requesting for registration. It had also closed the deal and the CERs (certified emission reductions) are purchased by a UK company, INEOS Fluor, who is supplying the HFC destruction technology to GFC. Following this, Indian industries such as Shriram Fertilizers Ltd, with potential for HFC destruction have initiated CDM project development activities.

Table 4.3 Replication potential of approved methodologies in India

Approved methodology	*Sectors that hold potential for replication*	*Estimated potential emission reductions* (million CERs)
Incineration of HFC23 waste streams (AM0001)	Refrigerant / fluoro-chemicals industries	10–15*
Grid-connected biomass power generation that avoids uncontrolled burning of biomass (AM0004) Analysis of the least-cost fuel option for seasonally operating biomass cogeneration plants (AM0007)	Grid-connected biomass power projects Biomass cogeneration projects	85**
Biomethanation of MSW (municipal solid waste) in India, using compliance with MSW Rules (AM0012)	MSW-to-energy projects based on biomethanation	65***

* per year, from four major producers

** cumulative (between 2003–12), including bagasse cogeneration (refer chapter 3 for estimation details)

*** cumulative (between 2003–12), including methane and CO_2 emissions (refer chapter 3 for estimation details)

HFC-based CDM projects may reduce the market for CDM in other sectors due to the huge volume of CERs being generated at a relatively lower cost. Also the revenues from HFC CDM projects may increase generation and use of HCFC (hydrochlorofluorocarbon). Thus, based on the information that has emerged since the approval of methodology AM0001, the CDM EB in their seventeenth meeting in December 2004 based on the METH Panel's review and recommendation, approved that AM0001 is applicable only for existing HCFC production facilities.

Gradually the EB is approving methodologies in the power and industrial energy efficiency sectors, which have a huge CDM potential. Indian project proponents have also submitted some methodologies in these sectors.

4.2.1.3 Consolidated baseline methodologies

CDM EB has recently approved the consolidated baseline methodologies for grid-connected renewables and landfill projects. The consolidation of methodologies has been a long awaited step to streamline the process for baseline methodologies, as the current project-by-project approach led to the submission of a multitude of rather similar, though not fully consistent new baseline methodologies.

The use of a consolidated baseline methodology in a project provides the project proponent with a reduced level of uncertainty regarding EB approval. On the other hand, the consolidated methodologies require a lot of data (for example, on the grid characteristics, merit order dispatch, etc.). For a vast country like India, a prescription in the form of a consolidated methodology does not take into account differing regional

situations and circumstances. In the absence of publicly available data on grid emission factors etc., the data intensity which is implied by this methodology may deter project proponents from developing CDM projects. To escape these requirements, the project proponent may therefore decide to submit a project-specific methodology with lower data requirements.

Despite CDM EB's clarification on the validity of the methodologies approved prior to the introduction of consolidated methodologies, and the decision to continue with submission of new methodologies with adequate justification, even after the introduction of consolidated methodologies, there are some outstanding concerns.

Application of the consolidated methodologies for grid-connected electricity generation from renewable sources, excludes biomass-based electricity generation, as leakage issues related to the biomass market have to be resolved. Further, the underlying objective of simplifying the approval of new methodologies, streamlining the process, and reducing the transaction costs, has been somewhat undermined by the high data requirements of all the techniques prescribed, with no justification of why and under what circumstances the different alternatives can be resorted to.

The present and future power scenario in India is mainly dependent on coal. With higher capacity power plants and efficient technologies, the 'low-cost most probable option' for power generation in majority of the cases would be coal-based power generation. And these plants would be partially running under the 'must run' condition and partially on the 'margin', and determination of this ratio will become important under a given scenario, for a given grid. These complexities may inhibit development of projects in the power sector, which has been identified as a major source of GHG emissions.

4.2.2 Establishing project additionality

Various approaches to define additionality were proposed during the negotiations of the Marrakesh Accords, which finally provided that 'a CDM project activity is additional if anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.'

4.2.2.1 Executive Board guidance on establishing additionality

The tenth session of the CDM EB in July 2003 suggested a two-step approach for establishing additionality (See <http://cdm.unfccc.int/EB/Meetings/010/eb10repan1.pdf>)

- Establish through a barrier test that the project is not (part of) the baseline scenario and hence different from the business-as-usual
- Calculate the GHG emissions reduction by designing an appropriate baseline using one of the approaches mentioned under paragraph 48 (a)–(c) of the Marrakesh Accords.

The CDM EB, during its sixteenth meeting approved the METH Panel's proposal on 'Tools for the demonstration and assessment of additionality' (See <http://cdm.unfccc.int/EB/Meetings/016/eb16repan1.pdf>) taking into account the comments received from different experts. The tool recommends a step-wise approach to assess additionality; include identification of alternatives to the project activity, investment analysis to determine that the proposed project activity is not the most economically or financially attractive, barrier analysis, analysis of other common practices and impact of CDM registration on economic, financial and other identified barriers. The tool standardizes different approaches that have been used in earlier methodologies and therefore brought much sought clarity to project and PDD developers. Also, the application of the tool is not mandatory, but may reduce the cost for developing PDDs, as no new additionality tools have to be developed for every new PDD; the PDD can simply refer to the tool.

The major concerns with this tool are as follows.

1 Project developers may have reservations in disclosing project financial details. The low CER prices may further limit the ability to demonstrate investment additionality
2 Limitation on project developer's part to provide adequate documentary evidence for CDM-related decisions for projects under various stages before this tool has emerged
3 Additional data and analysis requirement for demonstrating additionality using this tool will be an extensive exercise for project proponents and would add to the transaction cost.

Considering the above and other concerns expressed by a part of the CDM community during CoP (Conference of the Parties) 10, the CoP in its decision recalled that, as indicated by the EB in their sixteenth meeting, the use of the tool is not mandatory for project participants and also encouraged the EB to keep the tool under review, taking into consideration inputs from Parties. (See <http://unfccc.int/files/meetings/cop_10/adopted_decisions/application/pdf/16_cp_l_2.pdf>.)

Another equally important decision by the EB during its sixteenth meeting was on the clarification on the treatment of national and/or sectoral policies and regulations (paragraph 45 (e) of the CDM Modalities and Procedures) in determining a baseline scenario (See <http://cdm.unfccc.int/EB/Meetings/016/eb16repan3.pdf>). The details of this decision and its implications are discussed in chapter 6.

The EB has however approved a project that falls under the Solid Waste Handling and Management Rules, 2000 of the Government of India. This may indicate that the EB supports projects which fall under a legislation but may not have sufficient compliance due to various inherent barriers.

4.2.3 Financing of CDM projects

This section looks into financing issues related to structuring of the necessary equity and loan for CDM projects.

4.2.3.1 Issues affecting financing

One of the most important barriers to the further development of CDM is the hesitation of local banks and investors to provide upfront equity and loans for projects. Some of the concerns of the financial institutions are

- lack of clear policies regarding DNA (designated national authority) preferences for project approval,
- large time involved in getting projects cleared (for example, land clearance, EIA, etc.),
- uncertainties regarding CERs generation,
- lack of skills among FIs (financial institutions) regarding CDM project cycle, and
- large time involved in realizing the returns from the project activity.

In most of the ongoing initiatives in India, CER investors prefer not to pay upfront for CERs but to pay as the project performs and deliver CERs. Certain carbon purchase tenders mention penalty clauses for non-delivery, which also deters project developers from participating.

4.2.3.2 Key risks and their allocation

The risk components in a CDM project are summarized in Table 4.4.

Table 4.4 Risk components in a CDM project

Uncertain revenues	■ CER (certified emission reduction) quantity risk ■ Baseline risk: baseline may need to be adjusted during the crediting period due to technological innovation, new host country energy or environmental policy ■ Baseline emission risk: changes in the activity level resulting from uncertain demand, technological under-performance, business interruption etc. ■ CER price risk: uncertain market price for CERs
Uncertain costs	■ Abatement costs: uncertain investment costs and fuel prices ■ Transaction costs: uncertain market transaction costs and project cycle costs
Uncertain crediting lifetime	■ Uncertainty if renewal of the crediting period will be possible after 7 or 14 years
Uncertain discount rate	■ Problems in determining the relationship between the project risk and general market risks
Uncertainties related to CER generation	■ Demand- and market-related risk which affects the activity data ■ What happens if the CERs are less than expected/estimated ■ Penalties for non-delivery of CERs ■ Insurance industries or other agencies to cover such risks

Source Janssen (2001), complemented by TERI

4.2.4 Contractual framework, liabilities (private contract arrangements)

In order to address some of the risks identified in the previous discussion and avoid conflicts among different stakeholders in the CDM process, it is necessary to have strong contractual agreements between the CER seller and buyer. Box 4.2 highlights some of the important provisions that any contractual agreement should contain. Experience from a few projects under different carbon tenders and the contractual provisions covered therein are given in Annexe 12.

The allocation of liabilities between the buyer and the seller has a direct impact on the CER price for example recent international experience has shown that prices as high as USD 6–7/tonne of CO_{2e} are available if the non-delivery risk is on the seller, while the price is in the range of USD 3–4 if the risk is on the buyer. The non-delivery risk for the seller often comes with an attendant foreign exchange risk that comes into effect if the seller defaults in delivery of the credits and has to purchase in the international market.

Box 4.2 **Some important contractual provisions to cover the interests of buyers and sellers**

Contract clauses	*Buyer's interest*	*Seller's interest*
Substance to be transferred	CERs (certified emission reductions) only recognized form of emission reduction for compliance purposes	VERs (verified emission reductions): receives payment under the ERPA, therefore obligation deemed completed with transfer of VER
Ownership of GHG (greenhouse gas) reduction	Insist on contractual warranty – GHG reduction rights possessed fully by the seller – no encumbrances	Ensure that GHG reductions not assigned to third parties
Transfer of legal title of CERs	Issuance of CERs into the account at the earliest	Transfer of title only when payment has been made by the buyer
Terms of payment	Procure CERs at a fixed rate: specify price of additional CERs/ right of first refusal	Only specify the price of the CERs generated under the contract
Mutual indemnities	Limit liability to payment of the price of the contractual CERs	Undertake liability only when matter is under his absolute control
Dispute resolution mechanism	International arbitration	Negotiations/mediation/domestic litigation
Applicable substantive law	International rules of commercial arbitration	Domestic law

Source UNEP (2004)

4.2.5 Transaction cost

High TAC (transaction cost) of CDM project development and implementation is a major concern of project proponents. In several cases, the project proponents find that the high TAC is not even offset by the CDM revenues. This is more so in case of small-scale CDM projects.

TACs are the costs that arise from initiating and completing transactions, like finding partners, holding negotiations, consulting with experts (including the legal experts), monitoring agreements etc. (Coase 1960).

TAC estimates by different German researchers give a range of USD 50 000 for JI projects in the countries with EIT (economies in transition) and USD 200 000 up to USD 400 000 for CDM projects. Most figures available in the literature refer to the World Bank's average assessment of USD 250 000–300 000 TAC which refers to larger CDM projects in the 0.5–1 million CER range.

Though the absolute TAC for small-scale projects may seem low, the ratio of TAC to the total project cost comes to be very high compared to large-scale projects, as can be seen from the study by Michaelowa and Jotzo (2003) (Table 4.5). Due to such relatively high transaction costs, most small-scale CDM projects become uneconomic and even unattractive to investors due to their low volume of CERs. Thus, the investors will prefer large-scale CDM projects earning a large volume of CERs.

TACs of the first-of-its-kind projects are very high. It is expected that TAC will decrease once more and more experience is gained, and more approved methodologies, guidelines and case studies are available.

4.2.5.1 Estimates for transaction costs in India

Based on the experience of evaluating projects at IDFC (Infrastructure Development and Finance Corporation) the TACs are worked out and given in Table 4.6 below. The costs in some cases are lump sum costs assumed for the transactions, such as appointment of OEs, EB charges etc.

In addition to the above, Table 4.7 provides approximate TACs associated with the project due diligence which are not directly related to the transfer of CER.

Based on the above estimates, it can be seen that the upfront project development costs, including CDM transactions and due diligence are expected to vary between rupees 3 million and 12 million rupees (between USD 65 000 and USD 250 000)

Strategy for transaction costs reduction

Given below are some approaches for reducing TACs

(a) *Combining synergies with conventional financing*

Synergy between the conventional local financing and carbon financing may bring down the buyer-seller TACs by almost 40% –65%. Further as the TACs are normally recoverable through

Table 4.5 Project size and transaction costs

Project size	*Reduction* (TCO_{2e}/year)	*Transaction cost* (USD/TCO_{2e})
Very large	>200 000	0.1
Large	20 000–200 000	0.4–1.3
Small	2000–20 000	13
Mini	200–2000	130
Micro	<200	1300

Source Michaelowa and Jotzo 2003

Table 4.6 Transaction cost estimates in India

Sl. No.	*Activity*	*Costs* (Indian rupees in thousands) *Min*	*Max*	*Type*
1	Preparation of project design document	600	1775	Upfront
	Developing the baseline for the project	100	375	
	Developing monitoring and verification protocol	50	250	
	Additionality analysis	50	250	
	Sustainability analysis	20	100	
	Sectoral analysis	20	100	
	Environmental and social impact assessment	300	500	
	Finalization of PDD	60	200	
2	Host country endorsement	140	350	Upfront
	Preparation of documentation for submission to DNA	20	100	
	Presentation/discussion with DNA (including travel)	100	150	
	Responding to queries	20	100	
3	Methodology approval from CDM EB	120	525	Upfront
	Inviting/evaluating proposals and hiring an OE for methodology submission to EB	40	150	
	Complying with METH Panel's/EB's comments/observations	80	375	
4	Validation of PDD	780	1800	Upfront
	OE's fees	700	1500	
	Complying with OE's comments/observations	80	300	
5	Project registration with EB	225	1350	Upfront
	Registration fees	225	1350	
Total upfront (sum of 1 to 5)		**1865**	**5800**	
6	Verification and certification*			Upfront/ periodic
	Inviting/evaluating proposals and appointing a certifier	40	150	
	Certifier's fees	700	1500	
Total periodic costs (6)		**740**	**1 650**	

*These are assumed costs as no project has reached this stage

DNA – Designated National Authority; CDM EB – clean development mechanism Executive Board; OE – operational entity

Source IDFC experience (2004)

Note The exchange rate assumed is 1 USD = 45 Indian rupees

Table 4.7 Transaction costs associated with project deal

Activity	*Costs* (Indian rupees in thousands) *Min*	*Max*
Project technical due diligence	100	750
Project financial due diligence	100	1250
Project legal due diligence	100	500
Documentation and contracting	200	2000
Total	**500**	**4500**

Source IDFC experience (2004)

the financing spread and commitment/appraisal fees, this cost can possibly be largely avoided for CDM transactions.

(b) *Use of local skills and consultants*
The larger analysis already assumes a mix of local and international consultant use. It is estimated that engagement of local expertise, especially in the areas of validation, can bring down the fees (maximum costs) by about 30%. It should therefore be possible to define an outer limit for the CDM upfront transaction costs.

(c) *Bundling of projects*
Bundling of several small-scale projects into one may help to reduce the TACs. The issues attached to bundling are discussed under the section on 'experiences and lessons from bundling small-scale CDM project activities' in chapter 5.

(d) *Unilateral projects*
Unilateral CDM projects arise when a developing country, or an organization within a developing country, undertakes a CDM project without using an Annex I country as a partner. Unilateral projects may bring down the TACs initially by way of reducing the partner search and negotiation costs. However, at a later stage, the project developer would need to find a buyer. Issues associated with unilateral projects are discussed in the following section.

4.2.6 Unilateral projects

A unilateral CDM project is a project developed, financed and implemented by the host; no foreign investment takes place. The project owner sells independently produced CERs to interested entities in Annex I countries.

The decision 17/CP.7 (Conference of the parties 7) in the Marrakesh Accords does not provide a clear-cut directive regarding the inclusion or exclusion of unilateral projects. However, there is a divided opinion on the subject with the opponents of such projects citing that the original spirit of Article 12 envisaged CDM as a bilateral arrangement working to

the mutual benefit of Annex I and non-Annex I countries. They also cite fears that if unilateral CDM is allowed, the developing countries would develop their low-cost mitigation projects and sell their low-hanging fruit, and limit their recourse to high-cost option if and when they have to take future mitigation commitments. The proponents, on the other hand, feel that through unilateral project development, an initial seeding of the CDM market is taking place, especially when the buyers are few, and cautious, and no investment and technology flows are taking place as originally expected. Also this provides an incentive to the developing countries to develop projects which are truly in line with their development priorities including sectoral initiatives/ programmes.

Also the question related to selling off low-hanging fruits can be countered by the fact that these low- hanging fruits would not see the light of the day, and unilateral CDM could be used as an incentive to projectize them, bank them and sell them at a later date or use them for meeting commitments if such an eventuality becomes a reality.

Many of the projects being developed in India are unilateral in nature, and in this context it would be useful for the Indian negotiators to seek sanctity for such projects.

Many of the issues related to project development approval as discussed in this chapter have also been reconfirmed by the PDD development undertaken as a part of the NSS and are presented in chapter 5. Further, based on the findings in this chapter and those in chapter 5, elements of a facilitative framework have been analysed and presented in chapter 6.

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CHAPTER 5

Lessons learned from small-scale PDD development

5.1 Introduction

This chapter brings together the analyses of previous chapters with a review of project ideas to explore the application of CDM (clean development mechanism) methodologies in India. It draws upon the potential for CDM projects in key sectors (identified in chapter 2), the state of the CDM market, and prospects for India's participation assessed in chapters 3 and 4, and the national and international CDM procedural framework reviewed in chapter 6. The chapter starts with the review of projects received in response to the call for PINs (project information notes) from the Indian project developers. Five project ideas in key sectors are selected for the purpose of demonstrating baseline methodologies and additionality issues. The five PDDs (project design documents) are provided in a CD-ROM along with this report. The lessons learned by the NSS (National Strategy Study) team in preparing these five projects, along with the experiences shared by project developers and consultants, are used to develop framework for facilitating further development of CDM in India, with reference to large-scale, small-scale, and bundled projects.

5.2 Sector-wise project information notes

During the launch of the NSS, a call for PIN for developing few PDDs was made. Subsequently the call for PINs was also made through TERI-NSS website.[1] Key stakeholders were also contacted by the TERI-NSS team inviting PINs.

In response to a nation-wide call for PINs, TERI-NSS received 68 PINs from various sectors (in the first month and only dedicated to this

[1] Details available at <www.teriin.org/nss>

process). The number of PINs received, sector-wise, are given in Table 5.1. This is by far more than the number of project ideas received in other NSS. This demonstrates the level of CDM awareness in India.

Table 5.1 PINs received under NSS call

Sector-wise PINs	*Number*
Power[a]	4
Renewable energy	27
Waste-to-energy	11
Industrial energy efficiency,[b] fuel switch and MIC[c] in cement	21
Transport	2
Industrial process	0
Building sector	2
Agriculture	1
Total	**68**

[a] Includes one project proposing demand side management and energy conservation in reducing power consumption in one Indian state

[b] Excludes energy efficiency related projects from the power sector

[c] Substituting clinker with mineral components (fly ash, steel plants slag, etc.)

The summary of the PINs received is enclosed as Annexe 1.

5.2.1 Geographical distribution

PINs were received from all the regions of the country. Northern India was the most represented region, followed by the southern and western regions.

5.2.2 Characteristics of PINs

The details provided in the PINs varied widely with respect to CER (certified emission reduction) volume, project cost, project status etc. A few PINs provided only the project concept. The PINs received, clearly showed interest in developing small-scale CDM projects (31 out of 68). This may be due to the fast tracking status and simplified modalities and procedures available for such projects. Further the call for PINs was attractive for small projects in need of finance for PDD development.

5.2.3 Sectoral representation

The renewable energy sector dominated among the PINs received, representing wind, small hydro, biomass power, biomass gasification, bagasse cogeneration, and solar thermal. In the energy efficiency, fuel switch and MIC (substituting clinker with mineral components) category, industries like steel, cement, foundry, brick, glass, petroleum refinery, paper mill, and fertilizer were represented. Municipal solid waste and poultry litter projects were received in the waste-to-energy category. In the power sector, a PIN from a public utility discussed implementation of a supercritical plant for a 1980 MW power plant.

The PINs received represent mostly the CO_2 (carbon dioxide) gas emission reduction projects. Projects reducing non-CO_2 gas emissions (namely HFC, PFC, etc.), energy efficiency in buildings, industrial energy efficiency in cement, textile, aluminium, and sugar sectors were not received. Given its significant contribution to the national inventory emissions, the transport sector was weakly represented.

Very few projects proposed technology transfer namely steel industry energy efficiency, fertilizer, and waste-to-energy. All other proposed projects relied on domestic technologies. This is remarkable given the fact that CDM was designed to promote technology transfer.

5.2.4 Emission reduction potential

The total annual emission reductions from all the projects received is roughly estimated to be about 50 $MTCO_{2eq}$ (million tonnes of carbon dioxide equivalent). The emission reduction contribution from various sectors is provided in Figure 5.1. Only one project from the power sector contributed by far the highest share to emission reductions (30 million CERs), proposing demand side management and energy conservation for reducing power consumption in the entire state of Madhya Pradesh. Another large CER volume project (10 million/year) was also proposed by the same project developer in the state of Madhya Pradesh through rural electrification from renewables.

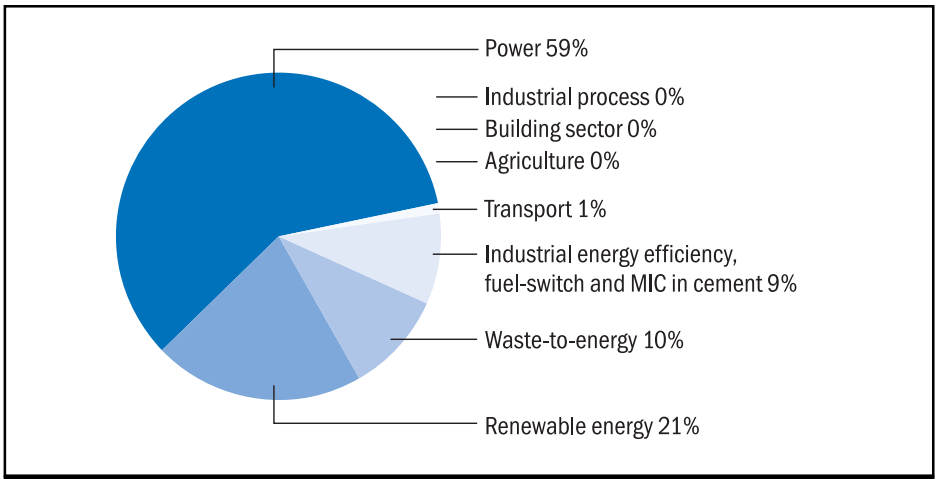

Figure 5.1 NSS PINs: percentage distribution of sectoral annual generation of CERs

5.2.5 Project promoters

The participating promoters belong to various sectors such as the joint and the public sector, state nodal agencies, private companies, consultants, financing institutions, and NGOs.

5.2.6 Subsidies

All the PINs for renewable energy projects, including waste-to-energy, have indicated to avail subsidies (capital or interest subsidy). Though the power sector enjoys indirect capital subsidy, details of the same were not available in the PIN.

The method of evaluating, shortlisting, and selecting PINs for PDD development is described in Annexe 15.

5.3 Results and lessons from PDD development and case studies

5.3.1 *Overview on selected NSS case study projects*

Out of 68 PINs, five projects from three sectors were shortlisted for PDD development, based on the evaluation as provided in Annexe 14.

- Grid-connected small hydro power project in Himachal Pradesh,
- Pelletization of municipal solid waste project in New Delhi,
- Energy efficiency in the small-scale foundries in Gujarat,
- Energy efficiency in the municipal street lighting in Karnataka, and
- Renewable energy-based rural electrification in Orissa.

A project brief for each of the five shortlisted PINs is provided in Annexe 15. The state-wise mapping of these shortlisted projects is provided in Figure 5.2.

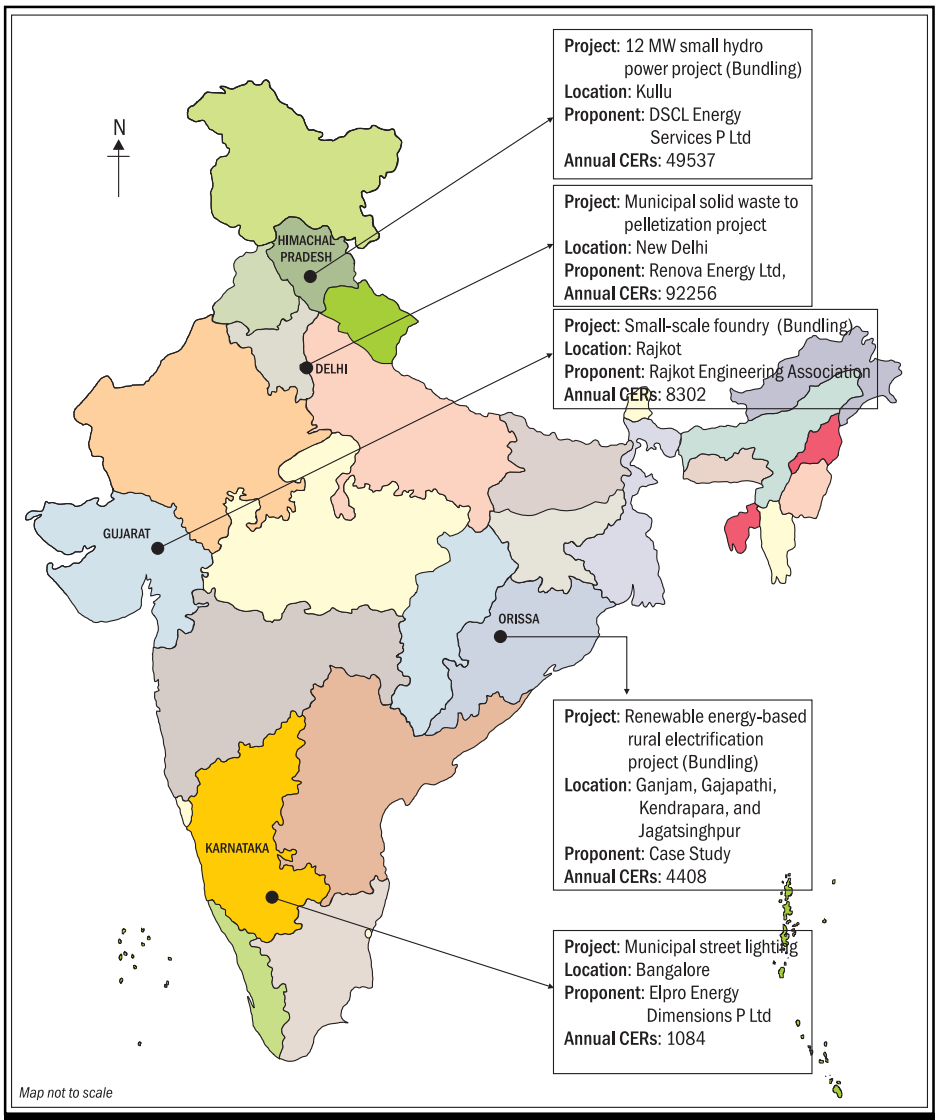

Figure 5.2 State-wise mapping of projects shortlisted for PDD development: summary map

All the five shortlisted projects belong to the small-scale CDM projects category. The selection reflects an emphasis on small- scale projects, which is not an indication of the Government of India's intent to promote projects of this scale only. Rather, it is an indication of the importance TAG (technical advisory group) accorded to using public funding to analyse issues and garner new knowledge in areas and projects that would not normally be addressed by commercial operations. A case in point is the case study on rural electrification and its development into a PDD.

The details of the PDDs developed are summarized in Table 5.2.

Developing PDDs for the small hydro and pelletization projects provide value addition as they are closer to dealmaking than the other projects that is, produce validation-ready PDDs. Further, these PDDs provide learning from the process of PDD drafting close to the actual implementation of the project for PDD developers and project hosts.

The main objective in developing the other projects is to contribute to methodology development and to advance international discussions in this regard.

Out of the five SSC (small-scale CDM) projects shortlisted for PDD development under NSS, four projects are executed by promoters and one is a case study. The involvement of all promoters in project development was good, and enhanced the quality of the PDD. In some cases the NSS team had to make greater efforts to improve awareness about methodological requirements and data needs.

5.3.2 *Lessons learned*

The experience and lessons learnt from developing the five PDDs based on the approved simplified baseline and monitoring methodologies for SSC projects are discussed in this section.

5.3.2.1 Qualifications to use simplified modalities and procedures, and selection of appropriate type

The MSW (municipal solid waste) project qualified for the Type III category of SSC projects in the simplified M&P (modalities and procedures) for SSC projects. As Figure 5.3 illustrates, 'type (III) projects shall not exceed total direct emissions of 15 kt (kilotonnes) CO_{2eq} annually, and must reduce greenhouse gas emissions'.[2] The emissions from the project itself fall within the limit specified above, though the project is estimated to reduce emissions greater than 15 ktCO_{2eq} annually (through avoidance of methane production).

[2] Refer to decision 17/CP.7, paragraph 6(c) (iii): details available at <http://cdm.unfccc.int/Reference/Documents/AnnexII/English/annexII.pdf>

Table 5.2 Summary of NSS PDDs

	Actual projects under various stages of implementation				*Case study*
	Small-scale foundry	*Small hydro*	*MSW to pellet*	*Municipal street lighting*	*Rural electrification*
Project description	Energy efficiency improvement in small-scale foundry units	Grid connected run-of-the-river small hydro (renewable energy) project	Recycling of MSW (municipal solid waste) into refuse-derived fuel	Energy efficiency in municipal street lighting	Rural electrification by decentralized distribution generation systems through a mix of renewable technologies
Technology	Energy-efficient DBC (divided blast cupola)	Small hydro turbine-based power generation	Pelletization of MSW into refused-derived fuel	ETrACS (energy tracking and control systems)	1) Biomass gasifiers and bio-oils; 2) Micro hydro; 3) Solar photovoltaics
Scale of project	190 foundries saving of 0.03 gigawatt hour per year	12 MW (three projects)	150 T of MSW per day	Street lights in 110 km long national highway 3500 lights saving 1.4 GWh per year	149 villages Small hydro ~575 kilowatt Biomass ~115 kilowatt and solar photovoltaics
Source of emission reduction	Reduction in consumption of coke as fuel	Displacement of fossil fuel based grid power	Avoidance of methane production from the MSW dumped in unmanaged land-fills	Reduction in consumption of fossil fuel-based grid power	Displacing kerosene for lighting and diesel generating sets for irrigation purposes
Annual emission reduction (TCO_{2eq})	8302	49537	92256	1084	4408
Small-scale CDM project category*	Type II D	Type I D	Type III E	Type II C	Type I A
Baseline methodology	Appendix B: Type II D Article 3 and 4	Appendix B: Type I D Article 7 (b): System Average	Appendix B: Type III E Article 3	Appendix B: Type II C Article 4 & 5	Appendix B: Type I A Article 4
Monitoring methodology	Appendix B: Type II D Article 6 (a, b, and c)	Appendix B: Type I D Article 9	Appendix B: Type III E Article 5	Appendix B: Type II C Article 8–10	Appendix B: Type I A Article 8(b)
Leakage	No leakage as per article 60 of Type II C	No leakage as per article 30 of Appendix B as it is a new project	No leakage as per article 94 of Type III E	No leakage as no equipment are transferred from another activity	No leakage as per article 30 of Appendix B as it is a new project

Continued...

Summary of NSS PDDs *(Continued...)*

	Actual projects under various stages of implementation				*Case study*
	Small-scale foundry	*Small hydro*	*MSW to pellet*	*Municipal street lighting*	*Rural electrification*
Application of methodology	Applicable for all cluster level SMEs (bricks, glass, etc.) engaged in energy efficiency in reducing existing fuel consumption by installation of new furnaces/ systems	Applicable for all grid-connected projects having net export of power from the state grid to the regional grid and projects whose implementation does not delay the implementation of mega power fossil power projects	Applicable for all MSW projects producing fuel out of the MSW and not accounting for emission reductions from fuel-switching	Applicable for energy efficiency in lighting projects in industries, university campuses and housing colonies	Applicable for electrification of rural and remote areas deprived of any kind of access to power through a mix of renewable energy technologies

SMEs – small and medium enterprises

* Details available at <http://cdm.unfccc.int/Reference/Documents/AnnexII/English/annexII.pdf> last accessed in January 2005.

Based on this interpretation, those projects having potential of larger emission reductions (> 15 kt CO_{2eq} per year) but having project-related emissions less than 15 kt of CO_{2eq} annually can use the approved simplified methodologies of SSC projects. The project boundary includes emissions from transporting refuse-derived fuel to various industries within a 100 km radius, but excludes emissions from utilization of pellets to avoid the resulting complexities in monitoring and CER sharing.[3]

In the case study on rural electrification through renewable energy, both Type I A and Type I D[4] categories were applied. However Type 1 D was not used since the options for baseline calculation provide formulae for estimation of emissions from generating units only. However in the baseline scenario of the case study, kerosene is used for lighting purposes. Type 1 A[5] was considered appropriate for two reasons. Firstly the baseline calculation provides formulae for estimation of emissions from the fuel consumed in the baseline scenario irrespective of the mode of its use. Secondly the ownership of the project rests with the

[3] No emissions are accounted for energy consumed for the production of pellets since the power will be supplied by an in-house biomethanation plant

[4] This category comprises renewables, such as photovoltaics, hydro, tidal/wave, wind, geothermal, and biomass, that supply electricity to an electricity distribution system, that is or would have been supplied by at least one fossil fuel or non-renewable biomass-fired generating unit

[5] This category comprises renewable technologies that supply individual households or users with a small amount of electricity.

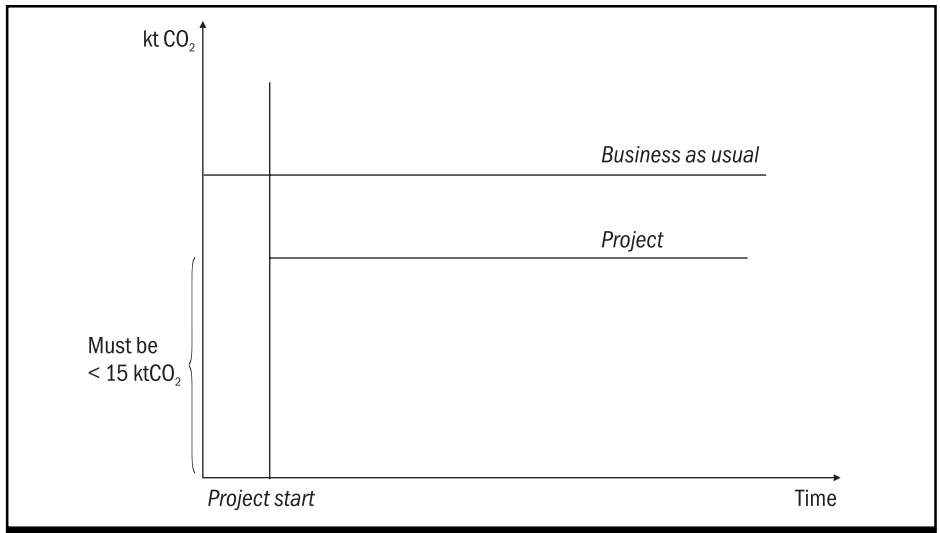

Figure 5.3 Eligibility for Type III project activities

community that makes for the users of the power generated and the category considers power supply to individual households or users consuming small amount of electricity.

5.3.2.2 Combination of methodologies

The SSC-approved baseline methodology provides a well-defined formula[6] for estimating baseline emissions, which is the amount of methane from the decay of the biomass or organic waste treated in the project activity. Subsequently, the project AM0012[7] established a precedent for cases where legislation exists by the introduction of compliance[8] parameter into this formula. Even though AM0012 is a MSW biomethanation project, the same concept has been applied in developing the PDD for the MSW pelletization project. Similarly, a modification has been proposed in the SSC-approved monitoring methodology by introducing the amount of pellets produced as an additional monitoring parameter. The application and interpretation of the two approved methodologies needs to be validated and confirmed by the DOE (designated operational entity).

[6] Version 4.0: 22 October 2004 Page 32 Article 3 of Type III E of Appendix B of the simplified modalities and procedures for small-scale CDM project activities: indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

[7] Biomethanation of municipal solid waste in India, using compliance with MSW rules, details available at <http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_627397095>

[8] Means that only a percentage of MSW (municipal solid waste) generated will be treated as per the legislation and hence, emission reductions can be estimated for the rest of the untreated MSW. This rate of compliance is expected to increase from 0% in the first year, 10% from the second year, and to 30% from the sixth year onwards after the date of start of the project activity

5.3.3 *Data collection: and its impact on baseline development*

The access, availability, and applicability of data for the sectors in which PDDs were developed are summarized in Table 5.3.

Availability of the relevant and essential authentic data at one source on a collective basis will be highly useful for the PDD developers, by helping improve the quality of baseline calculations.

5.3.3.1 Power sector (project: grid-connected small hydro power)

The actual performance data of the power plant in terms of grade of coal consumed and heat rates are not centrally available. A few institutions in India offer paid subscriptions for access to comprehensive power sector data which otherwise need to be collated from diverse print and electronic sources.

Recently, the MNES (Ministry of Non-conventional Energy Sources) carried out a study by engaging the services of TERI for establishing baselines for renewable energy projects (Box 5.1). While developing the study, in the absence of detailed data, the norms for performance of thermal power plants as stipulated by the CEA (Central Electricity Authority) were used for estimating the emission reductions.

5.3.3.2 Industrial sector (project: small-scale foundry clusters)

The prime difficulty in the cluster type of projects is the collection of production and energy consumption data from individual units. Generalization can be done for the energy efficiency data, production needs to be monitored and collected by industrial association(s).

5.3.3.3 Public utilities (project: municipal solid waste to pellets)

In addition to the data available at the state level, a specific study or survey is essential for collecting data of MSW dumped at the project site. Analysing MSW and its constituents is also equally important to analyse a suitable technology option.

5.3.3.4 Rural energy sector (project: village electrification)

The MNES has facilitated most resource data by carrying out countrywide resource assessment studies in the field of solar, hydro, biomass, and wind. However, the data needs to be refined to implement projects to match the local availability of resources with local demand patterns. Hence, PDD development for such projects involves the collection of data both at the household and local authority levels.

Table 5.3 Summary of data issues

Project	*Essential data*	*Data sources*	*Availability of level of data*	*Applicability of available data*
Power sector: small hydro	• Heat rates of the power plant; • Plant-wise auxiliary power consumption; • Specific fuel consumption; • Grid boundaries, power import and export details; • Financial details of the power plants; • Power plants planned on long-term basis (10 years projection); • Unit-wise performance data of power plants; and unit-wise heat rates; • Data for barrier analysis	• Websites and publications of: Central Electricity Authority; • Regional electricity boards; • Regional load dispatch centres; • State electricity utilities; • State electricity regulatory commissions; • Ministry of Power • Planning Commission	*Fair* • http://cea.nic.in (power plants data and hydro potential) • http://mnes.nic.in/baselinerpt.htm (baseline data, small hydro potential and achievement) • http://powermin.nic.in (power plants data, large hydro potential) • www.ntpc.co.in (NTPC owned power plants data)	Data collection is region or state specific. Hence, data collection needs to be new in the case of regions other than the northern grid. Need for updation of data on annual basis.
Industrial sector (small-scale foundry cluster)	*Foundry operational details* • installed capacity; • actual production; • fuel consumption; • technology and its performance details; *Financial details* • Data for barrier analysis	• Individual foundries • Foundry association • Technology suppliers (manufacturers) • Fuel suppliers	*Good* Data can be collected only from the individual units or through association	Data collection is project-specific. Data used cannot be generalized and is not applicable for other small-scale industrial clusters, even for those with similar activities
Public utilities (municipal street lighting)	• Energy consumption in kWh by street lights on monthly basis • Non-operating street lights • Data for barrier analysis	Monthly electricity bills from respective municipal zones	Same as for power sector and project-related data on streetlights and its power consumption	Data collection is project specific. Data used cannot be generalized and is not applicable for other similar activities
Public utilities (municipal solid waste (MSW)	• Daily waste generation/arrival at the project site; • Characteristics of the wastes; • Power consumption for pelletization; and • Pellets produced. • Data for barrier analysis	• Weigh bridge at the project site; • Lab analysis of MSW; • Monthly power bills; and • Stock and sales report	*Good* • www.indiawteplan.com (country waste potential) • http://mnes.nic.in (country potential, achievements) • http://envfor.nic.in/legis/hsm/mswmhr.html	Data collection is project specific. Data used cannot be generalized and is not applicable for other similar activities
Rural energy (village electrification)	• Household details for villages; • Existing kerosene / other fuel consumption load factors of DG sets for income generating industrial activities, if any • Data for barrier analysis	Census details National Sample Survey Organization report	*Fair* • http://mnes.nic.in/baselinerpt.htm • http://mnes.nic.in/frame.htm?remotevillelectr.htm • http://powermin.nic.in/rural_electrification/main.htm	Extensive data collection is required. Data used can be generalized incase of remote unelectrified villages

Box 5.1

MNES baseline study for Indian renewable energy projects

The MNES (Ministry of Non-conventional Energy Sources) commissioned a study titled 'Baselines for Renewable Energy Projects under Clean Development Mechanism' during 2001/02. The study was completed during 2002/03. The objective of the study was to develop baselines for grid-connected and off-grid renewable energy and fuel-switching projects.

The general methodology description applied for determining the baselines was as follows.

- For grid-connected projects, the system average methodology, one of the CDM EB (Executive Board) approved methodologies for the small-scale CDM projects under the category 'electricity generation for a grid', was selected. Estimations were made for actual baseline emission demonstrating the use of accepted methodology for India. State level, regional level, and national level emission factors were estimated considering power generation from only thermal projects and thermal with hydro and nuclear power separately.
- For off-grid connected projects, the baseline methodology is based on the emission intensity associated with the presently used fuel for example, kerosene for lighting, and diesel for power generation. This methodology is a modification of the methodology approved by CDM EB for small-scale CDM project activities for the category 'electricity generation by the user', to Indian conditions.
- For thermal energy projects (fuel-switching), the baseline methodology is based on emission intensity associated with presently used fuel for thermal energy use, namely electricity, diesel, and furnace oil. The methodology is the same as the methodology accepted by CDM EB, for small-scale CDM project activity category – 'thermal and the mechanical energy for user'. The use of methodology was demonstrated through case studies.

Regional and national baselines (kg/kWh) for grid-connected renewable energy projects

Region	*Thermal only*	*Including thermal*
Northern	1.07	0.82
Western	1.02	0.93
Southern	1.02	0.75
Eastern	1.37	1.19
North-eastern	0.63	0.36
National	1.08	0.87

5.3.4 Selection of appropriate system boundary

Selection of the appropriate project boundary shall reflect in the application of the approved baseline and monitoring methodologies for SSC projects. It also decides the type and number of monitoring parameters for firming up the monitoring methodology. In case of small hydro power PDD, the boundary includes the transmission system till

the evacuation point and hence only the net power pumped to the grid is taken into account for estimating the corresponding emission reductions.

For the rural electrification case study PDD, the estimation of emission reductions has been limited to the same service levels before and after the project implementation (lighting and irrigation). The emission reduction arising out of enhanced/additional activity after the project has not been considered.

The need for consistency in the system boundary for the calculation of energy balance and GHG emission reduction (and cost calculations) is highlighted in the MSW to pellets PDD. The only project-related emissions are those from power consumed for the production of pellets. Since the power is proposed to be generated from biomethanation of kitchen waste, there are no emissions. Even though the transportation of MSW to the project site and pellets to the industries is not in the project boundary, emissions related to pellets transportation to various industries has still been considered. Though insignificant (say 100 tonnes of CO_2 per year), the emissions are estimated based on the rationale that the pellets cannot be stored in the project sites for ever. Additional emissions could result from the storage of pellets over a longer period and if they remain unused by the industries. Therefore the project proponent has to monitor the storage and utilization of pellets in cooperation with the users.

5.3.5 Baseline setting and additionality justification

Selecting the most appropriate baseline from the given options is crucial to ensure environmental integrity to avoid an overestimation of baseline emissions.

It was observed that the selection of baselines for energy efficiency related SSC projects is simpler as compared to that of other project categories. Given the nature of energy saved and its quantum, the selection of appropriate baseline methodology becomes a straightforward issue. However, in the case of renewable energy (for grid-connected power projects) choice of the baseline demands substantial justification. For the small hydro grid-connected power project, weighted average generation of the current generation mix (Type 1 D. 7 [b]) has been chosen as the most appropriate baseline because of limited data availability for on-grid characteristics to calculate combined margin emission factors. The chosen average baseline includes power generation from large hydro and nuclear plants.

Besides, data availability for developing baselines for such projects, and demonstration of the effect of the CDM project on the baseline scenario is equally different. For renewable energy-based rural electrification project, few plausible baseline scenarios exist namely replacing the current consumption of kerosene for lighting, diesel for irrigation or considering only diesel-generating sets for power generation for both lighting and irrigation applications.

For SSC projects, static baselines are mostly considered, mainly to reduce the transaction cost in updating the baselines annually. Further for a majority of the crediting period, there may be only insignificant changes in the baseline scenario.

As all the PDDs developed under NSS belong to the SSC projects, the additionality assessment was based on the guidance / additionality tools[9] provided by the CDM EB for the SSC projects. The additionality tools suggest barrier analysis and mandate justification in explaining at least one barrier due to which the project would not have occurred (Table 5.4).

Table 5.4 **Additionality assessment summary for PDDs developed under NSS**

PDDs	*Investment barrier*	*Technological barrier*	*Other barriers*	*Not a common practice*
PDD 1 Small-scale Foundry	Not a significant barrier to the project	Not a significant barrier to the project	Lack of institutional and technological support	Production-oriented operation rather than energy efficiency. Rooted to the old operation systems and hence proposed intervention is not a common practice
PDD 2 Small hydro	Project investment is higher than that of a conventional power plant. Establishment of transmission and distribution infrastructure for evacuation of power is also a barrier. Commercial funding difficult.	Not a significant barrier to the project	Not a significant barrier to the project	Run-of-the river small hydro power projects not a common practice due to high risks
PDD 3 MSW to pellet	Not a significant barrier to the project	Not a significant barrier to the project	Current weak financial situation of municipalities inhibits implementation of MSW treatment projects.	Though national rules mandate for using biomethanation, pelletization, incineration and or composting for treatment of organic wastes, there is a widespread non-compliance and most MSW is dumped in landfills. Implementation of any MSW treatment technologies is not a common practice at present

Continued...

[9] Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, Version 04: 22 October 2004

Table 5.4 Additionality assessment summary for PDDs developed under NSS *(Continued...)*

PDDs	*Investment barrier*	*Technological barrier*	*Other barriers*	*Not a common practice*
PDD 4 Municipal street lighting	Not a significant barrier to the project	Technology is the first of its kind and is new for municipality street lighting. Penetration of this technology in our towns/ cities is yet to start	Municipalities have poor access to such energy efficiency measures as their priority is to supply only power. Access to financing of such projects is poor in India. No institutional support for promoting ESCOs. (Energy Service Companies)	Due to the weak financial status of municipalities, implementation of energy efficiency measures in street lighting is not a common practice. Implementation through ESCO concept is an innovative element of this project.
PDD 5 Rural electrification*	Not a significant barrier to the project	Limited experience in installation, O&M (operation and maintenance), and management of mini-grids; lack of performance data documentation	No institutional linkages for income generation and for ensuring long-term operation, absence of established revenue collection model and community participation, non-availability of funds for investment during the life cycle and for O&M.	Limited operation of mini-grids in India and hence lack of penetration in rural and remote areas

* Rural electrification projects based on renewable energy are heavily subsidized. However, to sustain the operations of such projects and to provide electricity to the community, an incentive is essential to have consistent performance. CDM in fact provides the right incentive only on performance and may thus serve the purpose.

Irrespective of the size of the CDM project, additionality remains critical for both SSC and non-SSC projects. However, to simplify the discussion on additionality, barrier analysis[10] is recommended by the CDM EB for SSC projects. Confining additionality arguments to one of the highly prevalent barriers may elevate the possibility of proving the project additional, as provided for in the SSC modalities and procedures. However, arguments on as many barriers as possible were presented in each PDD to demonstrate that the projects suffer from multiple barriers. In both the cases, the decisive factor will be, how effectively the barriers are discussed with substantial facts. Since basing additionality on an investment barrier entails rigorous financial analysis and information, and since investment is not a significant barrier to most CDM projects close to dealmaking, it was not the preferred choice. Barriers due to the prevailing practice and institutional barriers were the traditional options for justifying additionality. For projects employing new technologies, (for example, municipal street lighting PDD) establishing additionality through technology barrier alone is the most suited option as such departures from the business-as-usual technologies are justifiably

[10] Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities Version 04: 22 October 2004

additional. Lack or absence of institutional support for streamlining such technologies further strengthens the additionality arguments. The problem here lies in providing documented evidence for institutional or technological barriers. Industrial associations and governmental bodies might play a vital role in helping project proponents with published data on such barriers.

5.3.6 Selection of crediting period

The choice of the crediting period is linked to the operational life of the project and possible shift in the baseline scenario. For example municipal street lighting energy efficiency project has projected an operational life of only ten years and thus limited the crediting period to only ten years. In the case of MSW to pellets projects, it is expected that the compliance to solid waste handling rules will be higher after ten years and hence credits cannot be earned beyond this period.

On the other hand, the quantum of generation of emission reductions varies annually for bundled projects as sub-projects will be commissioned in different phases. While all the three small hydro projects will be commissioned simultaneously in the small hydro-bundled project, the foundries (foundry PDD) will install the energy efficient furnaces in a phased manner. The annual CER generation shall hence gradually increase and stabilize after one or two years. Even if the cumulative emissions are substantial during the crediting period, the reporting of annual emissions in the ERPA is useful for both the seller and buyer.

5.3.7 Replication potential of case study projects

The replication potential of the sectors in which the PDDs were developed is discussed below.

5.3.7.1 Power sector

Project: grid-connected small hydro power

An estimated potential of about 15 000 MW (refer Table 3.6 'Potential and achievements for renewable energy technologies' of chapter 3) of small hydro-power projects exists in India. Most small hydro projects are grid-connected and a few are decentralized, managed by local community organizations or NGOs promoted by the MNES.

Within the small hydro category, run-of-the-river projects have inherent risks due to seasonal variation affecting water flow, geographical constraints, and expensive power evacuation infrastructure.

Although constrained by these risks, promotion of run-of-the-river type of small hydro projects through CDM offers good replication potential.

5.3.7.2 Industrial sector

Project: small-scale foundry cluster

There are over 5000 foundry units in India and a majority of these are dispersed in about 20 well-known geographical clusters in India. They mainly cater to the automobile industry, besides textiles and other industries.

These foundries fall under the unorganized sector, operating highly energy-inefficient conventional cupola furnaces. Given the high energy savings potential (due to reduced coke consumption to the tune of atleast 25%) CO_2 reduction will be significant if such measures are implemented on a wider scale.

Though SMEs in the large unorganized sector offer high CDM potential, the major challenge will be the bundling of these type of projects (cluster approach) to reduce the transaction cost.

5.3.7.3 Public utilities

Project: municipal street lighting

Street lighting in most Indian towns and cities is comparatively ill-maintained and operated. There is tremendous potential for improved O&M (operation and maintenance) procedures, energy-efficient retrofits, and new, renovated or relocated street lighting installations. However, upgradation of the existing systems generally does not take place until a larger capital improvement project is planned. High investment requirements, poor awareness, and lack of access to energy-efficient street lighting techniques and methods act as barriers.

Energy-efficient projects for street lighting through ESCO and CDM route demonstrate the viability of the concpt and offer good replication potential.

Project: municipal solid waste

Huge quantities of MSW arising from domestic, industrial, and agricultural sources are disposed leading to severe environmental degradation in India. The annual quantum of MSW from class-I cities[11] alone is about 30 million tonnes. The national master plan for development of WTE (waste-to-energy) provides estimates for the energy generation potential for years between 2002 and 2017.[12] The potential estimated by the MNES as reported during 2003/04 is 1700 MWe. (refer to Table 3.6 'Potential and achievements for renewable energy technologies' of chapter 3).

Few initiatives are being taken to utilize the refuse-derived fuel pellets for energy generation, and composting of MSW.[13]

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[11] Indian cities with population 100 000 and above, details available at <http://urbanindia.nic.in/mud-final-site/urbscene/index.htm>, last accessed in January 2005

[12] details available at <http://www.indiawteplan.com/users/city/citysearch.htm>, last accessed in January 2005

[13] MNES is promoting the MSW-WTE programme under a national programme on energy recovery from urban, municipal and, industrial wastes and UNDP/GEF assisted project on development of high rate biomethanation

Given the high quantum of waste to be disposed, and the prohibitive barriers to various technology options, CDM benefits can inspire the private sector and channellize investment to this sector.

5.3.7.4 Rural energy sector

Project: village electrification

With 112 313 yet-to-be-electrified villages and 56.5% of the rural households lacking access to electricity[14] rural electrification is one of the most important developmental goals of the Government of India. Despite initiatives by MoP and MNES[15], the current utilization of renewable energy resources for rural electrification is far below its potential.

The small size of the project, technological risk inhibiting financing, and uncertainty in government priorities and policies are other perceived barriers for such projects.

CDM benefits can be used as one of the tools to address these barriers in combination with the existing subsidies from the central government. Demonstrating such a hybrid financing model (using CDM and subsidies) may assist in the sustainability of such projects, because CDM revenue stream and the related monitoring is an incentive to maintain the operation of the plant.

5.3.7.5 Experiences and lessons from bundling small-scale CDM project activities

Bundling of projects is one of the major facilitating tools for minimizing the transaction cost and thereby, enabling participation of very small-scale projects. Bundling can reduce transaction costs by combining certain steps of CDM project cycle, viz., baseline design, registration, monitoring and verification. It reduces search costs for deals, for both the buyer and the individual projects, as bundling organizations will be the point of contacts for both the buyers and the sellers. Bundled projects benefit from the SSC approved standardized baselines and streamlined procedures for validation, monitoring and verification as bundling is allowed only for SSC projects.

The following conditions favour bundling.

- *Same type of projects* This would facilitate the development of baseline, monitoring and verification plan, and the PDD as such. Though bundling of different types of projects is also allowed, it would not be as cost-effective as bundling of similar projects, because of the fact that a bundle of different projects may require different

[14] Details available at <http://powermin.nic.in/rural_electrification/status.htm>, last accessed in January 2005

[15] The Electricity Act, 2003 has made supply of electricity to all areas, including villages and hamlets, a statutory obligation and has provided various enabling provisions for RET markets. In order to achieve the national objective of 'Power for All' by 2012, the MoP (Ministry of Power) has constituted a REST (Rural Electricity Supply Technology) mission with an immediate objective to electrify 100 000 villages and 10 million households during the next two years. MNES has initiated a new programme for village electrification in the year 2001/02 with an objective to electrify all these villages through renewable energy sources by the year 2012.

baselines for different projects and also the monitoring would need to be carried out for individual projects. Similarly, validation and verification will also need to be carried out for different types of projects

- *Same geographical area* Projects bundling will be feasible if they are in the same geographic area, as framework conditions will be similar
- *Similar development stage* Bundling would be most effective if the projects are in similar developmental stage, as synchronization of the project cycle will be difficult for projects at different developmental stages.

As the Marrakesh Accord applies the SSC eligibility criteria (upper limits) for bundling, this cap limits the bundling of a large number of small-scale projects. Limiting the bundling capacity of projects under SSC prohibits bundling of a large number of very small-scale CDM projects, beyond the limits specified under SSC M&P (that is, 15 MW, 15 GWh or 15 000 tonnes). This may result in several bundled projects of a similar type and nature for a location. For instance, a comprehensive rural electrification plan for a state in India may be beyond the limit of 15 MW, and would require probably bundling into more than one project, but as such deserves to be treated as an SSC. Such limitation will increase the transaction cost and will be less attractive for the buyers. Hence, it may be worth re-examining the upper limit for bundled SSC projects, perhaps on a case by case basis.

The size and nature of the bundle will ultimately depend on the legal and financial ownership of the project and the financing structure. The ownership claimed by the FIs providing debt should also be taken into account.

Bundling of projects would require an intermediary organization to take care of preparation, implementation, and operation of a project bundle. On few occasions, the project developers are not comfortable sharing the information with the third party that is the bundling organization. This could, however, be overcome through appropriate cooperation agreements.

In view of the above issues, the feasibility of project bundling needs to be demonstrated. The IT Power, India, along with the ECN, the Netherlands, is carrying out a study to look into the issues engrained in project bundling.

Of the five PDDs developed under this study, three PDDs involve bundling of project activities on the basis of their inherent nature. The three projects involving bundling are listed in Table 5.5.

The fourth project offering scope for bundling is municipal street lighting project. Though the project has a number of street lights, the project boundary is within the limits and ownership of the Bangalore Development Authority. As such, projects offer very low emission

Table 5.5 NSS projects involving bundling

Project	*Nature of bundling*
Bundle 1 Small-scale foundry	Bundling of 190 foundries
Bundle 2 Grid-connected small hydro project	Bundling of three small hydro projects in the same stream (run-of-the-river)
Bundle 3 Case study on rural electrification	Bundling of power biomass gasifiers, small hydro and solar photovoltaic power plants

reductions, and only bundling of such projects from different geographical locations will make the project feasible, lowering the transaction cost considerably. In such bundling, technology providers may play the role of the organization facilitating the bundling.

The specific issues emanating from these projects are discussed below.

5.3.7.6 Nature of project activities

Each of these three PDDs have bundled activities of similar type, as shown in Table 5.6. For example, bundle 1 deals with implementation of energy efficiency measures leading to energy savings and emission reductions in the foundry sector only, and bundle 2 deals with generation of power for supply to the grid from run-of-the-river based small hydro projects alone. However, these projects vary greatly in their ownership and level of activities. These variations along with other characteristics of the three bundles are summarized in Table 5.6.

Table 5.6 Profiles of the bundled projects

Project / characteristics	*Bundle 1*	*Bundle 2*	*Bundle 3*
Activities of all the projects in each bundle	Energy efficiency in foundries	Grid-connected power supply	Power generation and supply to villages
Sectors bundled	One (foundry)	One (small hydro)	One (rural electrification)
Technologies bundled	One (DBC)	One (run-of-the-river water turbines)	Three (small hydro, biomass gasifier and SPV power plant)
Project promoters	Several (190 foundry owners)	Single	Several
Geographical location	Within a district of a state	In the same down stream of the river	In four districts in a state
Bundle size	0.13 GWh (energy reduction)	12 MW	Approximately 1.41 MW
Project implementation status	To be implemented in a phased manner	To be implemented simultaneously	To be implemented in a phased manner
Bundling organization	Industrial association	Project promoter	State nodal agency and/or local non-governmental organization

However, the heterogeneity of the set of emitters or mitigating projects among these bundled projects varies widely. In case of foundries, although they employ similar technologies, there is a variation among the units in terms of the size of the furnace, the quantity of metal produced, hours and frequency of operation, quality of fuel (coke) consumed, and operating practices. In the rural electrification project, the installed capacities in each village are the same (10 kW) for biomass gasifiers and SPV but different for the small hydro plants, as only three such plants are proposed to provide power for 131 villages. This necessitates an appropriate monitoring methodology and the degree of verification requirements.

5.3.7.7 Application of simplified baseline and monitoring methodologies

All the three bundled projects are meeting the criteria of the small-scale CDM projects (in terms of their capacity, energy savings, and project related emissions). Limiting the bundling capacity of projects under SSC constraints the bundling of a large number of very small-scale CDM projects, beyond the limits specified under SSC M&P (that is 15 MW [megawatt], 15 GWh [gigawatt hour] or 15 000 tonnes). This may result in several bundled projects of a similar type and nature for a location. For instance, a comprehensive rural electrification plan for a state in India may be beyond the limit of 15 MW, and would probably require bundling into more than one project, but as such deserves to be treated as a SSC. Such limitation will increase the transaction cost and will be less attractive for the buyers.

While the simplified baseline methodologies were readily applied for these projects, the monitoring requirements pose a challenge in three projects namely small-scale foundries, street lighting, and rural electrification. The small hydro project has a straightforward baseline calculation and monitoring plan and is simpler of all the four.

The rural electrification project has two baselines based on the service levels namely lighting and irrigation. Emission reduction benefits for any additional service levels received post-implementation (of village electrification) are not considered. Monitoring of all data will increase verification costs.

The foundries' dynamic operation (increased or decreased production over time) and the phased implementation of the projects have an impact on the actual emission reductions and hence the number of monitoring parameters. Subsequently the melt output and the coke inputs were identified to be the major parameters to be monitored. After assessing the various options, two monitoring approaches were adopted viz., measurement of melt input and coke input for all the foundries and a statistical approach for other eight parameters. The statistical approach (for measuring these eight parameters that are more or less the same for all elements of a certain cohort, but based on suitable random sampling) was adopted to lower the transaction cost without compromising

accurate and representative data collection (Table 5.7). This approach also reduces the documentation requirements of these parameters having less impact on the estimation of emission reductions from all the foundries.

Table 5.7 Monitoring approaches

Project	*Monitoring approach discussed*	*Monitoring approach suggested*	*Monitoring parameters*	*Rationale*
Bundle 1 EE in foundries	• Statistical approach* • Control group • All data monitored	All data monitored for two critical parameters and statistical approach for other eight variables	–	The advantage of a statistical approach for estimating project emissions is that it would involve least transaction costs. The approach would be quite accurate for the given population
Bundle 2 Small hydro	100% monitoring of power from small hydro	All data monitored	Power generation from hydro projects	Data required for estimating the emission reductions is only the power generation from the projects
Bundle 3 Rural electrification	• Statistical approach* • Control group • All data monitored	All data monitored	Power generation and power consumption for industrial applications other than the baseline service levels.	Data required for estimating the emission reductions is only the power generation from the projects

* Random samples, fix sample, number of samples necessary depending on homogeneity (variance) of elements in the bundle

5.3.7.8 Bundling organization

Excluding the small hydro project, the other two projects have different entities for bundling apart from the project promoters. The small hydro bundle has all the three bundled projects implemented by one promoter.

These bundling organizations are responsible for CDM project related activities – from PDD preparation to distribution of annual CER revenues to the project promoters. There are two critical issues in this regard.

- Revenue-sharing contracts between bundling organizations and project owners and among project owners-bundling organizations need to obtain consent from different project owners in the projects, estimate transaction costs, administration expenses, and workout details on sharing of CER revenue
- Distribution of the burden of liability among bundling organizations and project owners-bundling organizations are normally liable to meet any eventual shortfall in the supply of CERs according to their

contractual agreements with the CER buyer. This risk can be considerably reduced if bundling organizations share the liability with the bundled project operators by respective contractual agreements. Ideally if bundling organizations are identical to the project operators, this liability need not be shared with other parties.

The key factors that enable the success of any SSC bundling organization are listed below.

- A strong and skilled institution should organize the bundling, and act as a representative and project developer for the participants
- The entity should be financially sound, backed up with field professionals for ensuring the long-term delivery of the CERs contracted, and for distributing the benefits received from the sale of CERs
- A critical size of overall emission reduced should be exceeded
- Availability of data
- Development of a robust and efficient monitoring methodology that takes quality and inhomogeneous data into account
- SSC projects with higher CER price should be viable (normally they bring in more sustainable benefits than large-scale projects)
- The operational expenses and intended profit for running and motivating the bundling organization should be nominal as it should not demotivate the project promoters from participating in the bundle.

Should the bundling of SSC projects not be promoted adequately, these projects may participate in the VER (voluntary emission reduction) markets at a lower price but with a less complicated process and hence, low transaction cost. However also in VER projects, bundling is the key to reduce transaction costs.

5.3.7.9 Monitoring

Efforts in developing SSC projects with the main objective of reducing transaction cost will become futile should the monitoring methodologies encompass a detailed protocol. At the same time, loosely structured monitoring framework will also pose a threat to the environmental integrity of the project.

Different practices to mitigate such limitations include monitoring the entire project performance data but suggesting verification of limited monitored data, monitoring limited data representing the whole of project activity and verify all of them.

On an overall basis, the real challenge lies in recording and maintaining accountable and reliable data with decreased efforts and low monitoring costs, while not compromising the objectives of CDM.

Among the NSS PDDs, small hydro PDD has only one set of data to be monitored in each of the three sub-projects. This relates to power pumped to the grid, which can be easily monitored. However, in the case of foundries and rural electrification (though only few data types needs to be monitored), they have to be recorded for all the installations resulting in a mammoth data monitoring exercise and increased transaction cost. Thus, the application of a statistical approach for monitoring and verification incase of a larger number of (remote) project facilities is necessitated.

5.3.8 Transaction cost analysis

An application of the transaction cost estimates to the PDDs developed reveals (Table 5.8) that bulk of the transaction cost will be spent on monitoring and verification and certification (recurring expense cost) as compared to the PDD development and validation costs (fixed expense). This emphasizes the need for a large volume of CERs, to minimize the impact of transaction costs. It also underscores the need for competition among DOEs to keep prices for such services as low as possible.

Table 5.8 Transaction cost analysis

	Small hydro	*Foundry*	*MSW to pellets*	*Municipal street lighting*	*Rural electrification*
Volume of CERs/year	49537	8302	92256	1084	4408
Cost of CER (USD/CER)	5				
	Pre-implementation costs including PDD development, validation, registration, etc.				
Transaction cost per CER (US cents/CER)	9	53	5	357	88
Transaction cost as % of CER price	2	11	1	72	18
	Post-project implementation costs including monitoring, verification and certification, and 2% adaptation fee				
Transaction cost per CER (cents/CER)	33	198	18	1517	373
Transaction cost as % of CER price	5	33	3	253	62

Notes Pre-implementation costs are upfront costs incurred only once. Post- implementation costs are recurring costs, the periodicity of which will depend on the frequency of verification agreed by the parties.

According to the estimates of transactions costs, projects generating less than 4000 CERs would find it difficult to cover these from the current prices being offered (for example, municipal street lighting PDD), where the upfront costs per CER upto the validation and

registration stage are 72% of the price of a CER, and the monitoring and verification costs could be as high as 250% of the price on a per CER basis. For projects generating CERs in the 50 000–10 000 range (foundries and rural electrification projects) the upfront costs range from 11% to 18% and the monitoring and verification costs from 33% to 62% of the price on a per CER basis. It is only for projects generating between 50 000 and 100 000 CERs (bundled small hydro and MSW to pellets projects) that the transaction costs are in a negligible range.

5.3.9 Additional benefits of SSC project activities

Given the prevalent CER prices in the carbon market, revenues from CDM are not adequate to change the fortunes of any CO_2 mitigation project. However, such benefits may provide an impetus and play a vital role in promoting rural energy and municipal projects (energy from municipal waste, EE (energy efficiency) in municipal street lighting, water pumping, EE in buildings) in particular.

Special focus is warranted for rural electrification CDM projects given the national importance being accorded to this sector, as also the scope for enhancing sustainable development through these projects. Further, there is tremendous scope for implementing innovative financial delivery mechanisms along with CDM revenues for the success of rural electrification in the country. Replication of such rural electrification projects will go a long way in not only addressing the sustainable development goals but also in demonstrating effective utilization of an international financial tool, and partnerships that were envisaged at the WSSD (World Summit on Sustainable Development).

CER revenue from MSW projects is relatively high followed by HFC destruction projects. CDM may play a vital role in promoting MSW-based projects among the municipalities in India.

5.4 General experience of consultants developing PDDs in India

It is evident that consultants have succeeded in sustaining interest on CDM in the Indian private sector by offering innovative PDD development service packages such as one time fee[16], nominal fee[17], and success fee.[18]

An email survey of national and international PDD consultants revealed that 46 PDDs are being developed with an annual CER

[16] Consultancy services include PDD (project design document) development and general assistance for obtaining approval from the host country, validation, registration and identifying buyers. No commitment is offered for any of the activities apart from PDD development.

[17] The consultant charges a nominal amount for the services, and assumes responsibility to identify sources of funding for PDD and for purchase of CERs (certified emissions reductions).

[18] Success fee involves the consultant's share on the annual CER revenues from the project and, hence, the PDD is developed either free of cost or is based on nominal consultancy charges. The consultant provides all the services free of cost but claims a share of the revenue on CERs generated annually as success fee. In this case, the consultant invests his resources upfront in developing the PDD, scouts for buyers, and strives for the success of the Project as the business relies on the projects' success. Success fee is the obvious choice of the promoter.

generation potential of about 1.7 million. Eight responses were received from the consultants developing PDDs in India. A brief of the e-mail survey, analysis, and results is provided in Annexe 16.

The information available on the web and through various project promoters indicates that there are around 25 consultants who are involved in developing at least one PDD in India and close to 150–200 PDDs are being developed. Apparently, one HFC23 project generates 3.3 million CERs annually.

While around 25 projects are being developed under various international donor programmes, the rest are being developed either on a success fee basis or on a fully paid basis. Most of the PDDs being developed are on a unilateral basis, in that there are no buyers identified as yet.

The major observations, concerns, and recommendations of the consultants have been listed below.

5.4.1 Nationally

- Lack of publicly available authentic data for PDD development, which shifts the onus of validation to DOE and prolongs the validation process
- Poor understanding of CDM by promoters and consequent lack of interest in investing in such ventures
- Need for transparent, business-like, and accelerated decision-making by NCA (if necessary, supported by a low fee with exemption for SSC projects)
- Need for a national pool to support the development of unilateral CDM and register projects without buyers at the EB.
- Need for clarity regarding contribution towards sustainable development goals.

5.4.2 Internationally

- Complicated and time-consuming approval process for new methodologies
- Frequently changing M&Ps.
- Lack of conceptual clarity on additionality and consequent delays in approvals for non-SSC projects
- Limited applicability of approved project-specific methodologies
- Low market price, asymmetric information, and poor bargaining power of small project developers
- Problems with access to CDM finance.

5.5 Conclusions and guidance for further facilitating CDM

The vibrancy of CDM implementation in India can be judged from the existence of several international donor initiatives (see Table 4.1 in chapter 4), enhanced private sector participation, a transparent and fast approval process by the host country, deals made, and the role of consultants. Small-scale CDM projects assume a significant share in the current PDD development activities in the country.

Capacity building initiatives are necessary for enhancing the skills of consultants for improving the level of understanding and the quality of PDDs developed by them.

Access to relevant and authentic data for baseline development and for providing evidence for barriers and demonstration of additionality is the most crucial factor for developing a successful PDD for the consultants.

The current CDM project pipeline has gaps in sectors that are very relevant for India, such as the transport and DSM in residential sector, are barely represented and needs special focus for facilitating projects.

The scope for supporting the projects on small-scale foundries and rural electrification under CDCF (Community Development Carbon Fund) should be examined by the World Bank. These projects are very relevant from the perspective of sustainable development and directly subscribe to the underlying principles of the CDCF on reaching out to projects for poor rural communities and SMEs (small and medium enterprises).

The actual scale of reduction of transaction costs by bundling of SSC projects is yet to be demonstrated. However transaction cost of a bundled project will be significantly lesser than the cumulative cost incurred by each of the unbundled SSC projects.[19] Selection of similar projects within a region will reduce the cost in baseline development and facilitate in demonstrating the additionality applicable to those similar projects in the region. However validation requirements of all similar/ dissimilar projects in a given bundle need further evaluation from the transaction cost point of view.

The issues emerging from bundling options in three of the five PDDs are challenging and merit attention and evaluation for its success. Developing a framework for bundling SSC projects, promoting bundling organizations and gaining experience with various bundling options are essential to further bundling as a tool to help reduce the transaction cost and help CDM projects which have potentially high sustainable development benefits. Bundling organizations should analyse the legal aspects of sharing of assets/revenues and liabilities arising out of the performance of the bundled projects. Selection of a static baseline would always be economical for bundled projects. Monitoring aspects is considered imperative for ensuring the success of bundled projects as it entails multiple performance parameters. Statistical approach is recommended for such bundled projects having several similar activities. Small-scale projects may be bundled by lead sectoral organizations which have significant project-related and financing experience. Organizations such as NABARD (National Bank for Agriculture and

[19] Inception report: IT Power Ltd, UK, ECN and IT Power India on 'Establishing the institutional capacity to enable small-scale CDM projects in India' under EC-SYNERGY programme

Rural Development), SIDBI (Small Industries Development Bank of India), IREDA (Indian Renewable Energy Development Agency), financial intermediaries, technology providers, and industrial associations, need to be sensitized on CDM to enable them to undertake the role of bundling.

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CHAPTER 6

Facilitative framework for CDM implementation: role of the government

6.1 Aim and approach

The foregoing chapters have discussed the carbon demand and supply scenarios, the experiences and issues and concerns with CDM (clean development mechanism) projects development. This chapter discusses the existing government institutions in India for CDM and the role they can play in enhancing project development and implementation in the country. The key elements of this facilitative framework are classified under regulatory and institutional issues.

The discussion in this chapter draws on existing information, review of literature as also interactions with various stakeholders.

6.2 Existing institutions for CDM facilitation

India acceded to the KP (Kyoto Protocol) in August 2002. In order to guide the project promoters in developing the CDM projects in tune with the country's priorities, the MoEF (Ministry of Environment and Forests) announced an interim CDM project approval criteria in 2002 (see <http://www.envfor.nic.in/cc/ cdm/criteria.htm>). The criteria clearly laid out the additionality clauses (emission, financial, and technological) that would be considered along with the contours of sustainable development in each project that would be examined, along with other indicators including transparency in baseline formulation, financial indicators, technological feasibility, risk analysis and credentials of the project developer. These approval criteria are very broadly indicative of the intentions of the Government of India in that, they

would not consider projects that indicate a diversion of ODA (overseas development assistance), nor technologies that are sub-optimal in nature, as also their broad definition of sustainable development.

The selection of CDM projects (endorsed by MoEF) in India by the various tendering authorities motivated the private sector to engage in the development of more CDM projects. Simultaneously, in recognition of the potential for CDM projects in India, various international donors launched their capacity building programmes in India including project development in select sectors (see chapter 4).

The MoEF, the nodal host ministry for CDM established the DNA (designated national authority) in December 2003, which is known as the NCA (National CDM Authority). With an inter-ministerial structure, lead by the Secretary, MoEF, it has so far been dynamic in according approvals in a transparent and timely manner.

Before establishing the NCA, the MoEF provided host country endorsement for CDM projects through an adhoc committee with inter-ministerial representation. The first deliberation on such approvals was in response to the CERUPT tender of the Dutch government. This adhoc committee also endorsed projects in response to tenders floated by the Governments of Finland, Sweden, and Austria.

The NCA has been constituted under the powers conferred by sub-section (1) and (3) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) (Annexe 17). The composition of the NCA is given in Figure 6.1.

National CDM Authority

Chairperson

Secretary, MoEF (Ministry of Environment and Forests), Government of India

Member (or his nominee)

Foreign Secretary

Finance Secretary

Secretary, Industrial Policy and Promotion

Secretary, Ministry of Non-conventional Energy Sources

Secretary, Ministry of Power

Secretary, Planning Commission

Joint Secretary (Climate Change), MoEF

Member Secretary

Director (Climate Change), MoEF

Figure 6.1 Composition of NCA

The NCA has set up a clear process for granting approvals, which is outlined in Figure 6.2.

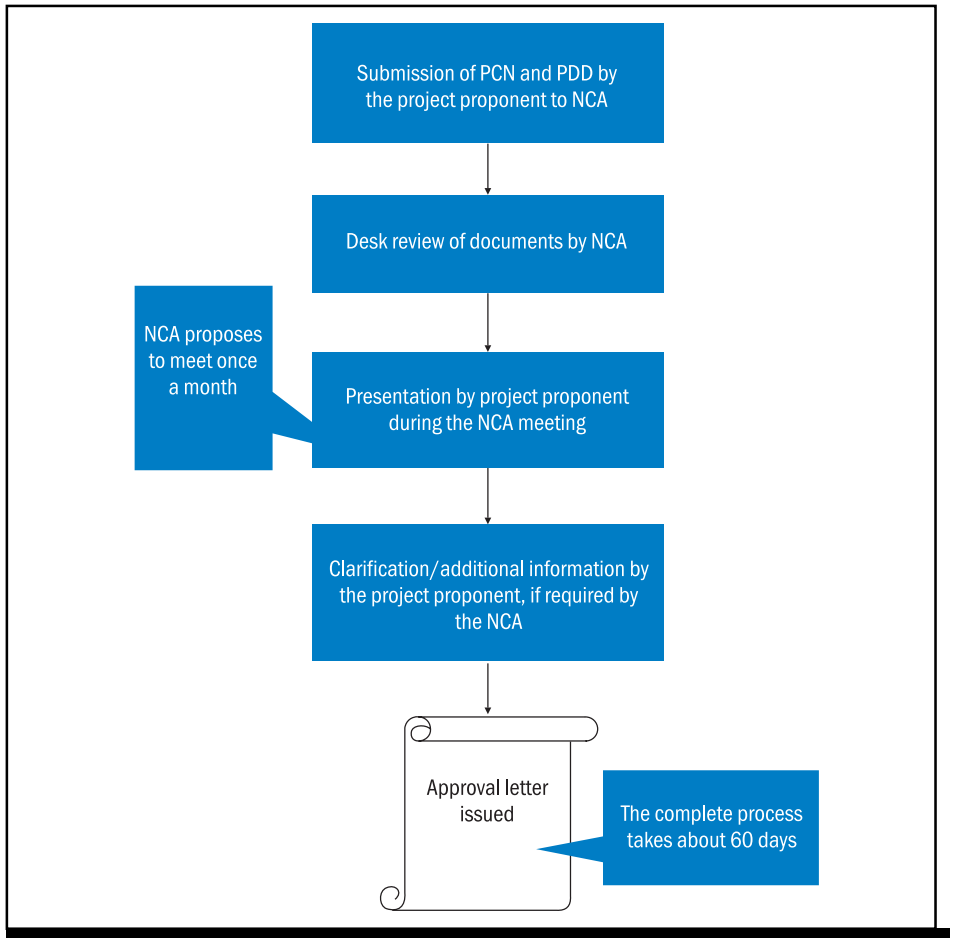

Figure 6.2 Approval procedure of the National CDM Authority

The approval procedure followed by the NCA is simple in that after projects are submitted for review, the member ministries under whose domain the project falls are requested to review the project, and the comments are provided and clarifications sought subsequently during a presentation made by the project promoters to the NCA. Thereafter, the decision of the NCA is communicated to the project promoters. It meets once a month. The NCA does not have a formal, explicit criteria for clearing projects, although the MoEF did set out an interim-approval criteria for clearing CDM projects, much before the constitution of the NCA in the country. Also, presently there does not seem to be scope for contesting the decisions taken by the NCA.

The NCA's powers and functions as detailed in the Gazette notification of the Government of India, relate to the approval of projects as per M&Ps (modalities and procedures) for CDM specified by the EB (Executive Board), a documentation role insofar as maintaining a

registry of approved projects is concerned and a facilitative role for information dissemination. However, there are two provisions in the notification which are potential areas of conflict, namely

a) The NCA will take a view on prioritization of projects in the event they are in competition for the same source of investment, based on sustainable development benefits, and the likelihood of success. While this may be plausible for unilateral projects seeking government financing, it may not be easy for other projects not only because the source of financing has the prerogative in investing, but also because the timing and sequencing of project submissions to the NCA may not make such a comparison possible.
b) The NCA will ensure that the market environment of CDM is not conducive to undervaluation of CERs (certified emission reductions) particularly for externally funded projects. The CER price is a mutually negotiated price, and at best the NCA can provide market price information to project proponents, but may not be able to restrict CER sales below a threshold price it perceives as best under the prevailing conditions.

In order to provide the initial momentum to CDM, currently the NCA does not charge any fees for the host country approval and does not envisage claiming ownership on the CERs generated from projects. However, the private sector is awaiting decisions on the issue of taxing the revenues from CER, especially after the precedent set by the KERC (Karnataka Electricity Regulatory Commission).[1] KERC declared several of the PPAs (power purchase agreements) with KPTCL (Karnataka Power Transmission Company Ltd) null and void, and asked KPTCL to renegotiate the PPAs with the non-conventional energy projects, which included clauses allocating 70% of the CER revenues to the utility and the remaining 30% to the project developers. The decision is premised on the fact that renewable electricity producers are availing themselves of preferential tariff, and any additional benefit they garner in the form of CDM revenues, necessarily needs to be shared for partaking such benefits, such that the general consumers also benefit. This decision has wider repercussion in that, some of the other regulatory commissions are keen to follow suit, without a complete appreciation of the subject, and has left project developers a little wary of such unilateral actions of the state governments.

It is in this context that it becomes essential to see what facilitation is required by the NCA on regulatory issues including taxation and sharing of CERs, institutional issues including the role of states and other national/state-level institutions. In addition, the whole issue of financing CDM projects deserves special attention.

[1] At the time of sending this report to print, KERC has withdrawn its directive to KPTCL for acquiring 70% of the CERs generated from CDM projects

6.3 Elements of a facilitative framework for CDM in India

The facilitative framework for CDM proposed comprises the following elements.

1 Policy and regulatory issues, including
- a proactive policy framework taking into consideration regulatory aspects to ensure that the current and proposed policies do not inhibit CDM development in the country. In this context the trade off between progressive policies and additionality needs to be suitably addressed.
- a considered view on subsidies being provided to projects availing of CDM benefits, and no blanket withdrawals of these subsidies
- a concerted effort to procure sanctity for unilateral CDM projects, internationally
- a careful analysis of sectoral CDM projects that may yield long-term benefits
- an explicit policy on ownership and taxation of CERs
- a dispute resolution mechanism to aid redressal or arbitration, especially to small-scale project proponents

2 Strengthening of the NCA
- The NCA needs organizational enhancement and reinforcement. It not only needs to contribute to capacity building at the state level but also facilitate access to data and undertake information dissemination activities. Other responsibilities it needs to discharge are enhancing inter-ministerial coordination in order to
  - improve coordination between sectoral policies and CDM rules and regulations
  - establish a positive list of technologies that do not require explicit proof of contribution to sustainable development
  - coordinate processes to resolve conflicts and contentious issues in a timely manner (such as states' claims on CERs, removal of subsidies)

3 Finally, the underlying issue of financing of CDM projects need to be analysed, to identify ways and means to address the perceived risks, as also promote appropriate projects in line with national priorities.

6.3.1 Policy and regulatory issues

The rules governing CDM projects and trading of CERs are enunciated by the KP, Marrakesh Accords, and the CDM EB decisions. These rules have, however, to be implemented within the domestic policy framework of the host countries. The complex and sometimes incongruous regulatory systems in the host country inhibit project developers on the one hand and delay the project cycle on the other. The existing policy frameworks as well as the new policy developments need to recognize CDM as an instrument for financing. In this context one of the

outstanding issues relates to the evolving policy and regulatory frameworks, and how CDM could provide a perverse incentive to new and progressive developments.

The Meth (methodology) panel in its twelfth meeting brought out for consideration of the EB (Executive Board), a note on national and/or sectoral policies and regulations. These recommendations identify four types of national and/or sectoral policies and regulations as shown in Table 6.1.

Table 6.1 Different types of national and/or sectoral policies and regulations as classified by Meth panel

Type	*Description*
Type E+	Existing national and/or sectoral policies or regulations–that create policy-driven market distortions which give comparative advantages to more emissions intensive technologies or fuels against less emissions-intensive technologies or fuels
Type E-	National and/or sectoral policies or regulations that create positive comparative advantages to less emissions-intensive technologies against more emissions-intensive technologies (for instance, public subsidies to promote the diffusion of renewable energy, or to finance energy efficiency programs)
Type L-	Sectoral mandatory regulations adopted by a local or national public authority motivated by the reduction of negative local environmental externalities and/or energy conservation and which would incidentally also reduce GHG emissions
Type L+	Sectoral mandatory regulations taken by local or national public authorities motivated by the reduction of local negatives environmental externalities and which incidentally prevent the adoption/diffusion of less emitting technology

Report of the sixteenth meeting of the CDM EB, details available at <http://cdm.unfccc.int/EB/Meetings/016/eb16repan3.pdf>, last accessed in November 2004.

The EB in its sixteenth meeting has directed that only the E+ national and sectoral policies and regulations that were implemented prior to the adoption of the KP shall be taken into account for developing a baseline scenario. Further, if such policies/regulations came into being after the adoption of KP, the baseline would not consider these, but rather a hypothetical situation without these being in place. This is to check any efforts to inflate the baseline, and generate higher CERs than rightfully called for.

Also, to ensure that progressive policies and regulations do not penalize CDM projects on grounds of additionality, E– national/sectoral policies or regulations implemented since the adoption by CoP (Conference of the Parties) of the CDM M&P, may not be taken into account while developing the baseline scenario. This is a positive development, but at some point in time there will be a need to ensure that this is not an open-ended provision, as E- group has a tremendous potential for altering the baseline over a given time frame. Hence the EB has to give guidance for the timing of E– category becoming a part of the

baseline. Also, some of the E– policies may graduate into the L– category, for which no decision has been taken as yet by the EB, and such plausible transitions need careful analysis.

The additionality tools partly take care of the implementation rate of the regulations while justifying additionality of a project.

Sectoral policy framework in India vs additionality

Many developing countries including India are adopting various policies and programmes aimed at pollution abatement, energy efficiency, resource conservation, and sustainable development.

There is general agreement that the simple existence of such programmes and policies does not make a project non-additional. Statements of intent in policies do not automatically translate into implementation, due to a range of technical, financial, and institutional constraints in developing countries. The project developer or the approving authority should look into the implementation status and the host of barriers in getting such policies implemented. The view points of experts on two regulations: the Indian Electricity Act, 2003 and additionality of projects for grid-connected renewable energy projects and implication of Energy Conservation Act, 2001 on CDM additionality are summarized in Boxes 6.1 and 6.2.

Box 6.1

Electricity Act and additionality concerns for renewable energy projects

State electricity regulatory commissions have a mandate to promote cogeneration and renewables and hence play a major role in mainstreaming RE (renewable energy) as per the Electricity Act, 2003. They can promulgate RPS (renewable portfolio standards). Once such standards come into place, the examination of additionality of RE projects would be subject to closer scrutiny, as this would represent a graduation from E– to L– category. In the interim, there is no threat from this provision in the EA (Electricity Act). However, a forward looking view of the SERCs (state electricity regulatory commissions) could be forged by educating them about the possibility of using CDM to achieve ambitious RPS.

Further, the withdrawal of subsidies to CDM projects should be avoided, as this would remove the incentive for these projects to secure carbon revenues. In many cases it would render the project unviable, as CDM revenues alone would not sustain such projects. Instead, it should be emphasized that CDM revenues can, despite low prevailing carbon prices, help attract financing for such projects, serve as an incentive for performance, and encourage developing countries like India to move to a relatively lower GHG (greenhouse gas) intensive path. In this context, perhaps there is a need for periodic reviews of CDM projects in

Box 6.2

Energy Conservation Act and additionality of energy efficiency projects

The Energy Conservation Act, 2001 that has come into force with effect from 1 March 2002 has established a statutory authority called the BEE (Bureau of Energy Efficiency) for recommending suitable energy standards and procedures for different energy consuming products/systems, and also prescribe measures for energy conservation by industry. Any individual energy conservation project proposed under CDM may not be taken as 'business-as-usual as per existing laws' as the Act does not give energy standards for any industry; the BEE plans only development of energy utilization norms with the help of individual industry associations of designated consumers. These norms vary from plant to plant depending upon its raw material, location, capacity, age of the plant, etc. so these cannot be fixed as standards. However, it will become incumbent on the project promoter to establish the additionality of the project either due to various prevailing barriers or due to financial additionality.

subsidized sectors to assess the viability of such projects with/without subsidies, so as to facilitate changes in subsidy policies.

State-level regulatory policies and their implications on CDM

State-level policies related to electric utilities, environmental protection agencies, and pollution control boards could have a dampening influence on the project developers. The oft-cited case as mentioned earlier in the chapter, is of the KERC directing that the utilities are entitled to 70% of the CDM revenue.

The revenues from the sale of CERs at the moment are not large, and if the utilities start demanding a huge share, without cognizance of the extra effort and cost that is incurred to make a project CDMable, this may create disinterest among the project developers. This is not to deny the utilities the right to adjust the preferential tariffs being given to the RE (renewable energy) sector, in light of additional revenues that a project proponent may generate – but this right should be limited to net additional revenues only.

In this context, the role of capacity building and information dissemination at the state-level assumes importance, and this subject is dealt with further under the section on capacity building of stakeholders.

6.3.2 *Ownership and taxation issues*

The CERs are produced through an investment in a CDM project, which would reduce the CO_2 (carbon dioxide) levels in the atmosphere. It is imperative that this physical act be transcribed within a legal regime, enabling the creation of legal rights to the CERs. It is important to mention, however, that the determination of the physical category, under which the CERs fall, will affect their legal status – do the CERs fall in

the category of natural resources, goods, financial instruments, electronic rights like shares and derivatives, etc. (Mathur 2004). The nature of the CERs and the concomitant ownership regimes associated with it has been analysed in Annexe 2. It is important to note that the ownership of CERs is not based on contractual terms of agreement but also on the regulatory framework of the government and the aims and objectives it wishes to achieve.

The overriding concern in the ownership issue is the likelihood of a government claiming sole ownership as it does with naturally occurring minerals and resources. However, CERs are a creation under an international protocol, and this claim can be faulted on that ground.

The ownership issue is compounded by the issue of taxation and clarity on both is required, as voiced during the stakeholder consultations undertaken in this project.

The issue of the tax imposition (such as value added tax, consumer tax, sales tax or income tax) on the trade of CERs has also been widely debated. From a legal perspective the host nation would have the right to impose taxes on CERs being generated through a CDM project activity undertaken on its national territory.

The applicable tax regime in case of the receipts derived from the sale of CERs would be determined by their legal nature, that is, whether they are financial instruments, capital assets or business assets (Mathur 2004). CERs are probably best described as financial commodities. Consequently, receipts from their sale would constitute business income which would be taxed under the heads of profits and gains of business or profession in accordance with the provisions of the Income Tax Act.

As CER revenues would necessarily be foreign currencies, both earning and trading of CERs may be exempted from income tax.

The second tax that could be applicable is sales tax. However, Article 286(1) of the Constitution of India prohibits a state from levying a tax on sales and purchase in the course of exports or imports of goods. Since the CERs only acquire financial value once it is exported and sold to a buyer, a case can be made for the exclusion of sales tax on CERs, as they are purely export items.

A third tax that could be levied is the service tax on intermediaries operating in India, such as carbon traders or brokers. At present service tax is payable by specific service providers. It is applicable to a number of services including real estate, security and foreign exchange processing, etc. The latest budget proposes an enlargement of the service tax net.

The above discussion is a good index of the urgent need for clarification from the government on the issue of taxation of the CERs. This is a delicate issue because the incidence of the tax would have a direct impact on the investment climate in attracting foreign investment and participation of the private sector.

The government can, in the initial stages (till the carbon market stabilizes), introduce investor-friendly schemes like providing a tax holiday or providing subsidies to the CDM projects. This can be done, either by giving a tax-holiday to all CDM project activity, or by integrating the tax net with reference to specific CDM project activity, for instance renewable energy resources.

6.3.3 Strengthening the NCA and inter-ministerial coordination

The implementation of the CDM demands one of the most complex multi-jurisdictional legal frameworks, due to participation of a host of cross international actors. It is therefore absolutely necessary that the host nation invest in infrastructural and institutional mechanisms that would enable smooth functioning of CDM. A summary of the roles and responsibilities of DNAs (designated national authorities) set up in select countries is provided in Annexe 19.

Structure and functions of DNA

The Marrakesh Accords require host countries to approve the projects before submission to the CDM EB for registration. As mentioned earlier the DNA in India has been set up by the MoEF.

The ministry bears all the costs involved in the functioning of the DNA that is NCA. The NCA at present does not plan to charge any fee from the project developers for project approval or other services. In order to encourage the Indian industries, participation in the CDM, the NCA does not plan to levy a tax on the CERs at the moment but does not rule out a possibility to levy a tax on the CERs once the CDM market develops in due course.

Apart from the regulatory function of approving the projects, the NCA can take up several other facilitative functions. The NCA will have to address several emerging issues regarding CDM development in India, including urgent development of a clear action plan for its functioning.

Table 6.2 lists some of the important issues that need to be addressed in this regard.

In order to streamline the functioning of the NCA, it is required that it is equipped with all kind of requisite information and data for taking an informed decision on project promotion, project approval, interaction in the international markets etc. Keeping in view the broad mandate given to NCA, it is recommended that it builds its human and infrastructural capacities and establishes separate technical and marketing units.

To build its capacity, in addition to its own resources the NCA may piggy back upon several bilateral and multilateral programmes going on in the country. This does not mean that the NCA shall control all these

Table 6.2 Strengthening the NCA

Issues	*Actions*
Organizational strengthening of the NCA (National CDM Authority)	■ Equip the NCA with a full-fledged secretariat to handle CDM related activities ■ Secretariat to host a 'technical unit' comprising 3–5 key sectoral experts (power, renewables, industry, LULUCF (land use, land use change, and forestry)) to oversee and guide project evaluation process ■ Secretariat to also host a 'marketing unit' for facilitation (capacity building, information dissemination and outreach)
Capacity building	■ To build state level (governments, industrial associations, financial institutions, regulatory bodies, energy development agencies, municipalities, technology providers etc.) capacity for catalysing CDM activities, across the country
Information dissemination and outreach	■ Disseminate relevant information for CDM project development, criteria for approval, decisions on approved projects, examples of best practice projects etc. on a CDM website and other communication channels ■ Provide links with websites of other organizations which will have relevant data for baseline design etc. viz. Ministry of Power, Ministry of Non-conventional Energy Sources, Ministry of Shipping, Road Transport and Highways, etc. ■ To assist the proponents of NCA-approved projects in marketing CERs through carbon forum, carbon bazaars, apprising the visiting delegations of Indian CDM portfolio ■ To promote the development of an Indian CDM community and interactions among key players in the CDM project cycle namely proponents, investors, DOEs, consultants, NGOs (non-governmental organizations) to improve quality of PDDs
Inter-ministerial coordination	■ Coherence between sectoral policies and CDM rules and regulations is required for encouraging CDM project development ■ To build capacity in member ministries, to enable NCA to expedite scrutiny and approval of projects ■ To jointly approve a positive list of technologies that do not require explicit proof for sustainable development contribution ■ To establish a coordinated process to resolve conflicts and contentious issues in a timely manner (such as states claim on CERs)

Note NCA should focus on coordinating and supplementing all existing and forthcoming efforts (see Table 1 in chapter 4) in capacity building, information dissemination and outreach

programmes and activities. Instead it should have a clear business plan of its own and should try to synergize with these programmes, many of which are being coordinated by civil society organizations and consultants.

6.3.4 Role of NCA in mainstreaming CDM at different levels

National and state level

For the NCA to widely reach out to regional and state levels, it will be useful to coordinate with state-level organizations. It will also necessarily have to coordinate with the activities of other institutions and bodies such as energy development agencies, the pollution control boards, the

energy service companies, consultants, technology providers, industry associations, municipalities, cooperatives and NGOs, etc. and benefit from the synergies thus developed.

The present approach of the NCA to restrict its role to host country approval is more in line with consultants' views than with the industry's perspective. However, this minimalist approach of the NCA should be maintained, while catering through other means to the industry's request for access to (cheaper) project development services. A more sectoral approach is called for, which could be addressed by establishing small units within the sector ministries that are members of the NCA board already. These units could help mainstream the CDM in general sector policies.

The states are regarded as having an influence on CDM project development and approval, which is not generally seen as positive. The states do not have any formal right in terms of approving CDM projects per se. They clear projects on environmental issues and they may enter into PPA for grid-connected energy projects. The states should be encouraged to market themselves as 'biased' in terms of CDM project development. They may – as three states have already done – set up CDM promotional cells, which may also help prevent unwelcome tax or credit sharing orders at the state level.

While there may be a lot of project development experience in India, it is concentrated with a few consultants in the country. Industry in general, regards both the CDM policy framework and the transaction costs as hindrances to project development, but at the same time – and inconsistently – agrees that CDM is an important project driver. Advisors naturally prefer fewer restrictions for project development. Industry is relatively more in favour of bilateralism and technology transfer on concessional terms. This might also help in identifying CER buyers as well as provide upfront financing. The call for an enabling environment is believed to be not particularly related to unilateral projects, but to projects in general.

Interactions with bi/multilaterals in capacity building

Over the last five to six years there have been several capacity building programmes launched by bilateral and multilateral organizations in the country. The major ones are listed in Table 4.1 in chapter 4. These programmes have been successful in sensitizing the stakeholders viz. the government officials and CEOs of large corporates on climate change. However, these programmes being short-term in nature lack continuity and fail to address the sectoral and stakeholder-targeted in-depth training.

The NCA needs to interact with these bilateral initiatives for pooling skills and integrating their approach for maximizing the outreach impact.

Databases and information channels

While developing CDM projects, the developers have realized lack of relevant data as a major bottleneck. In several cases data is available but there may be gaps in between or some inherent inconsistency.

There is a strong need for identifying relevant data for different possible types of projects. Chapter 5 has attempted this for a few sectors as can be seen in Table 5.3. An assessment of the kind of data available with different ministries and departments of the Government of India should be carried out and the gaps identified.

In several cases, the project developers are also not aware of the sources of information and data. In order to make this available to project developers, these data should be made available in public domain. The NCA website may be used as a source of information to project developers and consultants.

Capacity building of Indian FIs

A necessary condition for an in-depth involvement of the financial sector is the development of transparent and effective approval rules by regulators both at the central and state level as well as improved project development capacity of the private sector.

Barring a few banks, the majority of FIs (financial institutions) in India are not proactive and need to play a role in accelerating CDM implementation by funding CDM projects. Primarily, FIs need to assess and consider the carbon risk during their appraisal for funding, develop innovative market mechanisms like special purpose vehicles, CDM funds or CDM bonds. (Deodhar, Michaelowa, and Krey 2003), bank and trading of CERs (nationally and internationally) and establish networks among themselves for promoting CDM. Presently, a couple of FIs in India, namely IDFC and Rabo India are operating the carbon funds, supported by PCF and the Dutch Government respectively. However, they are yet to consider the carbon risk.

In the past some bilateral organizations have attempted to build the capacity of FIs. However, like any other training programme, these have been sporadic events.

In order to raise awareness of the sector and build its capacity, sector-specific training modules may be developed. Initiatives like UNEP-FII (United Nations Environment Programme – Financial Institutions Initiative) may also prove useful as it develops cutting edge research and management tools, and provides a voice for FIs on important global issues such as the World Summit for Sustainable Development in Johannesburg, the United Nations Financing for Development Conference and climate change negotiations.

The NCA should also establish mechanisms to monitor and review its activities (including the effectiveness of capacity building initiatives) on a periodic basis.

6.3.5 Other facilitative measures

Inter-ministerial coordination

Given the facts that international legal framework governing the CDM is still getting cemented and nationally the implementation of the CDM projects involves inter-sectoral policy-making, it is essential to establish the exact legal status of NCA and its arena of policy-making vis-à-vis the authorization of CDM projects on the other. For instance, there might be inter-sectoral rife in terms of policy-making between the RBI (Reserve Bank of India) and the NCA with reference to participation of foreign investment capital in CDM projects. Similarly, there could be conflicting views of the NCA and specific sectors such as power, renewables, transport, wastes etc. and policies of the Ministry of Finance regarding taxation, subsidies and ODA.

There is, therefore, an urgent need to forge institutional partnerships to facilitate CDM implementation. However, for any government this would be a Herculean task as parallel chains of command tend to oppose rather than cooperate.

Favourable investment climate

The host nation's policy (in the short term) should be that of no interference inasmuch as to allow the project developers' flexibility to negotiate the proper sharing of benefits, costs and risks associated with project development. If the ministry imposes a utility sharing clause in the project permit, it would deter potential foreign investors from investing in the CDM. This is especially true in the present climate of competition among non-Annex I countries to attract as much of FDI (foreign direct investment) in this area. 'Globally, projects are not necessarily going to the countries with the greatest potential for cost effective GHG emissions reductions: rather the projects are going to countries with the most favourable business and regulatory environment for the CDM'.

Definition of the term 'stakeholders'

For according host country approval, the NCA in its charter is not only required to ensure that the projects are compatible with the local priorities but also that 'stakeholders' have been duly consulted. This is a potentially problematic area. The problem arises in the legal interpretation of the term 'stakeholder'. If we follow the various UNEP guiding documents on CDM, then it is usually taken to mean project stakeholders or entities involved at any stage of the project development and implementation. However going by the laws of statutory interpretation, the meaning of the term in the context of the entire

provision would include the local-level stakeholders like the gram panchayats at the local level and the NGOs and other members of civil society, etc., who would in some way be affected by the development of the project. There is, therefore, a need for clearly defining the ambit of the term 'stakeholder', so as to obviate the dangers of possible disputes over the obligations of the NCA vis-à-vis the 'stakeholders'.

Dispute resolution

It is also incumbent on the host country to provide for a dispute resolution mechanism and arbitration options. This can be provided, either by setting up a specialized tribunal under the NCA or by opting for a regular redress system within the Indian judicature. The process of dispute settlement to a large extent would also be contingent on the financial capability of the parties involved in the dispute. If the project is on a large scale, the project participant would have the finances to go for international arbitration, however the same cannot be said for small-scale project developers. For them the domestic system of redressal of disputes is a relatively inexpensive and therefore, a far more accessible alternative to international arbitration.

State CDM cells

State-level CDM cells may help with information dissemination and awareness generation regarding the CDM process, thereby encouraging more project development activities. These cells may be instituted either with the existing industrial promotion agencies, renewable energy development agencies or any other government bodies. Alternatively an independent body may also be constituted depending upon the interest of the business sector and volume of business expected.

The Governments of Andhra Pradesh, Madhya Pradesh, and West Bengal have set up CDM cells to explore the CDM potential in the states. The other state governments may also like to set up similar cells in order to facilitate CDM implementation. Such a cell can further facilitate the interaction between state-level project developers and the NCA, bringing down the transaction costs to some extent.

National-level operational entities

A DNA under the CDM is either a domestic legal entity or an international organization accredited and designated by the EB having the following functions.

- Validate and subsequently request registration of a proposed CDM project activity, and
- Verify and certify emission reductions from a registered CDM project activity, and request the EB to issue CERs.

As on September 2004, the EB has given accreditation and provisional designation for validation to the following four organizations: JQA (Japan Quality Assurance Organization); DNVcert (Det Norske Veritas Certification Ltd); TUV Industrie Service GmbH TUV (TUV Industrie Service GmbH TUV SUD GRUPPE); and SGS (Societe Generale de Surveillance UK Ltd).

All the four accredited operational entities are multinational companies and operate in India through their regional offices.

Involvement of international operational entities for validation and verification ostensibly translates into higher transaction costs. Therefore the need for national-level designated operational entities has been voiced. The NCA in India also agrees with this view and, keeping in view the technical capacities resting with some of the organizations, it would encourage emergence of national-level operational entities. Towards addressing this need, the NCA is planning to support the ICFRE (Indian Council for Forestry Research and Education) to become an operational entity for the LULUCF (land use, land use change, and forestry) sector. Similar encouragement may be provided to other exceptionally competent organizations with significant local knowledge in the field of energy and industrial process.

However, the national DOEs (designated operational entities) may not necessarily lead to lower costs. The main element of reducing the DOE's prices is the development of a functioning global market and a competition for their services. Further, the high liabilities of DOEs and the insurance coverage they need, pose an additional barrier to the emergence of national DOEs.

Moreover, the comparative advantage that national DOEs may provide in terms of costs, may be outweighed by the preferences and dictates of buyers to engage particular DOEs. The case in point of ICFRE however, remains, as there are very few organizations with such depth of knowledge and skills in the forestry sector to be able to validate and verify LULUCF CDM projects.

Bundling organizations

Most of the CDM projects currently being developed in India belong to small-scale category of CDM projects. Many of these projects may have high sustainable development benefits but, due to their smaller size, the projects are not able to bear the high transaction cost related to project development and other steps. Studies on transaction cost have indicated that bundling of small projects into one, or bundling of project steps, may reduce the transaction cost of such projects (*see* Table 5.8 in chapter 5).

This creates the need for bundling organizations which can coordinate the preparation of CDM-related documents, validation and registration of the projects, and monitoring and verification of emissions

reduction on the one hand, and also act as a single contact point for the carbon buyers on the other. The consultants, energy service companies, technology providers, etc. may be well placed to take up this task. Additionally, agencies such as SIDBI (Small Industries Development Bank of India) and NABARD (National Bank for Agriculture and Rural Development) can also act as bundling organizations for rural development and community development-oriented projects. Such organizations with necessary wherewithal including technical knowhow, convening power, administrative skills and in particular, legal and contracting skills are best suited candidates. They may also serve as a seller's pool, thereby securing the interest of the sellers.

A few such examples are already available in the country, for example, an NGO – Women for Sustainable Development – in Karnataka is coordinating the activities of small-scale CDM project developers, providing them technical assistance and assisting them in the sale of the emissions reductions from these projects. The IT Power, India and the ECN, the Netherlands also carried out a study under the Synergy Programme of the European Commission to assess the existence of potential bundling organizations in the country and their capacities.

In the initial phase of CDM, several bundling organizations will need support to build up their capacity and to coordinate, train, and assist local project developers. Such support could come from development agencies, which are interested to foster sustainable development by implementation of small-scale projects, or from the NCA.

National CDM registry

According to the Marrakesh Accords, the CDM EB shall establish and maintain a CDM registry to ensure the accurate accounting of the issuance, holding, transfer and acquisition of CERs by parties not included in Annexe 11. This registry shall be in the form of a standardized electronic database which contains, inter alia, common data elements relevant to the issuance, holding, transfer and acquisition of CERs.

The non-Annex I countries are as such not required to maintain a CDM registry and the data record related to their transactions will be maintained by the CDM EB registry. These countries can any time log into the EB registry to get the requisite information. The EB registry, however, keeps a record of the projects, from its registration with EB onwards.

The NCA would be receiving a large number of projects and the ones that are accorded approval and forwarded for registration, may be a subset of these. It would thus be useful for India to maintain proper records of all the stages that a project undergoes, starting from its receipt to its approval. This database will allow NCA to publish key figures on CDM activities in the country, such as estimate of the CER potential of

the proposed projects, monitoring of this potential, sectoral and geographical coverage, capacity building needs, etc. The NCA in its role definition has also provided for a national CDM registry.

To track the transactions with the buyers, a link with the CDM EB registry is called for.

Stakeholder capacity building

The level of capacity of CDM stakeholders in India is fairly uneven, with some institutions very high on the learning curve while others, mostly at the state-level, relatively unaware of issues concerning CDM project development and implementation.

The general level of awareness is generally quite high in India, higher among consultants than within industry. However, there is a lack of specific knowledge of access to project advice through DOEs present in India, and advice is generally thought of as being foreign and expensive, hence the need for low cost Indian advisors. The industry is generally not aware of the risks associated with project development, while the Indian consultants are.

While there may be less need now for general information campaigns to raise awareness of CDM in broad terms, specific training on a sectoral basis is required on legal, financial, and operational issues. In that regard, there may be a need for training the trainers in the first phase.

6.3.6 Financing

A significant aspect of CDM projects is the need to tie up underlying financing. However as the international negotiations have largely been a multilateral process, and given the uncertainty that continues in the sector, mainstream financing is yet to formally engage in CDM transactions.

This is particularly so in India, even though there is no shortage of funding and the financial markets are mature. There are two possible ways in which financial institutions become critical for CDM.

- Financing of projects that are also eligible for CDM (no risk of CDM except possibly upside), and
- Designing financial instruments that leverage CDM.

While the first is being done to some extent as a matter of course, the latter is yet to be initiated by the financial community in the country.

The critical barriers to a pipeline of CDM projects increasingly are

- lack of good projects and project promoters,
- inability of new promoters to bring in equity to be able to avail of market financing, and
- lack of development of project ideas and promoters for small community projects.

To overcome these barriers a NCF (national carbon fund) is proposed. This fund could have three separate arms each addressing the barriers outlined above.

- Small CDM project development facility
- CDM project equity fund, and
- Carbon pool for covering non-delivery risk.

Details of the rationale for these are outlined below.

Small CDM project development facility

This facility is proposed to develop projects that have direct community benefits and will bring them up to financial closure and implementation. The idea would be to seek to operate these projects on commercial principles with support from the government where required. These projects will essentially be development projects that leverage state subsidy and assistance rather than being funded out of development assistance. CDM will be an additional benefit and revenue stream.

The facility may be set up with a one-time grant or endowment and will, if it is able to realize sufficient money from the project development activities (from government or from the project), become self sustaining. The government can also keep an annual revenue stream based on success of the project development facility in setting up community-related projects with clear development benefits.

CDM project equity fund

This addresses the problem that CDM project promoters often face where they are not able to bring in adequate equity to be able to obtain debt, and also not able to leverage the CDM revenue streams to secure financing. The fund may be set up (initially) as a pilot fund, say 10 crore, with contributions from the government as well as the financial markets.

The fund will initially focus on the following.

- Providing equity to projects that are CDMable, and
- Providing mezzanine capital leveraging CDM revenues

This fund corpus can be increased if the projects begin to show returns with other investors participating.

Carbon pool for covering non-delivery risk

An important risk that can make conventional lenders shy away from carbon projects is the non-delivery risk associated with project failure. This is a problem that can be very significant as when a project fails, the lenders are anyway under pressure due to reduction in revenue streams from the project. The additional liability of the penalties associated with non-delivery would therefore be a double hit for the project. It is not expected that the market will be able to address this matter as the

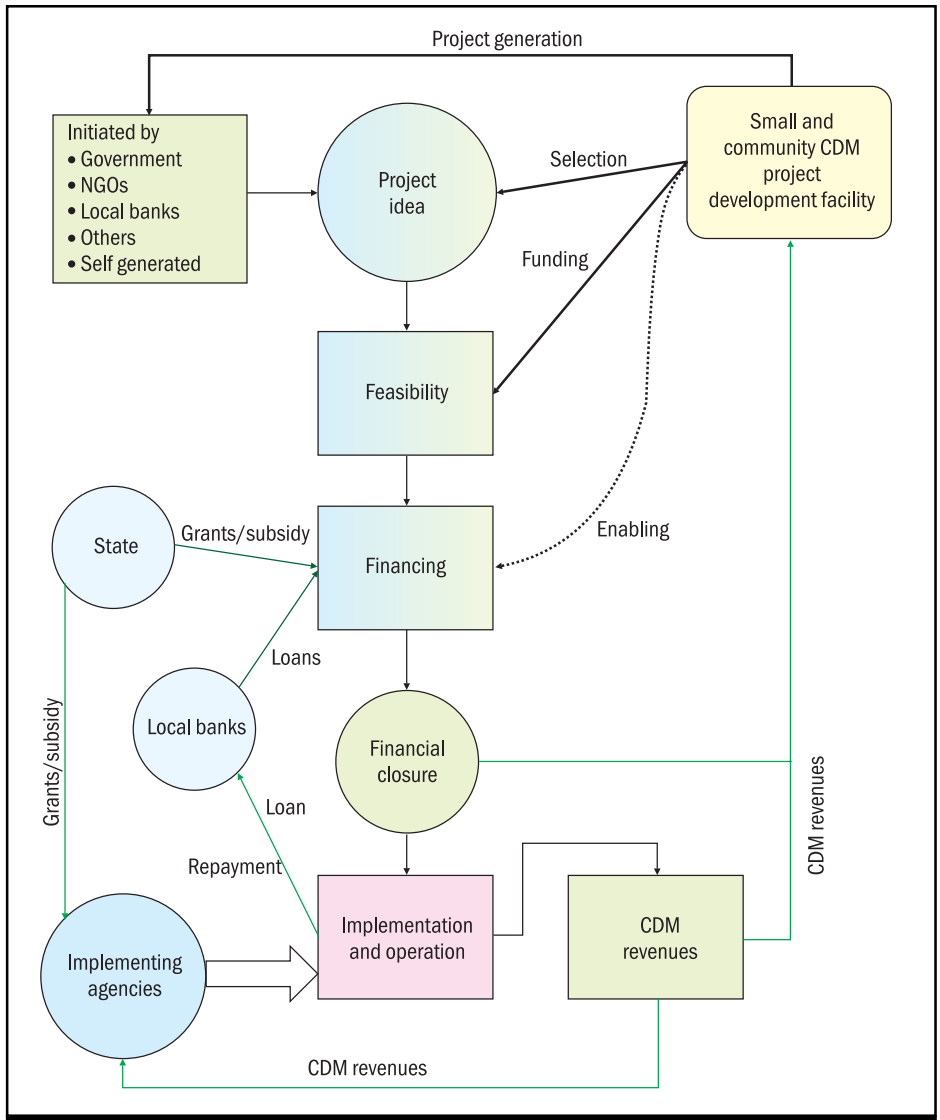

Figure 6.3 Small project development facility: a proposed scheme
Source IDFC 2004

mainstream begins to consider these projects. What is a likely scenario is that even as mainstream lenders begin to consider carbon revenues and therefore financing, the non-delivery risks present a downside that would be unaddressed.

To address this, in the interests of facilitating a healthy carbon market in India, this NSS proposes the setting up of a carbon pool for 'insuring' the non-delivery risk.

- All projects that wish to participate in the pool can voluntarily cede a percentage of their expected ERs to the pool.
- The understanding being that the pool will keep these credits and make good the non-delivery losses to a particular project. The pool would be expected to sell the credits at a slight premium to the

purchase price, to ensure that the contributors that do not suffer a non-delivery risk, also benefit from the increased price of CER. Further the failing project will have the option of purchasing the credits at a significantly cheaper price than what may be prevailing in the market at that time. This matter however needs to be thought through for hardening and softening markets.

- The pool will also have direct linkages with the lenders.

The pool can be operated either on a voluntary basis or a national requirement basis. The former is suggested in the interests of a free market. In essence this will operate like an insurance scheme and the involvement of the insurance sector can also be considered.

The architecture of this NCF and the integration and interaction between the three suggested sub-components needs to be analysed in-depth and is the scope of a separate study, which would require detailing of actors, roles and responsibilities, and also the relationship with NCA and the Government of India.

6.4 Summary of recommendations

For providing a conducive environment for CDM implementation in India and encouraging project developers to participate proactively in CDM, the following issues need to be addressed on a priority basis.

- Some guidance on priority sectors, contributing to sustainable development and generating CERs may build the confidence of the project developers.
- The NCA should facilitate availability of relevant data for baseline design, through coordinating with suitable ministries and government departments and providing links between the NCA website and other appropriate websites.
- The NCA should lay down clear guidance regarding the implications of national policies and regulations on CDM project additionality.
- All practicable steps to bring down transaction costs shall be encouraged by keeping the process simple and transparent, promoting local-level operational entities, bundling organizations etc.
- Protecting the interest of project developers, especially the small-scale developers by supporting and guiding initiatives such as sellers' pool and mobilizing other developing countries not to participate in CDM at CER prices below a certain threshold.
- The financial institutions and the insurance industries in the countries shall be geared up to participate in the CDM process and pool in the domestic financing.
- Promoting emergence of CDM cells at the state level to widely reach out to the project developers.

- To avoid confusion related to the sharing of CERs among the stakeholders, imposition of taxes etc., the NCA shall thoroughly analyse these issues and announce its policies related to above issues.
- All likely risks and dispute possibilities shall be visualized and their redressal measures and agencies to handle such issues shall be identified.
- NCA shall support capacity building of different stakeholder groups, more important at the state level. For this the NCA may like to build upon various capacity building programmes by different bilateral and multilateral organizations.
- Capacity and infrastructure building of the NCA is also necessary to handle the volume of business in the offing.
- A website for NCA shall be developed which provides all the necessary information, approach and policies of the NCA to project developers, state agencies etc.
- Finally and most importantly, the need for setting up an NCF for small project equity fund and pooling of non-delivery risks, needs to be examined.

6.5 Note

This chapter has drawn significantly on the various discussions that the team has had with different stakeholders, especially at the two workshops held under the aegis of NSS, namely the Launch and Public Workshop held on 21–22 October 2003, and the brainstorming session held on 20 July 2004 on policy recommendations for CDM implementation in India, and the background material prepared for these two workshops. Interactions with different players at other national fora have also contributed to the discussion in the chapter.

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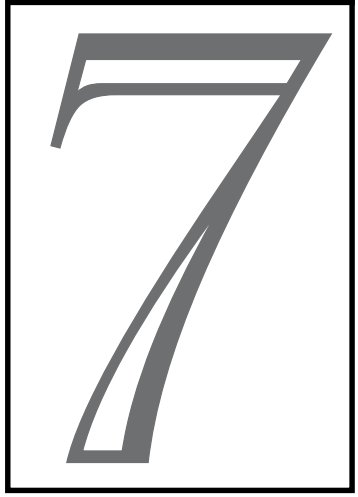
2 tables

CHAPTER



Elements of an action plan for facilitating CDM implementation in India

In this chapter, the analysis of the international CDM (clean development mechanism) market (chapter 2) and of the promising potential for CDM in India (chapters 3–5) is translated into a strategy for the government to make optimum use of the CDM to the benefit of India. Further, a preliminary plan of action is proposed that aims at operationalizing the strategy within the government.

7.1 CDM: benefits for India

India is likely to capture 10% of the global carbon market during the first commitment period. The country's volume of CER (certified emission reduction) exports in 2010 may range between 3.7 and 26.4 $MTCO_{2eq}$ (million tonnes of carbon dioxide equivalent), bringing in revenue in the range of 5–100 million USD per year.

The contribution of CDM projects to GHG (greenhouse gas) emission reductions and to the protection of the global climate system will assist India in meeting its environmental foreign policy commitments under the UNFCCC (United Nations Framework Convention on Climate Change). Further, India could proactively pursue a policy of leveraging CDM revenues for projects that are in consonance with sustainable development and its development priorities.

7.2 Strategy for CDM in India

The Indian policy-makers need to strategically assess opportunities in the emerging carbon offset market at the macro and micro levels.

- What are the economic, social, and environmental benefits of participating in the CDM regime?
- What is the development of the demand for CERs in the global carbon trade market?
- What are the carbon price trends? How likely are supply shortages within the first commitment period and how best to bring to the market Indian CERs?
- What are the priority areas for carbon finance investments, especially in the energy-related sectors?

These questions were addressed while developing the strategy.

With the KP (Kyoto Protocol) in force, negotiations on commitments for subsequent periods for Annex I parties, which may take the form of amendments to Annex B of the Kyoto Protocol, will be launched by the end of 2005. If this path is followed, and commitments can be negotiated successfully, the CDM will likely be part of the future policy mix, under a continuation of the Kyoto regime. Otherwise, and this risk is substantial, the validity and value of CERs after 2012 is uncertain.

As a result, at present, investors are mainly interested in making financial commitments to CDM projects for CERs generated through 2012. Time is a critical factor if we assume that the CDM projects to be implemented by India shall have a seven-year crediting period. Such projects would have to be operational by the end of 2005 to capture the full value of the project's eligible CERs during the first commitment period.

In this context a two-pronged strategy capitalizing on opportunities in the short- and medium-term, as also aiming for the long-term with sectoral projects is called for. These strategies are discussed below.

7.2.1 *Target CDM markets in the short to medium term (2005-07)*

If India is to capture and retain a significant CDM market share in the order of 15–25 $MTCO_{2eq}$ per year, it would have to adopt a proactive strategy. This strategy would comprise the following points.

- Encouraging the submission of a significant number of good quality projects to the EB (Executive Board) for registration by 2006
- Replicating the use of approved methodologies in sectors with significant mitigation potential
- Supporting preparation of methodology for projects for CDM approval in sectors where the country has a large potential, and which match sustainable development needs.

For a targeted approach in the short-term, the government needs to take a view on the spectrum of projects/sectors in which projects are being developed, the ease and speed with which they can be implemented and then undertake a comparative assessment of these on their contribution to sustainable development.

The contribution of CDM projects to GHG emission reductions and to the protection of the global climate system will assist India in meeting its environmental foreign policy commitments under the UNFCCC. Yet the main driver for India's participation in the CDM is the promise of local sustainable development benefits.

The assessment of such external benefits and the contribution to the production of global common goods should be embedded in the sustainable development criteria, applied to CDM projects. Given the prevalent CER prices in the carbon market, market incentive from CDM is not adequate to tip the balance significantly in favour of clean technologies. However, such benefits may, in combination with other government policies, provide an impetus and play a vital role in promoting projects with significant co-benefits in terms of sustainable development.[1] Table 7.1 provides a grouping of CDM projects on this basis.

In the short to medium term, the government has to choose between projects being proposed by the private sector, especially the one that can be characterized as low-hanging fruit (including projects of reducing industrial gases or projects in the renewable energy sector) on one hand, and projects very clearly contributing to sustainable development objectives (such as rural electrification, energy efficiency improvements), on the other.

The government's role in this context is to continue providing an efficient and transparent regulatory framework for according host country approval. It should also undertake some facilitation in the form of capacity building and enhancing data availability. However the second category of projects may require some concerted effort in project financing to reap the sustainability premium, as also aggressive tapping of opportunities from investors that are willing to pay a sustainable development premium such as the World Bank's CDCF (community development carbon fund).

Finally and most importantly, the opportunities expected from setting up a national carbon fund for small-scale project development, project equity fund, and pooling of non-delivery risks should be examined. This carbon fund's objectives would need to address the critical barriers to a pipe line of good CDM projects, inability of new promoters to bring in equity to leverage market financing and lack of

[1] Rural energy and municipal projects (energy from municipal waste, EE [energy efficiency] in municipal street lighting, water pumping, EE in buildings)

Table 7.1 **Capabilities of different CDM project types to co-produce global common goods**

Types of CDM projects	*Benefits internalized*	*External benefits, global common goods co-produced by CDM*
HFC, PFC, N_2O, as industrial gases, plus methane recovery: low-hanging fruits, large GWP leverage	• Straight-forward business deals • Industrialized gas-based CDM projects yield low level of sustainable development benefits • Important role in Kyoto compliance market as they help Annex I meeting their commitments comparatively cheap, which reduced barriers for Annex I policy-makers to comply with Kyoto targets • China has proposed to ensure sustainable developments benefits of such projects through sharing of benefits between project proponents and the state, with funds reinvested in other activities in support of sustainable development	While methane recovery projects in the waste sector contribute to leverage much needed investment into urban waste management, HFC (hydrofluoro carbon) 23 have been under controversial debate due to potentially adverse impacts on their implementation of the Montreal Protocol A significant external cost may result form implementation of HFC23 projects • HFC 23 projects subsidize HCFC (hydro chlorofluoro carbon) 22 price in international market • disincentive for non-Annex I countries to phase out HCFC 22 in time • disincentive for technology transfer in ODS- free technology • increased consumption of HCFC 22 contributes to global warming, though not accounted under UNFCCC
Energy efficiency in industry and large potential in energy sector public enterprises (clean coal)	• Few proven business cases from India, prevailing barriers in large-scale power sector[1] • Better prospects for energy efficiency	To bring large-scale power sector projects to market would mainstream technology transfer, modernize, partly outdated capital stock and developing country participation with a view to post-Kyoto deals.
Renewable energy	• A number of renewable energy CDM projects from India are well placed in the CDM project pipeline. • The significant number of straight-forward, mainstreamed CDM business cases could give boost to the renewable energy sector, mitigation potential of these at global scale, however still limited. • Projects prone to adverse regulatory barriers.[2]	Strong sustainable development benefits; in some cases additionality difficult to demonstrate due to regulatory framework
Small-scale sector projects such as rural electrification and small-scale foundry	• In most cases not assessed feasible as commercial business deals need clients ready to pay premium for sustainable development contribution, such as higher CER price paid by CDCF (community development carbon fund)	Significant contribution to sustainable development, CDM cases to demonstrate convergence between development agenda/millennium goals and environment agenda

[1] Improvement in efficiency of generation is not revealed by the power generator as there is an ambiguity in sharing the benefits of lower cost of generation with the consumers
[2] Additionality uncertain due to domestic regulatory framework and low carbon prices

development of small community projects. Such a carbon fund for India could assist the country to gain a sustainable development premium from CDM implementation.

7.2.2 Target CDM markets in the long term

The shape of the international climate policy regime for the post-2012 period will determine whether CDM project starting operation after 2008 have commercially viable future and whether CERs generated after 2012 have value for India and other host countries. Further India's CDM strategy, policy and implementation plans to adopt a proactive and sustainable CDM policy, also assumes importance from a longer term perspective.

In the long term, India would look to streamline the processes and produce CERs in larger volumes more efficiently. The option of developing sectoral programmes in the CDM mould, if a CDM like mechanism is accepted in the post Kyoto timeframe, needs to be investigated in-depth in the years ahead.

The strategic option of developing a national framework for application of sectoral CDM (for example, for the power sector) should be investigated further. There is scope to use CDM investment (or proceeds from sales of CERs, depending on the transaction model) to supplement government initiatives to introduce advanced technologies (clean coal, new and renewable technologies, energy efficiency), without expecting initially the full recovery of incremental cost.

Currently, CDM is implemented on a project-by-project basis. This has allowed a prompt start under the framework established under the Marrakech Accords. However, in the mid term this is likely to lead to inconsistencies in the methodologies with transaction costs remaining at high levels. Also, CDM in its current form provides disincentives to developing countries to implement binding environmental regulations, as such policies and regulations lead to tougher baselines and therefore less CERs per project.

Sectoral CDM would be a mechanism that enables the implementation of sectoral policies or regulations by providing financial and other resources in exchange for the resulting CERs. With sectoral CDM, a larger volume of reductions is possible with lower transaction costs than in the classical project-by-project based CDM. However, sectoral CDM poses challenges for additionality assessment and monitoring. There is an urgent need for more development of the concept of sectoral CDM both at the UNFCCC and country level, as it poses an opportunity to make use of the full potential for GHG reduction and sustainable development in host countries.

The lead, of course, will have to be taken by the MoEF (Ministry of Environment and Forests), and this could be an important programme of capacity building within the ministries of Government of India, various public utilities, and state-level agencies.

Sectoral CDM would be a vehicle for sectors that are important for the sustainable development of India, but are less suited for conventional CDM. Here, the technical, economic, methodological, institutional, and legal basis has to be developed in parallel to the discussions for the second commitment period.

Simultaneously, efforts should be made to obtain sanctity for unilateral CDM projects to become a part of a proactive strategy to move towards lower GHG-intensive development pathways, which are also coincidental with sustainable development pathways. This could become very relevant also in the context of demonstrating the country's willingness to take part in any international effort to mitigate climate change. In fact higher involvement in CDM can be construed as meaningful participation by India in such efforts.

7.3 Preliminary plan of action

In order to operationalize the strategy for CDM within the government of India, the implementation of the following actions is proposed.[2]

Table 7.2

Organizational strengthening of the NCA

Responsible	*Action*	*Target*	*Financing*	*Time*
NCA (National CDM Authority)	NCA to be equipped with a full-fledged secretariat to handle CDM-related activities	NCA	MoEF	Mid 2005
NCA	Secretariat to host a technical unit comprising 3–5 key sectoral experts (power, renewables, industry, LULUCF) to oversee and guide project evaluation process	NCA	MoEF	Mid 2005
NCA	Secretariat to also host a separate unit for facilitation, to coordinate and support capacity building, information dissemination and outreach	NCA	MoEF, international donors	Mid 2005

Capacity building, information dissemination, and outreach

Responsible	*Action*	*Target*	*Financing*	*Time*
NCA unit for facilitation; coordinates and supports activities	To build capacity for catalysing CDM activities targeting promising projects with high sustainable development component (SSC including bundling, residential, SMEs, municipal services, etc.) across the country.	Governments, industrial associations, financial institutions, regulatory bodies, energy development agencies, municipalities, technology providers, NGOs (non-governmental organizations), etc.	MoEF, international donors	2005–07

[2] An earlier preliminary exercise outlining a facilitative framework for CDM in India was undertaken by the Planning Commission in 2003. Since then several national and international developments have taken place which have been considered in the present work.

Table 7.2

Capacity building, information dissemination, and outreach *(Continued)*

Responsible	*Action*	*Target*	*Financing*	*Time*
	Disseminate relevant information for CDM project development, criteria for approval, decisions on approved projects, examples of best practice projects, etc. on a CDM website and other communication channels	Promising candidate proponents for projects with high sustainable development premium	MoEF, international donors	Early 2005; regular update
	Provide links with websites of other organizations which will have relevant data for baseline design, etc. viz. Ministry of Power, Ministry of Non-conventional Energy Sources, Ministry of Shipping, Road Transport and Highways, etc.	National and international PDD (project design document) developers	MoEF, international donors	Early 2005; regular update
	To assist the project proponents in marketing CERs through Carbon Forum, Carbon Bazaars, apprising the visiting delegations of Indian CDM portfolio	All Indian and international proponents of CDM projects in India	International donors, technology providers	2005–07
	To promote interactions among key players in the CDM project cycle namely to improve quality of PDDs	Project proponents, investors, DOEs, consultants, NGOs	International donors	2005–07
	To promote development of domestic designated operational entity for validation of Indian CDM projects	Domestic academic and research institutions	MoEF, International donors	2005/06

Inter-ministerial coordination

Responsible	*Action*	*Target*	*Financing*	*Implementation*
NCA	Coherence between sectoral policies and CDM rules and regulations is required for encouraging CDM project development	Relevant ministries, departments and regulatory agencies at the state and centre, Planning Commission	MoEF	2005/06
NCA	To build capacity in member ministries, to enable NCA to expedite scrutiny and approval of projects	-do-	MoEF, International donors	2005
NCA	To jointly approve a positive list of technologies that do not require explicit proof for sustainable development contribution	-do-	Self financed	2005
NCA	To establish a coordinated process to resolve issues in a timely manner such as states claim on CERs (certified emissions reductions), HFC, etc.,	Relevant core group of Ministries, including Ministry of Finance	MoEF	2005/06

Continued...

Table 7.2 Policy and guidance on unresolved issues *(Continued...)*

Responsible	*Action*	*Target*	*Financing*	*Implementation*
NCA	The NCA needs to deliberate and take policy stands on issues such as ownership of CERs, sharing of CERs by utilities, etc., taxation of CERs	Core group of ministries, including Ministry of Finance	NCA corpus funding	2005/06
NCA	The NCA representations in international debates at CoP/MoP on issues such as additionality, methodologies, unilateral CDM, etc. will help the Indian project developers	CDM Executive Board, international conferences/ seminars on CDM	NCA corpus funding	2005/06
	Periodical evaluation of EB (Executive Board) decisions and their impact on Indian CDM portfolio	Information dissemination to project proponents	NCA corpus funding	2005/06

7.4 Outlook

Recalling the spirit of Article 12 of the KP, which envisaged CDM as a tool to assist developing country parties in achieving sustainable development, while aiding the countries with commitments to use this mechanism to achieve the same, the over-reliance on the market to canalize funds into projects with high sustainable development characteristics has not materialized so far. There are still uncertainties related to demand for CERs, the price that they can fetch, and the number of projects from India that will go through the full project cycle, leading to financial/investment flows to the country.

However, for India's preparation for the second commitment period, CDM can prove to be an important tool not only to tap opportunities for technology transfer and sustainable development of certain important sectors, but also to showcase its participation and partnership in global efforts to mitigate climate change.

ANNEXE

1

Calendar of events

Date	*Activity*	*Participants/target audience*	*Follow-up or outcome*
21–22 October 2003, New Delhi	NSS (National Strategy Study) launch event	Public and private stakeholders and NGOs (non-governmental organizations)	Questionnaire and call for PINs targeted at private sector (companies and consultants)
10–13 November 2003, New Delhi	International Round Table on CDM (clean development mechanism) and Climate Technology Bazaar	Public and private stakeholders and NGOs	Wider publicity for NSS-India
6 December 2003, Milan	CoP-9 NSS side event	International audience from policy-making, public and private sector and NGOs	Introduction of NSS-India aims and activities to international audience
9 December 2003, Milan	E7 closed workshop on the CDM – conditions for successful energy investments in developing countries	International audience from policy making, public and private sector and NGOs	
January 2004	Forum of Infrastructure Regulators	Regulators	Wider publicity for NSS-India, sensitization on CDM issues
January 2004, Bangalore	International Congress on Renewable Energy, organized by Solar Energy Society of India	International and national audience from public and private sector and NGOs	
2–4 February 2004, New Delhi	IETA South Asian Forum on CDM	Policy-makers and project developers from India and South Asia	Discussion of specific project ideas, follow-up forum in February 2005
March 2004, Kolkata	IGES–ICS (Institute for Global Environmental Strategies-Integrated Capacity Strengthening) CDM Workshop	Public and private stakeholders and NGOs	
22–23 March 2004, Bangalore	IGES–ICS CDM workshop–issues for policy-makers in southern India	Policy-makers and project developers from southern India	Follow-up outreach activities in 2005 for facilitating state level CDM cells
27–28 March 2004, Coimbatore	IGES–ICS CDM workshop-opportunities for small scale industries	Potential project developers from small-scale industry	
March 2004, New Delhi	IT-Power workshop	Consultants and project developers	
30 April 2004, New Delhi	Natsource CDM PDD (project design document) facility launch	Consultants and project developers	Advisory role by TERI

Continued...

Date	*Activity*	*Participants/target audience*	*Follow-up or outcome*
April 2004	Point Carbon's International conference on carbon market Insights 2004	Public and private stakeholders and NGOs	
May 2004, Chennai and Kolkata	CII–RFI regional workshops	Public and private stakeholders and NGOs	Questionnaire
31 May 2004, Chennai	Special meeting at Tamil Nadu State Electricity Board		Exploring options for developing CDM projects portfolio in Tamil Nadu power projects
7–8 June 2004, Hamburg	Conference on 'climate protection as development opportunity'	Consultants, project developers, carbon market brokers and buyers, and NGOs	
9–11 June 2004, Cologne	Carbon Expo (IETA and The World Bank)	International and national policy-makers, consultants, project developers, carbon market brokers and buyers, and NGOs	
15 June 2004, Bonn	Donors' meeting on promoting public–private partnership for efficient CDM operations in India	International donors, consultants, project developers, carbon market brokers and buyers, and NGOs	
June 2004, Haryana	International training programme on accelerated penetration of cost effective renewable energy technologies	International audience including policy-makers and consultants	
20 July 2004, New Delhi	Brainstorming session on policy recommendations for CDM implementation in India	Invited policy-makers and consultants	Proposals on legal, policy, and financial issues
21 August 2004, Mumbai	CDM opportunities for the corporate sector	Corporate sector	Recommendations on capacity enhancement
25 October 2004	NSS: CDM PDD workshop		
January 2005, Pune and Visakhapatnam	Facilitating CDM in states in southern and western India: role of policy-makers. Workshop organized under the Integrated Capacity Strengthening Programme for the CDM Project,	Policy-makers	Follow-up facilitating and establishing state-level CDM cells and sectoral projects development
31 January 2005	NSS final dissemination workshop	Public and private stakeholders and NGOs	Dissemination of final outputs of the study
1–2 February 2005	South Asia GHG Forum	Policy-makers and project developers from India and South Asia	Follow-up forum in February 2005
February 2005	Meeting at Maharashtra State Electricity Board		Exploring options for developing CDM projects portfolio in Maharashtra power projects

ANNEXE

2

Details of CERT-based analysis

This annexe introduces the CERT (carbon emission reduction trade) modelling framework and provides a rationale for the inputs that go into the model.

CERT modelling framework

CERT was developed by Grütter Consulting together with the ETH Zürich on behalf of the World Bank in 2001 (Grütter 2002c). CERT is a partial equilibrium model to simulate the emerging market of GHG (greenhouse gas) emission reductions. It uses the inputs of GHG emission projections and marginal abatement cost curves from other models. It adds up the quantities (x-axis) potentially supplied and those potentially demanded at each price (y-axis) across the constituent regions. As one varies the price, the demand and supply curves for this market are described, and their intersection indicates the market clearing price (Grütter *et al.* 2002a). [1]

The market is cleared for the first commitment period 2008–12, and the year 2010 is taken as a representative value for that period. Neither does the date of Kyoto Protocol ratification nor a function simulating the deal volume development taking into consideration for example, the time lag between the endorsement of a methodology for a given sector/project type by the EB (Executive Board) and the availability of CERs in the market, appear in CERT. CERT assumes that the ratification has taken place and there is sufficient time to reach equilibrium. It also cannot model real world market conditions and the prevailing market barriers, such as preferential demand for CDM credits or availability of EB approved methodologies for specific sectors.

Marginal abatement cost estimates for India

The CERT model offers five different MAC (marginal abatement cost) curves for India (Table 1). As the last column reveals, there are immense differences in the costs of abatement of 100 $MTCO_2$ (million tonnes of carbon dioxide), with a standard deviation of 130 and an average value of about 200 million USD. This underlines the huge amount of uncertainty associated with the estimation of India's MAC.

[1] Note that CERT automatically deduces the maximum amount of sinks from Annex I reduction requirements.

Table 1 MAC (marginal abatement cost) curves for India in CERT

Name	*Price base year*	*Type of function*	*Costs* (million USD of 2000) *of 100 MTCO$_2$ abatement*
EPPA MACs CO_2	1985	Quadratic	63
GTEM MACs CO_2	1995	Exponential	293
GTEM MACs all GHG	1995	Exponential	133
GTEM bottom-up CO_2	1995	Exponential	371
IPAC/AIM bottom-up CO_2[a]	1990	Quadratic	128

[a] Joint MAC for India with south-east Asia and south Asia, excluding China
Note GTEM – global trade and environment model

The CO_2 MACs focus on the energy sector and do not take carbon sequestration into account. The GTEM (global trade and environment model) MACs on all GHGs are considered outdated as they do not take into consideration the recent development in developing projects for HFC (hydrofluorocarbons) and N_2O (nitrous oxide) abatement.

A very significant research effort would be required to estimate robust MACs for a reliable analysis of the global carbon market for the first and subsequent commitment periods. This in particular applies for non-CO_2 MACs. Containing non-CO_2 MACs of low robustness, version 3.1 of CERT does not appropriately simulate for example, the large potential of HFC23 decomposition or N_2O fertilizer industry projects that are being currently developed in several countries.

Moreover, the CERT model itself has severe limitations as an analytical tool for the study of the complex global carbon market at this stage of the implementation process. It would therefore be appropriate to propose a follow-up to the present study to obtain more realistic estimates of the international demand for CDM. This is particularly relevant for the negotiation of a post-Kyoto agreement.

Business-as-usual emission scenarios

The CERT model contains CO_2-only BAU (business-as-usual) estimates based on the United States' Department of Energy's International Energy Outlook 2002 (reference, low, and high growth scenarios), and one based on IPAC. In addition, it has an all-GHG BAU estimate based on Meinshausen and Hare (2002). As part of the NSS-India study an attempt has been made to explore internationally accepted sources of data for BAU scenarios that can be used in CERT. In addition to the standard scenarios built into the CERT model, the NatCom and WEO BAU estimates were used to define seven additional scenarios (Table 2).

Table 2 Additional scenarios based on NatCom and WEO data

Full name of emissions scenario	*Scenario short name*
National Communications BAU with all GHGs, MACs from GTEM for all GHG	NatCom all GHG
National Communications BAU with CO_2 only, MACs EPPA CO_2	NatCom CO_2, EPPA
National Communications BAU with CO_2 only, MACs GTEM CO_2	NatCom CO_2, GTEM
National Communications BAU with CO_2 only, MACs GTEM bottom-up, CO_2	NatCom CO_2, GTEM bottom-up
2002 World Energy Outlook BAU, EPPA MACs CO_2	WEO, EPPA
2002 World Energy Outlook BAU, GTEM MACs CO_2	WEO, GTEM
2002 World Energy Outlook BAU, GTEM bottom-up, CO_2	WEO, GTEM bottom-up

EPPA – emissions prediction and policy analysis; MAC – marginal abatement cost; GTEM – global trade and environment model; CO_2 – carbon dioxide; BAU – business-as-usual; NatCom – National Communications

Market parameters

CDM implementation rate

The assumption of a scenario with 100% CDM implementation rate in non-Annex I countries would offer a theoretical upper bound, but has no practical relevance for characterizing the CER supply potential during the first commitment period.

1 Owing to the project-based nature of the CDM and its additionality requirement, the potential for actual CDM projects is much lower than that estimated by top-down assessments that generate a range of possible mitigation options. Only a limited number of methodologies had been approved by the CDM EB by fall 2004 (for details refer to chapter 4).
2 Development and implementation of potentially eligible CDM projects is in practice delayed, and hence unavailable for the first commitment period. Related barriers such as low project development capacity in non-Annex I countries, and unfamiliarity of banks and financial institutions with CDM investment etc. are addressed in chapter 4.
3 Small-scale projects with less than 5000–10 000 TCO_2 annual abatement potential in the industry, transport, rural, urban, and commercial sectors (demand side management) are economically unattractive due to their high transaction cost to project cost ratio.

Based on these considerations the implementation rate is set at 30% in the reference scenario. Barriers to the supply of CDM projects are discussed in detail in chapter 4.

US participation rate

The US (United States) participation rate refers to voluntary action taken at the state level or by private companies (for example, Chicago Climate Exchange, Massachusetts, New Hampshire, and Oregon). This leads to a limited participation by US entities in the world carbon

market despite non-ratification of the Kyoto Protocol. A review of the main buyers of project-based transactions (Lecocq 2004) reveals that the market share of US buyers has been steadily declining from 9% in 2001/02, to 6% in 2002/03, and to 4% in 2003/04 (in terms of volume of emission reductions purchased). This translates into less than 1% of the country's Kyoto demand. Lecocq (2004) interprets this as a reflection of the lack of a federal requirement to constrain GHG emissions.

The McCain-Lieberman Climate Stewardship Act of 2003 proposed to establish a limit on GHG emissions beginning 1 January 2010, and implemented through an emissions-trading programme. During the first six years of the programme (2010–16), annual GHG emissions would be limited to 2000 levels, and in the subsequent years, reduced to 1990 levels. Pizer and Kopp (2003) predict that required reductions will rise from 860 $MTCO_2$ in 2010 to 2900 $MTCO_2$ by 2020. While the act failed in the US Senate by a vote of 43 to 55, the margin seems to indicate support for a more aggressive climate change policy, which may come about with a change in government.

The CERT-based analysis explores the market implications of the US voluntary participation rate going up to 10% with additional state-level or federal action. However, it should be recognized that this appears unlikely in the first commitment period.

Market strategy of FSU, supply of hot air

The market potential for CDM depends critically on the restriction of the sale of surplus Kyoto units by Russia and Ukraine (Annexe 7). In addition to a perfectly competitive market, CERT allows for price leadership by the FSU (former Soviet Union), with other suppliers acting as price followers. In other words, the FSU sets the supply knowing the reaction function of the other parties. The Stackelberg solution calculation is made, based on iterative steps towards the profit maximization for FSU with all other countries acting as free riders.

ANNEXE

3

Methodological notes

Marginal abatement cost estimates

Several studies reviewed in chapter 2 (ADB-GEF-UNDP 1998, TERI 2002, Shukla *et al.* 2002) have attempted to estimate the costs of GHG mitigation in India, and two approaches may be distinguished (Table 1). The 'top-down' approach based on macroeconomic multi-sector and/or multi-region representations determines the economy's future trajectory by minimizing total system costs over mid- to long-term periods of some ten years. A simulation without constraint on GHG emissions provides the BAU (business-as-usual) scenario and the corresponding total system costs, which may

Table 1 Comparison of top-down and bottom-up approaches for estimating marginal abatement costs

	Top-down approach	*Bottom-up approach*
Advantages	1 broad availability and general acceptance of models used (for example, MARKAL) 2 use of aggregated macroeconomic data (for example, share of coal in power generation), which are readily available in most cases, and less prone to uncertainty	1 more robust estimate derived from project-specific data 2 does not involve large-scale simulations over longer time periods, and hence less dependent on crucial assumptions on technical progress, etc. 3 present list of mitigation options, potential, and costs, which can be easily compared with other studies
Disadvantages	1 representation of economic processes as a frictionless adaptive continuum, which cannot be applied to a project-specific activity such as the CDM 2 use of sensitive and generally difficult-to-make assumptions about future technical progress, growth of GDP, etc., for the extended periods covered by these simulations 3 expression of abatement costs in terms of changing total system costs, making comparison of different top-down studies difficult	1 small errors on the micro-scale might either cancel out (random errors) and thus reduce overall uncertainty, or be blown up to substantial errors on the macro scale (in case of systematic errors) 2 use of a non-representative case study example encompassing too small a sample of projects, might lead to heavy systematic errors in the outcome

then be compared to simulation runs where emissions, per year or cumulative, are subject to given limitations. The 'bottom-up' approach usually draws on specific projects or case studies, and interpolates cost information to generate an overall picture.

Deriving additional business-as-usual scenarios

Business-as-usual scenarios from Annex B National Communications

In 1999, Zhang estimated the expected amount of emissions reductions and 'hot air' through the official National Communications of Annex I countries to the UNFCCC (United Nations Framework Convention on Climate Change) that were available at that time. The result was an estimated gross demand for GHG offsets of around 2275 $MTCO_{2e}$ per year[1] and an amount of hot air of 385 $MTCO_{2e}$ per year (Zhang 1999), which was a low-lying estimate for the total market size compared to other, model-based studies.

Of the 20 likely Annex I countries (including Russia, but excluding the United States and Australia), all but two (viz. Ukraine and Romania) have submitted at least one updated NatCom (National Communication) in the meantime. Using the inventory of GHG emissions for 1990, with respect to each country's Kyoto target, the resulting net demand for GHG offsets turns out to be negative (Figure 1a). Of the total demand 94% is met by the three biggest

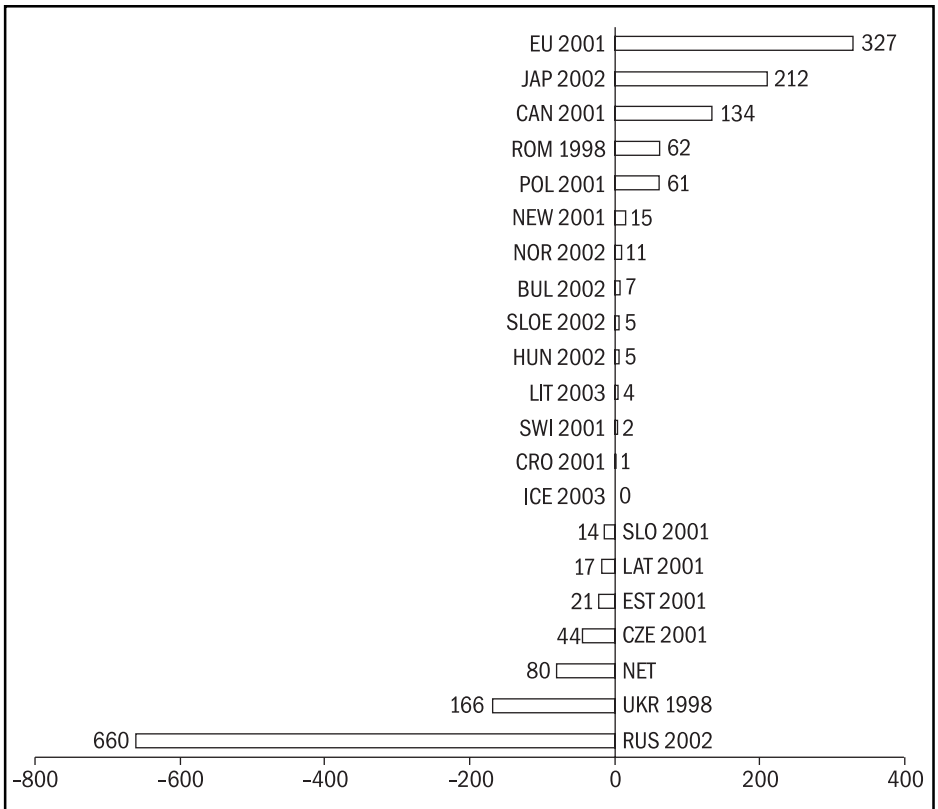


Figure 1a GHG emission reductions required in 2010, of Annex I countries as per most recent National Communications

[1] Assuming full US participation

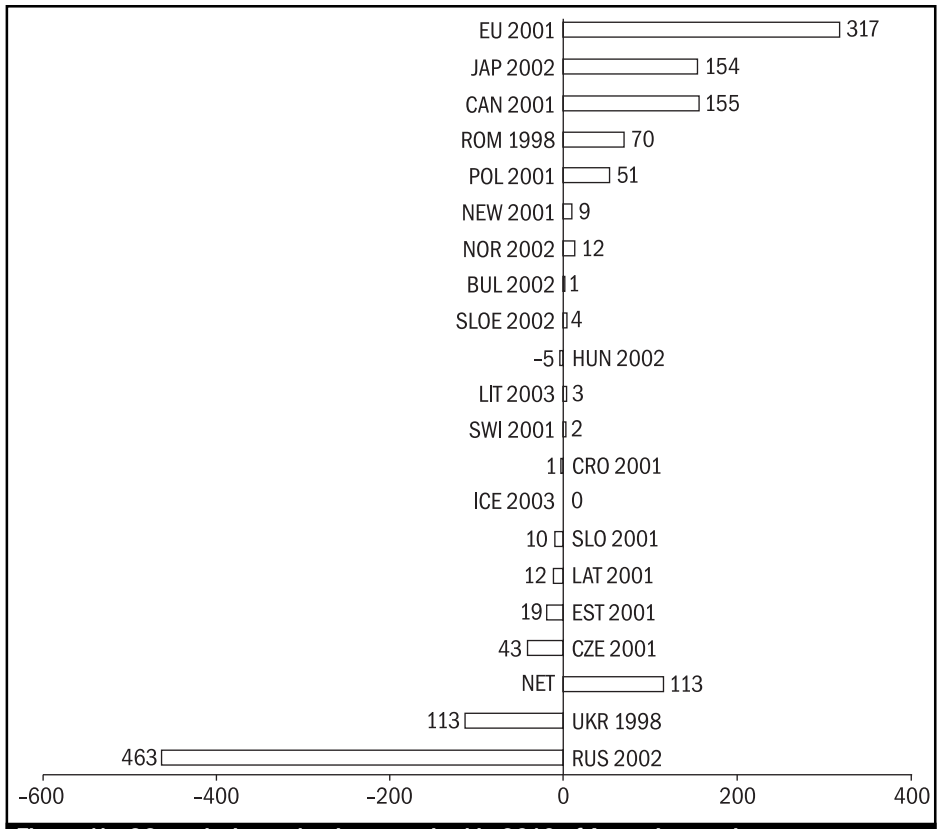


Figure 1b CO_2 emission reductions required in 2010 of Annex I countries as per most recent National Communications

suppliers of hot air: Russia, Ukraine, and the Czech Republic and 80% of the demand comes from the 15 EU countries, Japan, and Canada.

Comparing this figure for all GHGs to the one that relates to CO_2 only (Figure 1b), the expected carbon market is nearly 200 MT greater, with a positive net demand of 113 $MTCO_2$ per year. Russian and Ukrainian hot air supply is reduced by 252 $MTCO_2$, while the combined demand of the EU, Japan, and Canada falls by only 46 $MTCO_2$. Hungary and Poland's demand goes down by 9 $MTCO_2$ each, while Romania's rises by 8 $MTCO_2$ per year. For all other countries, the difference between considering all GHGs and CO_2 only amounts to 6 $MTCO_2$ or less.

Business-as-usual scenarios from WEO (World Energy Outlook)

IEA (2002) projections of CO_2 emissions to 2030 have been used to calculate a net Kyoto gap of 159 $MTCO_2$ per year (Figure 2). In deriving figures that would be a suitable input to the CERT model, some assumptions have been made about the shares of different countries in total CO_2 emissions (Annexe 1) to address the following problems.

- In many cases data is presented in an aggregated form for groups of countries rather than individual countries for example, for Canada and the United States together, as well as for the group of Australia, Japan, and New Zealand

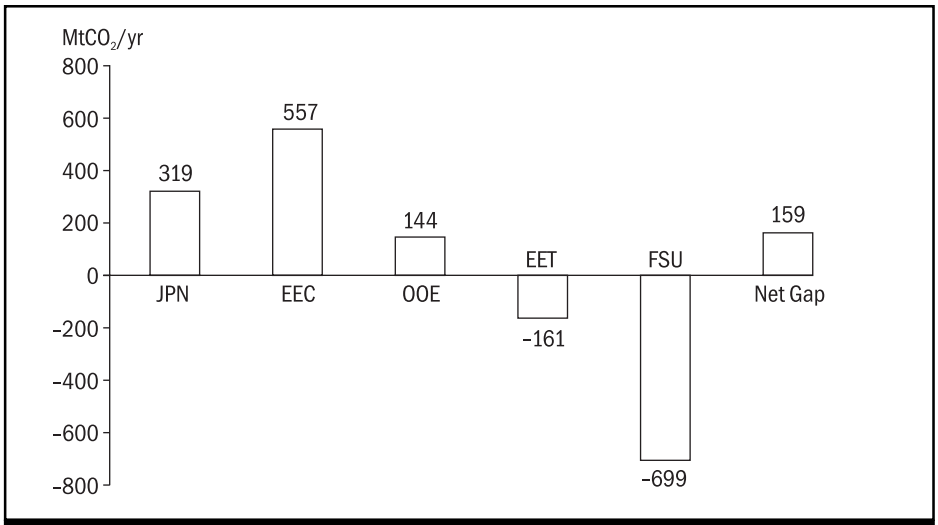


Figure 2 Demand and supply of CO_2 offsets projected by WEO 2002

- Hot air estimates are attributed either to Russia, or jointly to the Ukraine and eastern European countries
- Often 1990 baseline emissions in IEA (2002) do not match the data taken from other sources for example, UNFCCC NatCom

Notes on deriving BAU scenarios from NatCom data

1 For Poland, other GHGs were assumed to grow 6% from 1990 to 2010, corresponding to the figure given for N_2O.
2 For Lithuania, GHG growth rates were taken from Zhang (1999).
3 Russia's 'Scenario I' projection included only CO_2. Since non-CO_2 GHG emissions decreased faster than CO_2 emissions in 1990–99, we assume that the relative weight of CO_2 increases by two percentage points, from 77.4% to 79.4%, as was the case for Ukraine, where the relative weight of CO_2 shifted from 76% to 78%.
4 The GHG inventory for Iceland has no separate figure for CO_2.
5 Whenever multiple scenarios for the 2010 projections were available, preference was given to the 'with measures', or 'reference' or 'first' scenario.
6 Because of the scarce availability of data, sinks from LULUCF were excluded.

Notes on deriving BAU scenarios from WEO data

1 To separate Australia, Japan, and New Zealand, we calculated emission-weights according to 1990 actual emissions and projected individual emissions in 2010 as given by each countries' latest NatCom. The resulting weights that were applied to the WEO 1990 and 2100 figure were 23:75:2 and 24:74:2 respectively.

2 The same was done for Canada and the USA, with resulting relative weights of 9:91 in 1990 and 8:92 in 2010.
3 To get the total reduction of the CERT OOE (other oil exporters) group, Norway's and Switzerland's expected reductions were taken from their latest NatCom.
4 The total Kyoto gap of Russia and Ukraine and EET (eastern Europe) was allocated to the CERT groups FSU and EET in a way that preserves the relative CO_2 emissions volumes according to the most recent NatComs.
5 A small estimation error will be caused by always taking 1990 emissions for base-year emissions, since this is not necessarily so. However, the largest deviation in that sense can be observed for Australia, which is not included in our assessment.

A simple ex post consistency check of the re-allocation of the WEO data to the CERT categories can be done by comparing the calculated net Kyoto gap of 159 $MTCO_2$ per year to the WEO's projection of a gap of roughly 250 $MTCO_2$ per year (IEA 2002) for the case of US non-participation. This, however, does still include Australia, which, according to the above estimates, would contribute towards the gap by 59 $MTCO_2$/year, but seems unlikely to ratify the protocol for now, and was hence left out. Thus, with Australia's demand added on, we obtain 218 MT compared to a rough 250 $MTCO_2$ per year, in satisfactory agreement.

ANNEXE

4

Details of CERT-based analysis

Trends in carbon market estimates

Early studies of the demand for CDM had predicted impressive amounts of more than 4000 $MTCO_{2eq}$ per year. However, recent discussions (Ellermann *et al*. 1998, Grubb 2003) are limited to expecting a low or high surplus scenario. The pull-out of the United States in 2001, downward corrections of BAU (business-as-usual) estimates for many Annex I parties, the initially unforeseen existence of huge amounts of 'hot air' mainly from Russia and Ukraine (now possibly even from Kazakhstan), and the extended rules concerning the inclusion of sinks from the Marrakesh Accords in 2001, are reflected in the downward trend in subsequent estimates (see Figure 1).

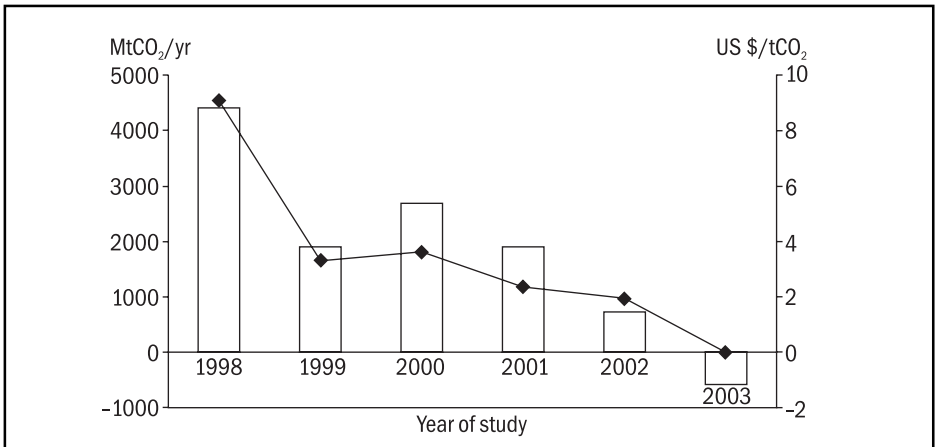


Figure 1 Projected required emissions reductions of Annex I parties under the Kyoto Protocol and corresponding equilibrium price (in USD of 2000) under competitive market assumption

Note Studies reported are Ellermann *et al*. (1998), Zhang (1999), GTEM from the ABARE (Australian Bureau of Agricultural and Resource Economics) 2000 model as shown in Jotzo *et al*. (2002), PET with US DoE forecast as shown in Indonesia NSS 2001, 'Combined Scenario' with 30% US voluntary participation from Grütter (2002b), and average of low and high surplus scenario from Grubb (2003). Carbon price calculated using CERT model (Grütter 2002a).

ANNEXE

5

Selected global carbon market studies

Study	*Annex I parties' emission reduction requirement in $MTCO_{2e}$ (2010)*	*CDM market size in $MTCO_{2e}$ (2010)*	*CER price range in USD/ TCO_{2e}*
IPAC emission model 2004, 30% implementation rate, 10% US participation[a]	1250	165	3–7
Selected NSS completed since 2001*	1300–(3000)	300–(2000)	1.7–(10)
International Energy Outlook, EIA/USDOE 2002	860–1540	80–465	–
Supply-demand balance study, Grubb 2003	415–1250**	50–180	0–13.8
EU emission trading study, Criqui *et al*. 2003	1140	330–360	6–12
Point Carbon study for ADB and IETA, 2003	5056***	100–150	3.5–7.5
Transaction cost study, Michaelowa/Jotzo 2003	1105	363	< 4

[a] The IPAC (Integrated Policy Assessment Model for China emission model) is applied in the study on the methodologies and its application of clean development mechanism in China, sponsored by the World Bank, Switzerland, Germany, and China, draft 10 November 2003. This estimation was to be revised, with a new run with 5%–10% US participation in the January 2004 edition of the final report.

* Vietnam, Peru, Indonesia.

** Assuming 50% of reduction requirement met by domestic action in the 15 EU member states.

*** Does not take into account the effects of planned further domestic emission measures.

ANNEXE

6

National and institutional programmes and investments into JI/CDM

Currently the global carbon market is composed of the following, mostly delinked segments.

1 Kyoto-driven market (for example, EU ETS at present, investment of several European governments into tenders or funds operated by the World Bank group, Japanese facilities and offset demand from Canada and Norway in the future)
2 Non-Kyoto markets (for example, New South Wales benchmarks, Oregon performance standards)
3 Retail market (voluntary corporate participation usually not for compliance).

In the buyer's market prevailing at present, different buyers adopt distinctive strategies in complying with the Kyoto rules, selecting technologies, or prioritizing their project pipeline for CDM (clean development mechanism) investments.

Governments

Government and multilateral funds have so far played a central role on the buyer side in transactions on potential CDM projects. However, Annex I governments' main reason for investing in potential CDM projects has so far been country-level compliance rather than trading. Such a 'funder's keepers' strategy could, if followed by many government actors, potentially delay market development and harm its liquidity. However, another trend is also being observed. Government actors are putting aside funds for investing in the emerging private undertakings as well, creating public-private partnerships like the KfW (Kreditanstalt für Wiederaufbau) carbon fund. This could help private funds through a difficult introductory phase when uncertainty on the status of the Kyoto Protocol hampers CDM investment.

Institutional buyers

Institutional buyers such as the Prototype Carbon Fund of the World Bank, IFC, the Asian Development Bank, or EBRD (European Development Bank) are partly acting on behalf of OECD governments (the Netherlands, Italy, Spain etc.) or on behalf of large corporations.

Funds make important preparatory work for the development of the market by promoting pilot projects and acquisition of first verified and certified emission reductions.

Private sector

Large Japanese and European GHG emitters from energy intensive industries and the power sector are in the process of directing their own investments into the emerging CDM and JI (joint implementation) market or are developing their own carbon offset portfolio. Commercial banks and large financial sector players are still significantly under-represented on the market place. They may assess the risk associated with an early involvement as being still too high. Project developers and brokers on the other hand, such as special departments in internationally operating enterprises and specialized consulting companies, together with NGOs, are the most active stakeholders in the current global carbon market.

In addition, there are several private initiatives such as the Spanish Carbon Fund, Natsource's GG-CAP (Greenhouse Gas-Credit Aggregation Pool), Econergy's Clean Tech Fund, Fondelec's fund initiative towards Asia, and the Climate Investment Partnership.

Institution/country	*Name*	*Volume*
World Bank	Prototype Carbon Fund Community Development Carbon Fund BioCarbon Fund	180 million USD (17 companies, 6 governments) 40–100 million USD (planned) 40–100 million USD (approved in September 2003)
The Netherlands	Carboncredits.nl, Dutch ERUPT/CERUPT IFC- NCDMF (Netherland Clean Development Carbon Fund) IFC-Netherlands Carbon Facility	250 million USD 175 million USD, CDM tender for the Dutch government 40 million USD
Japan		200 million USD
Denmark	JI/CDM programme	2004–2007: 27 million USD annually
Germany	KfW JI/CDM fund	50 million USD for a first phase, 100 million USD later (in preparation)
Austria	JI/CDM programme	2004: 12 million USD, 2005: 24 million USD, as of 2006: 36 million USD annually (in preparation)
Finland		5 million USD
Other countries (Sweden, Spain, etc.)		N.A.
Asian Development Bank		40 million USD
European Development Bank (EBRD)		61 million USD

ANNEXE

7

European Union emissions trading system

Emission trading schemes and other national regulations potentially offer additional incentives for private and public investments to the carbon offset market. The regulatory framework for the Kyoto Protocol in most Annex I countries is still in a stage of voluntary measures and has not become legally binding yet. But the EU ETS (emission trading scheme of the European Union) started trade legally binding emission allowances from January 2005.

The EU Emissions Trading Directive became formal European law on 25 October 2003. In the first phase of the EU ETS (2005–07) each EU member state has to allocate a cap on emission allowances to each of its installations in the following sectors.

1 Energy sector: combustion (> 20 MW thermal excluding waste combustion, mineral oil refineries, and coke ovens)
2 Metals sector: ores, pig iron and steel (> 2.5 t/hour)
3 Minerals sector: cement (> 500 t/day), lime (> 50 t/day), glass (>20 t/day), ceramics (> 75 t/day)
4 Other sectors: pulp and paper (> 20 t/day).

The CO_2 emissions from more than 12 000 installations in these sectors account to 46% of the EU's total CO_2-emissions. In the first phase (2005–07), only CO_2 emissions will be covered.

Until spring 2004 all EU member states (also the new accession states, with the exception of Malta and Cyprus) have issued and submitted their NAP (National Allocation Plans) on the emission allowances to all installations in the above-mentioned sectors.[1]

In the second phase of the EU ETS (2008–12) installations in the chemical, aluminium and transport sector may also receive caps on emission allowances, and an extension to the other five gases under the Kyoto Protocol is foreseen.

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[1] As of 5 May 2004, only the final NAPs (National Allocation Plans) of 10 countries are available, another 5 NAPs are available in drafts, and 10 countries have not yet submitted any information. Details available at <http://europa.eu.int/comm/environment/climat/emission_plans.htm>

In the case of non-compliance with the emission caps set in the NAPs, companies face sanctions as follows.

- *Phase 1* 40 euros/TCO_2 and delivery of the missing EU emission allowances
- *Phase 2* 100 euros/TCO_2 and delivery of the missing EU emission allowances

Although the European industry is expected to reduce most of its CO_2 emissions domestically and by trading emission allowances in the first phase of the EU trading scheme, the EU Parliament adopted the Linking Directive on 20 April 2004. Under this directive companies covered by the EU ETS are allowed to convert CERs into EU emission allowances on a one-to-one basis as of 2005. Credits from JI (ERUs) will be allowed from 2008.

Although the credits from JI and CDM projects are fungible with EUAs (EU emission allowances), double counting of emission reductions shall be avoided. This has to be taken seriously, as 8 out of the 10 new EU accession member states also qualify as JI host countries. There is an initial limit on the use of CERs and ERUs at 6% of the total EU ETS cap, with an automatic review to determine whether the limit on the use of offsets should be raised to 8%. A disagreement prevails on banking. Presently, France is the only country to allow emission trading participants to bank unused EU emission allowances or CDM credits from the first phase into the second phase of the EU ETS.

Zetterberg *et al.* (2004) review of 12 NAPs shows that several member states have current emissions that are considerably higher than the emissions allowed according to the EU burden sharing agreement of the Kyoto Protocol. Allocation in the trading sector is higher than current emissions in the trading sector for Austria, Finland, Lithuania,[2] Luxembourg, Sweden, and Italy. The allocation quota (allocation divided by emissions) in the trading sector is often higher than the 'Kyoto quota', that is, the member state's current total emissions divided by the Kyoto commitment, which means that in order to comply with the Kyoto targets, the member state will need to reduce emissions more in the non-trading sector than in the trading sector. This implies that the trading sector will need to reduce its emissions less (in percent terms) than the member state and that a higher proportion of reductions are needed in the non-trading sector or through CDM/JI mechanisms. This is the case for Austria, Denmark, Finland, Germany, Ireland, Luxembourg, the Netherlands, Sweden, and Italy. Nine countries have declared that they plan on using CDM/JI for reaching their Kyoto commitment: Austria, Denmark, Finland, Germany, Ireland, Luxembourg, the Netherlands, Belgium, and Italy (Zetterberg *et al* 2004).

[2] The most extreme example is Lithuania where allocation is more than 50% above 1998 emissions

ANNEXE

8

Summary of global carbon market modelling studies

Model or Study	*Unrestricted sales of Russian AAUs*					*Restricted sales of Russian AAUs*				
	2010 emissions all GHGs	*Annex B demand ex US*	*Annex B supply ex Russia*	*Russia/ ESU*	*CDM*	*Annex B demand ex US*	*Annex B supply ex Russia*	*Surplus AAUs sold (%)*	*Russia/ ESU*	*CDM*
Blanchard, Criqui, and Kitous	20 414[a]	862[a]	193[a]	1429[a, b]	0	688[a]	73[a]	10	443[a, b]	174[a]
Böhringer and Löschel	19 616[a]	1298[a]	271[a]	1027[a, b]	0[d]	830[a]	399[a]	31	431[a, b]	0[d]
Eyckmans, *et al.*	21 101[a]	1731[a]	0[e]	1470[a, e]	261[a]	1414[a]	0[e]	55–60[b]	915[a, e]	499[a]
Grubb-low surplus	–	807[a]	279[a]	844[a, e]	0	–	–	56	473[a, e]	55[a]
Grubb-high surplus	–	195[a]	488[a]	1395[a, e]	0			0	0	184[a]
Grütter	–	1100–1500[a]	200–600[a]	500–900[a, b]	0–500[a]	1000–1200[a]	– –	25 –	250–300[a, b]	250–500[a]
Hagem and Holtsmark	–	900[g]	325[g]	500[g]	75[g]	–	–	–	–	–
Holtsmark-Case 1[j]	19 974[a]	1404[a,]	230[a]	1174[a, b]	–	–	–	–	–	–
Holtsmark-Case 3[j]	–	–	–	–	–	1246[a,]	280[a]	48	588[a, b]	379[a]
Holtsmark-Case 5[j]	–	–	–	–	–	1298[a,]	264[a]	64	778[a, b]	256[a]
Jakeman, *et al.*	21 620	2372	–	1074[b]	–	935[a]	387[a]	45	500[b]	<49[h]
Jotzo and Michaelowa	–	1040[a]	75[a]	1562[a, b]	0	–	–	32	500[a, b]	465[a]
Jotzo and Tanujaya	–	1375[a]	255[a]	1200[a, b]	0	–	–	75	1100[a, b]	62[a]
Löschel and Zhang	19 610[a]	1375[a]	255[a]	1350[a, b]	0	865[a]	395[a, b]	34	470[a, b]	0[d]
Average	–	1220	277	1144	59	1047	300	43	539	250
Range	19 610–21 620	807–2372	75–600	599–1562	0–500	688 to 1298	73–399	10–75	250–1100	49–500

Source Haites (2004)

ANNEXE

9

Summary of technological options for energy saving in industry sector

Sector	*Projected industry growth rate (%)*	*Present technological status*	*Existing energy consumption levels*	*Energy consumption–international comparison*	*Energy saving / GHG mitigation potential*	*Long-term technological options for energy conservation*
Cement	7–8	Mainly state-of-the-art dry process plants and a few old wet process plants	New plants: 68–90 kWh/t of cement and 665–800 kCal/kg clinker Older plants: More than 90 kWh/t of cement and 800 kCal/kg clinker	Electrical: 63 kWh/t of cement Thermal: 640 kcal/kg clinker	0.1–0.15 tonnes CO_2/tonne of cement through adoption of energy-efficient equipment and use of blended cements 1.5 million tonnes of CO_2 per annum through cogeneration	• Increased use of blended cements • Use of waste fuels • Cogeneration • Use of energy-efficient equipment in various sections
Iron and steel (integrated plants)	7	Blast furnace–basic oxygen furnace–continuous casting	27–38 GJ/ tonne of crude steel	18 GJ/tonne of crude steel	~ 1.6 million tonne CO_2 per year for primary steel production sector	• Coke dry quenching • PCI in BF • Thin section continuous casting
Aluminium (primary)	6	Smelting: Soderberg and pre-baked systems	14 000–17 000 kWh/t aluminium	13 200 kWh/t aluminium	10%–20% energy savings	Conversion to pre-baked systems with higher current efficiency
Fertilizer	3	Naphtha, fuel oil, and natural gas based systems	8.6 GCal to 12.8 Gcal / tonne of ammonia	8.5 Gcal /tonne of ammonia	Upto 25% energy savings for older plants	State-of-the-art gas based systems with options for use of naphtha

ANNEXE

10

NCA approved projects by December 2004

No.	*Sector*	*Project*	*Project promoters*	*Location*
1	Renewable energy–biomass power	Biomass–based power	Raghu Rama Renewable Energies Ltd	Ramanathapuram, Tamil Nadu
2	Renewable energy–bagasse power	Bagasse–based cogeneration power	Dhampur Sugar Mills Ltd	Dhampur, UP (Uttar Pradesh)
3	Renewable energy–wind power	Wind power project	ESL (Encon Services Ltd)	Chitradurga, Karnataka
4	Renewable energy–biomass power	Biomass–based power	Rithwik Energy Services Ltd	Chittoor, AP (Andhra Pradesh)
5	Renewable energy biomass–small hydro power	Small hydro power plant	Narayanapur Right Bank Canal	Raichur, Karnataka
6	Renewable energy–biomass power	Biomass–based power	Clarion Power Corporation Ltd	Prakasam, AP
7	Renewable energy–biomass/bagasse power	Bagasse/biomass cogeneration power plant	Balarampur Chini Mills Ltd	Haidergarh, UP
8	Renewable energy–bagasse power	Bagasse–based cogeneration power project	Sri Chamundeswari Sugars Ltd	Mandya, Karnataka
9	Renewable energy–bagasse power	Bagasse–based cogeneration power project	Bannari Amman Sugars Ltd	Sathyamangalam, Tamil Nadu
10	Renewable energy–biomass power	Biomass (mustard crop residue) power project	Alwar Power Co. Pvt. Ltd	Alwar, Rajasthan
11	Renewable energy–rice husk–based power	Rice husk–based power project	Vandana Vidyut Ltd	Bilaspur, Chhattisgarh
12	Fuel-switching	Fuel-switching from naphtha to natural gas	BSES	East Godavari, AP
13	Switching of fossil fuel	Switching of fossil fuel from naphtha to natural gas	Essar Power Ltd	Hazira, Gujarat
14	Renewable energy–bagasse power	Bagasse–based cogeneration power project	Bannari Amman Sugars Ltd	Mysore, Karnataka
15	Fozal small hydro project	Fozal small hydro electric power project	–	Kullu, HP (Himachal Pradesh)
16	Gas waste power	BOF gas waste heat recovery power project	Jindal Vijaynagar Steel Ltd	Bellary, Karnataka
17	Corex gas waste heat power	Corex gas waste heat recovery–based power project	Jindal Vijaynagar Steel Ltd	Bellary, Karnataka

No.	*Sector*	*Project*	*Project promoters*	*Location*
18	Clinker	Optimal utilization of clinker and conversion in cement manufacturing plant	Birla Corporation Ltd	Rajasthan
19	Energy efficiency	Energy efficiency initiatives	Kamat Hotels India Ltd	Andheri, Mumbai
20	Energy efficiency	Energy efficiency through installation of modified CO_2 removal system in ammonia plant	Indo Gulf Fertilizers Ltd	Sultanpur, UP
21	GHG emission reduction	GHG emission reduction by thermal oxidation of HFC	Gujarat Fluorochemicals Ltd	Panchmahal, Gujarat
22	Municipal solid waste	Municipal solid waste processing and waste-to-energy plant	Asia Bio-energy India Ltd	Lucknow, UP
23	Waste heat recovery power	Waste heat recovery-based captive power plant	Orissa Sponge Iron Ltd	Orissa
24	Energy efficiency	Energy efficiency using a coke dry quenching system	Tata Iron and Steel Company	Jamshedpur, Jharkhand
25	Renewable energy	Bagasse power	Triveni Industries	Deoband, UP
26	Renewable energy	Bagasse power	Shree Renuka Sugars Ltd	Belgaum, Karnataka
27	Renewable energy	Bagasse power	Bannari Amman Sugars Ltd	Karnataka
28	Industrial process	Emission reduction	India Aluminium Ltd	Orissa
29	Renewable energy	Bio-diesel	–	Karnataka
30	Renewable energy	Biomass-based	Gujarat Ambuja Cements Ltd	Punjab
31	Renewable energy	Small hydroelectric power	–	Karnataka
32	Renewable energy	Small hydroelectric power	–	HP
33	Energy efficiency	Fuel-switching	Chhatisgarh Electricity Co.	Chhattisgarh
34	Thermal efficiency in coal-fired boiler system	Energy efficiency	Indian Rayon Industries Ltd	West Bengal
35	Waste heat recovery-based captive power plant	Energy efficiency	Ispat Godavari	Chhattisgarh
36	Renewable energy	Small hydroelectric power	Dharamshala Hydro Power	HP
37	Energy efficiency	Demand side energy efficiency programme	Indian Rayon Industries Ltd	West Bengal
38	Renewable energy	Cogeneration project	DCM Shriram Consolidated Ltd	UP
39	Renewable energy	Hydroelectric project	Orissa Power consortium Ltd	Orissa
40	Renewable energy	Small hydroelectric power	Meenakshi Power Ltd	Orissa
41	Renewable energy	Cogeneration expansion project	Rajashree Sugars and Chemicals	Tamil Nadu
42	Industrial process	GHG emission reduction	–	Punjab
43	Renewable energy	Hydroelectric project	Orissa Power Consortium Ltd	Orissa
44	Energy efficiency	Waste heat recovery power	OCL India Ltd	Orissa

ANNEXE 11

Methodologies from India submitted to CDM EB

Round	*Number*	*Methodology title*	*Sector*	*Status of approval*
Round 9		N.A.		
Round 8				
1	NM0083	AutoLPG in India	Road transport sector fuel-switch	N/A
2	NM0080	Natural gas-based grid-connected major combined cycle power generation	Power generation	N/A
3	NM0073	Switching of fossil fuel from naphtha to natural gas at Essar Power Ltd	Fuel-switch	N/A
4	NM0071	BOF gas recovery at JVSL (Jindal Vijayanagar Steel Ltd) and combustion for power generation and supply to Karnataka Grid, India	Waste heat recovery in steel plant	N/A
5	NM0069	30 TPD bio-diesel project in Andhra Pradesh	Bio-diesel	N/A
Round 7				
6	NM0062	Natural gas-based combined cycle power plant	Power generation in conventional power sectors	N/A
7	NM0057	PFC emission reductions through installation of PBF (point break feeders) in HSS (horizontal stud Soderberg) cells	Aluminium	N/A
Round 6				
8	NM0049	Waste heat recovery from BOF gas at Jindal Vijayanagar Steel Ltd through power generation and supply to Karnataka grid	Waste heat recovery in steel plant	C*
Round 5				
9	NM0045	Birla Corporation Ltd CDM project for optimal utilization of clinker and conversion factor improvement	Cement	B*
10	NM0044	Energy efficiency improvements in municipal water utilities: power factor improvements	Energy efficiency-municipal water utilities	C*
11	NM0042	Energy efficiency improvements in municipal water utilities water pumping efficiency improvement	Energy efficiency-municipal water utilities	N/A

Round	*Number*	*Methodology title*	*Sector*	*Status of approval*
12	NM0037	Energy efficiency project by modification of CO_2 removal system of ammonia plant to reduce steam consumption	Energy efficiency–ammonia plant	B*
13	NM0031-revised	OSIL 10 megawatt waste heat recovery based captive power projects	Waste heat recovery in steel plant	N/A
14	NM0030 - rev.	Haidergarh bagasse/biomass-based power projects	Renewable energy: bagasse cogeneration	N/A
Round 4				
15	NM0035	TA sugars cogeneration and fuel–switch project–capacity augmentation component	Bagasse cogeneration and capacity augmentation	Withdrawn
16	NM0032	Municipal solid waste treatment cum energy generation	Municipal solid waste	A
17	NM0028	TA sugars cogeneration and fuel–switch project–fuel–switch component	Cogeneration and fuel–switch	A
18	NM0025	18 MW grid-connected biomass power project	Renewable energy: biomass power	C
Round 3	NA			
Round 2	NA			
Round 1				
19	NM0011	SCM bagasse/biomass-based cogeneration power project	Cogeneration	C

A – approved; B – under revision; C – rejected
N/A – proposed new methodology is being reviewed at the methodology panel level
N.A. – not applicable; no projects were submitted from India during these rounds
* CDM Executive Board 15th meeting, 1–3 September 2004

ANNEXE

12

Some important provisions in existing standardized contracts

Provisions	*Type A*	*Type B*	*Type C*
1 Substance to be transferred under the contract in the event of non–ratification of the KP (Kyoto Protocol)	VERs (verified emission reduction)	Consultations between the buyer and the seller	Not mentioned
• Seller's risk	Does not bear any risk	Prevent the seller from attempting to sell VERs in the open market	Risks losing investment
• Buyer's risk	Bears risk of KP not coming into force	Has exclusive entitlement to the VERs	Does not bear any risk
2 Purchase and sale of CERs	Minimum CERs (certified emission reductions) specified/additional CER: buyer reserves option to purchase	Offer of sale of first surplus (amount specified) to the buyer	First offer of sale of additional (unspecified amount) CERs to the buyer
• Seller's obligation	Restricted from direct sale of additional CERs in the open market	Restricted from direct sale of first surplus in open market	Obligation to sell all additional CERs at predetermined price
• Buyer's right	Right to purchase additional CERs at a pre-determined price	Right to purchase first surplus at a pre-determined price	Right to purchase all CERs generated under the project, at a predetermined price.
3 Failure to generate or transfer minimum amount	Production/transfer failure/gross negligence	Stipulates a percentage of CERs to be delivered	Non-compliance with contractual terms
• Seller's obligation	Obligation to give prior notice to the buyer/pay damages in case of gross negligence	Obligation to pay contractually specified fine	Obligated to honour the buyer's demand for damages/may contest buyer's concurrent rights to recover damages under ICA and the contract.
• Buyer's right	Has options of extending time schedule/replacement rights/ recover liquidated damages	Right to recover contractually specified fine–could be in the form of CERs conforming to his sustainability criteria	Right to recover liquidated damages/ terminate agreement or impose penalty under the contract/and all other rights available under law
4 Sharing of project costs	Preparation of project documents, validation, verification, certification, etc.	Administrative costs	Cost of engaging the DOE (designated operational entity) for validation and registration of the project/costs of verification and certification
• Seller's obligation	Bears all costs	Bears 50% of the costs	Bears 50% of cost of engaging DOE in addition to costs of verification and certification.
• Buyer's obligation	Only bears cost of initial verification.	Bears 50% of the cost	Bears only 50% of the cost of engaging DOE

ANNEXE

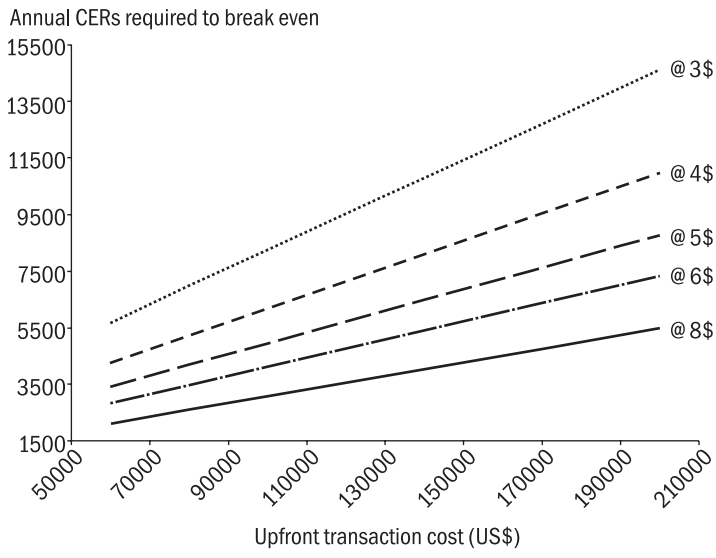
13

Impact of transaction costs on CDM project viability

An analysis based on current estimates was carried out to determine the levels of CERs that would be required for different transaction costs and at different CER purchase prices. The assumptions are provided below.

- Duration of accounting 10 years
- Discount rate 10%
- Periodic validation costs USD 10 000
- Periodicity of validation: maximum two times in addition to initial validation
- Year of commencement of CER generation: second year onwards

The graph below needs to be studied in conjunction with the CER/MW (megawatt) figures presented in Table 1. It essentially means that to cover the transaction costs of USD 70 000, a project will be required to generate 6000 CERs per annum assuming a CER price of



Transaction costs and CDM project viability

Table 1 Annual CER per MW for different technology options*

Technology	*CERs/MW*
Solar	2 203
Wind	2 938
Hydel	4 039
Biomass	6 243
Biomethanation	98 323

*Assuming a 33% thermal efficiency of the baseline coal thermal power plant

USD 3. This can be achieved by setting up a 4.5 MW wind plant or a 3.8 MW hydel plant. It should be highlighted that this analysis presents only a rough picture, and further research and analysis is necessary in order to come up with better data. This analysis provides only an indication of the required CER levels and is based on certain assumptions regarding plant load factor, given in Table 2, for various technology options for replacement of a coal-fired power plant with 80% plant load factor.

Table 2 Assumed PLF for different technologies

Technology options	*Plant load factor* (%)
Solar	30
Wind	40
Hydel	55
Biomass	85
Biomethanation	85

ANNEXE

14

Summary of PINs received under the NSS call

See p. 140

No.	Reference code	Sector	Project	Proponent	Developer	Technology
Renewable energy sector						
1	NSS_RE_01	Renewable energy – bagasse power (cogeneration)	Grid-connected power : bagasse combustion	Davangere Sugar Company Ltd	IREDA (submitted)	Biomass direct combustion and condensing turbine (Rankine cycle)
2	NSS_RE_02	Renewable energy biomass power	Grid-connected power : biomass combustion	Koppal Green Power Ltd	IREDA (submitted)	Biomass direct combustion and condensing turbine (Rankine cycle)
3	NSS_RE_03	Renewable energy biomass power	Grid-connected power : biomass combustion	Poweronicks Ltd	IREDA (submitted)	Biomass direct combustion and condensing turbine (Rankine cycle)
4	NSS_RE_04	Renewable energy biomass power	Grid-connected power : biomass combustion	Konark Power Projects Ltd	IREDA (submitted)	Biomass direct combustion and condensing turbine (Rankine cycle)
5	NSS_RE_05	Renewable energy biomass power	Grid-connected power : biomass combustion	Koganti Power Ltd	IREDA (submitted)	Biomass direct combustion and condensing turbine (Rankine cycle)
6	NSS_RE_06	Renewable energy small hydro power	Grid-connected power : mini hydro	RREC through BSES Ltd	RREC	Mini hydro
7	NSS_RE_07	Renewable energy small hydro power	Grid-connected power : mini hydro	RREC	RREC	Mini hydro
8	NSS_RE_08	Renewable energy wind power	Grid-connected power : wind farm	Rajasthan Renewable Energy Corporation Ltd	Suzlon Energy Ltd	Wind farm (1.25 MW each)
9	NSS_RE_09	Renewable energy biomass power	Grid-connected power : biomass gasification	Ankur Scientific Energy Technologies P Ltd (yet to be finalized by RREC)	RREC	Biomass gasification
10	NSS_RE_10	Renewable energy biomass power	Power : biomass gasification	Chanderpur Works	Chandrapur Engineering Works Private Ltd	Biomass gasification
11	NSS_RE_11	Renewable energy biomass power	Grid-connected power : biomass combustion	B B S Power Projects Ltd	APITCO (submitted)	Biomass direct combustion and condensing turbine (Rankine cycle)
12	NSS_RE_12	Renewable energy power	Rural electrification	MP Urja Vikas Nigam Ltd	MP Urja Vikas Nigam Ltd	Renewable energy technology
13	NSS_RE_13	Renewable energy wind power	Grid-connected power : wind farm	Ideal Windpower Systems Ltd	Ideal Windpower Systems Ltd	Wind farm
14	NSS_RE_14	Renewable energy biomass power	Rural electrification	Not disclosed	Fethapur Taga energy Society	Biomass gasification
15	NSS_RE_15	Renewable energy biomass power	Grid-connected power : biomass combustion	B Seenaiah and Company (Projects) Ltd	B Seenaiah and Company (Projects) Ltd	Biomass direct combustion and condensing turbine (Rankine cycle)
16	NSS_RE_16	Renewable energy small hydro power	Grid-connected power : small hydro	DCM Shriram Consolidated Ltd	DCM Shriram Consolidated Ltd	Small hydro
17	NSS_RE_17	Renewable energy biomass-thermal-bundling	Replacing fossil fuel furnaces with biomass gasifiers	Vijay Engineering Enterprises	Vijay Engineering Enterprises	Biomass gasifier (down draft)
18	NSS_RE_18	Renewable energy biomass-power	Rural electrification	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh State Renewable Energy Development Agency	Solar Home Lighting Systems (solar photovoltaics)
19	NSS_RE_19	Renewable energy small hydro power	Grid-connected power : small hydro	Mandhagere Small Hydro Scheme	Bhoruka Power Corporation Ltd	Small hydro
20	NSS_RE_20	Renewable energy biomass -power	Captive power plant with 50% biomass and 50% coal. Biomass ash to be used for cement manufacturing	Ambuja Cement Eastern Ltd	Gujarat Ambuja Cements Ltd	Biomass direct combustion and condensing turbine (Rankine cycle)
21	NSS_RE_21	Renewable energy wind power	Grid-connected power : wind farm	M P Windfarms Ltd	M P Windfarms Ltd	Wind electric generators-750 kW
22	NSS_RE_22	Renewable energy small hydro power	Grid-connected power : small hydro	NCL Energy Ltd	IREDA (submitted)	Small hydro power (horizontal Kaplan turbine)
23	NSS_RE_23	Renewable energy small hydro power	Grid-connected power : small hydro	Cosmos consulting	Cosmos consulting	Horizontal shaft type francis turbine
24	NSS_RE_24	Renewable energy biomass-power	Grid-connected power : biomass combustion	Santhoshimatha Power Projects Ltd	Santhoshimatha Power Projects Ltd	Biomass direct combustion and condensing turbine (Rankine cycle)

Capacity	*KP : GHG*	*CER volume* (million per annum)	*Location*	*Project cost* (million rupees)	*CER price* (USD/CER)	*Status**	*Baseline status***	*GoI subsidy*
24 MW	CO_2	0.07	Davangere, Karnataka	740.00	–	D	C	Interest subsidy
6 MW	CO_2	0.05	Koppal, Karnataka	243.00	–	D	A	Interest subsidy
6 MW	CO_2	0.05	Bellary, Karnataka	248.00	–	D	A	Interest subsidy
6 MW	CO_2	0.05	Tumkur, Karnataka	238.00	–	D	A	Interest subsidy
6 MW	CO_2	0.05	Raichur, Karnataka	243.00	–	D	A	Interest subsidy
5.5 MW	CO_2	0.0165	Chittorgarh, Rajasthan	270.00	–	D	A	NA
1.2 MW	CO_2	0.008436	Kota, Rajasthan	80.00	–	A - (pre-feasibility completed)	A	NA
25 MW	CO_2	0.044	Jaisalmer, Rajasthan	1010.00	–	B	C	NA
1 MW	CO_2	0.0054	Alwar, Rajasthan	41.11	–	B	A	Capital subsidy (37% of project cost)
1 MW	CO_2	–	Ambala, Haryana	40.00	–	A	A	Capital subsidy (50% of project cost)
6 MW	CO_2	0.027	East Godavari, Andhra Pradesh	234.00	5.00	D	A	Interest subsidy
0	CO_2	10	Varied locations in Madhya Pradesh	4000.00	25.00	Concept	C	NA
15.75 MW	CO_2	0.032	Chitradurga, Karnataka	750.00	4.00	Not a to e	C	Nil
–	CO_2	0.041	Varied locations in Haryana and Uttaranchal	194.00	5.00	Concept	C	NA
7.5 MW	CO_2	0.04 (assumed @ 0.75 kg/kWh)	Nellore, Andhra Pradesh	230.00	–	E	A	Interest subsidy
12 MW (4 projects)	CO_2	0.50808	Kullu, Himachal Pradesh	715.00	5.00	A+	A	NA
NA	CO_2	0.005	1 city in Karnataka and 4 cities in Tamil Nadu	11.23	–	E	A	Available
NA	CO_2	NA	237 remote villages in Chhattisgarh	380.00	10.00	D	A	Capital subsidy (40% of project cost)
3.5 MW	CO_2	0.0016	Mandya, Karnataka	199.00	–	D	A	NA
15 MW	CO_2	0.03	Raipur, Chhattisgarh	450.00	5-10	A	A	NA
15 MW	CO_2	0.034	Dewas, Madhya Pradesh	630.00	9.90	B	A	Interest subsidy
8 MW	CO_2	0.03	Bellary, Karnataka	232.00	–	D	C	Interest subsidy
9 MW	CO_2	0.04	Kullu, Himachal Pradesh	499.00	–	A+	A	none
7.5 MW	CO_2	0.04 (assumed @ 0.75 kg/kWh)	Shimoga, Karnataka	297.00	–	B	A	Interest subsidy

Continued

No.	Reference code	Sector	Project	Proponent	Developer	Technology
25	NSS_RE_25	Renewable energy solar-thermal	Steam generation by solar thermal route (bundling)	Solar Power Corporation and C Trivedi Group of Industries	Solar Power Corporation and C Trivedi Group of Industries	Steam generation by solar parabolic square dish concentrator
26	NSS_RE_26	Renewable energy – bagasse power (cogeneration)	Grid-connected power : bagasse combustion	J K Sugar Ltd	J K Sugar Ltd	Biomass direct combustion and condensing turbine (Rankine cycle)
27	NSS_RE_27	Renewable energy – hybrid	Rural electrification	Case study	Case study	SPV, biomass gasifier, and micro hydro
Power sector						
28	NSS_PS_01	Power	Renovation and modernization of old power plant	NTPC (National Thermal Power Corporation)	NTPC	Renovation and modernization
29	NSS_PS_02	Power	Demand side management for reducing power consumption	MP Urja Vikas Nigam Ltd	MP Urja Vikas Nigam Ltd	Demand-side management
30	NSS_PS_03	Power	Renovation and modernization of old power plant	INDALCO (Indian Aluminium Company) Ltd	INDALCO Ltd	Renovation and modernization
31	NSS_PS_04	Power	Installation of super critical thermal power plant	NTPC	NTPC	Super critical thermal power plant
Industrial energy efficiency						
32	NSS_EE_01	Energy efficiency in industry	Upgradation of hot direct reducing iron charging facilities	Essar Steel Ltd, Hazira	Essar Steel Ltd, Hazira	Available within India
33	NSS_EE_02	Energy efficiency in industry	Installation of DAN_Mod plus and DAN_Mod technology	Essar Steel Ltd, Hazira	Essar Steel Ltd, Hazira	Imported technology (Italy)
34	NSS_EE_03	Energy efficiency in industry	Waste heat recovery steam generator to generate energy	Essar Steel Ltd, Hazira	Essar Steel Ltd, Hazira	Available within India
35	NSS_EE_04	Energy efficiency in industry	Recovering pressure energy in the natural gas pipeline	Essar Steel Ltd, Hazira	Essar Steel Ltd, Hazira	–
36	NSS_EE_05	Energy efficiency in industry	Reheater degasser and continuous orgon stirring and oxygen blowing in steel melting furnace	Essar Steel Ltd, Hazira	Essar Steel Ltd, Hazira	–
37	NSS_EE_06	Paper industry	Energy efficiency improvement	Mysore Paper Mills Ltd	Mysore Paper Mills Ltd	Available within India
38	NSS_EE_07	Energy efficiency in industry	Air preheater for fired heater in petroleum refinery	Essar Oil Ltd, Jamnagar	Essar Oil Ltd	Available within India
39	NSS_EE_08	Energy efficiency in industry	Energy efficiency improvement at ammonia-urea plant	IFFCO (Indian Farmers Fertiliser Cooperative Ltd)	IFFCO	Available within India
40	NSS_EE_09	Energy efficiency in industry	Energy efficiency improvement at ammonia-urea plant	IFFCO	IFFCO	Available within India
41	NSS_EE_10	Energy efficiency in industry	Energy efficiency improvement at ammonia-urea plant	IFFCO	IFFCO	Available within India
42	NSS_EE_11	Energy efficiency in industry	Recovery and use of CO_2 for bottling and dry ice manufacturing	Indian Petrochemicals Corporation Ltd	Indian Petrochemicals Corporation Ltd	Available within India
43	NSS_EE_12	Energy efficiency and renewable energy	–	–	–	–

Capacity	*KP : GHG*	*CER volume* (million per annum)	*Location*	*Project cost* (million rupees)	*CER price* (USD/CER)	*Status**	*Baseline status***	*GoI subsidy*
–	CO_2	–	Bhavnagar, Gujarat	50.00	–	A-	C	–
10 MW	CO_2	0.025 @ 0.7 kg /kWh	Bareilly, Uttar Pradesh	184.00	5–10	D	A	Interest subsidy
4–5 MW	CO_2	to be estimated	Orissa	NA	NA	–	–	Capital and interest subsidy
440 MW	CO_2	reaching up to 1.067 by 2006	Tanda, Uttar Pradesh	5060.00	5–10	D	C	NA
–	CO_2	30	Varied Locations in Madhya Pradesh	4000.00	25.00	Concept	C	NA
Installation of AFBC boilers and upgradation of turbogenerators	CO_2	24 103 metric tonne coal and 2800 kilolitres of diesel savings per annum	Ranchi, Bihar	–	–	D (various stages)	C	NA
1800 MW	CO_2	0.38	Sipat, Chhattisgarh	83 500.00	5.00	B	C	NA
–	CO_2	0.0137	Hazira, Gujarat	100.00	–	D	A	NA
–	CO_2	0.2	Hazira, Gujarat	250.00	–	A	C	NA
75 MW	CO_2	0.7	Hazira, Gujarat	2410.00	–	A	C	NA
2.5 MW	CO_2	0.023	Hazira, Gujarat	1280.00	–	A	A	NA
–	CO_2	0.063	Hazira, Gujarat	400.00	–	A	C	NA
–	CO_2	0.037	Bhadrawati, Karnataka	216.00	–	C	C	NA
–	CO_2	0.005	Jamnagar, Gujarat	90.00	–	D	A	NA
–	CO_2	0.12	Phulpur, UP	1490.00	5–6	A	C	NA
–	CO_2	0.086	Aonla, UP	1310.00	5–6	A	C	NA
–	CO_2	0.082	Kalol, Gujarat	1250.00	5–6	A	C	NA
–	CO_2	0.029	Raigad, Maharashtra	–	–	A	C	NA
Submitted only the capability statement of the consultant company and hence not considered								

Continued

No.	*Reference code*	*Sector*	*Project*	*Proponent*	*Developer*	*Technology*
44	NSS_EE_13	Energy efficiency in small-scale industry	Energy efficiency improvement in pot furnaces in glass industry cluster	The Glass Industry Syndicate and other industrial associations	TERI	Available within India
45	NSS_EE_14	Energy efficiency in small-scale industry	Energy efficiency improvement in foundry units cluster	The Institute of Indian Foundrymen	TERI	Available within India
46	NSS_EE_15	Energy efficiency in small-scale industry	Energy efficiency improvement in foundry units cluster	Rajkot Engineering Association	TERI	Available within India
47	NSS_EE_16	Energy efficiency in small-scale industry	Energy efficiency improvement in brick kilns cluster	Karnataka brick kiln owners association and brick kiln owners association, Maharashtra	TERI	Available within India
48	NSS_EE_17	Energy efficiency in municipal utilities	Energy efficiency in municipal street lighting	ELPRO Energy Dimensions Pvt. Ltd	ELPRO Energy Dimensions Pvt. Ltd	Available within India
MIC						
49	NSS_IWU_01	Industrial waste: cement manufacturing	Manufacture of cement by partial substitution of clinkers with industrial wastes (fly ash / steel plants slag): bundling	Gujarat Ambuja Cements Ltd	Gujarat Ambuja Cements Ltd	Available within India
Waste-to-energy						
50	NSS_WTE_01	Waste-to-energy	MSW (Municipal solid waste) to energy	Renovo Energy Ltd	Amrit NCES Ltd / Hi-tech Agro Projects P Ltd	Pelletization of MSW to produce RDF (refuse derived fuel)
51	NSS_WTE_02	Waste-to-energy (poultry litter)	Grid-connected poultry based biomethanation power project and biomanure production	G K Bioenergy P Ltd	G K Bioenergy P Ltd and IREDA (both submitted)	BIMA high rate biomethanation : Entec, Austria through Indian licensee, Enkem Engineers Pvt. Ltd
52	NSS_WTE_03	Waste-to-energy	MSW to energy	EDL India Pvt. Ltd	EDL India Pvt. Ltd	Biomethanation
53	NSS_WTE_04	Waste-to-energy	MSW to energy	EDL India Pvt. Ltd	EDL India Pvt. Ltd	Biomethanation
54	NSS_WTE_05	Waste-to-energy	MSW to energy	EDL India Pvt. Ltd	EDL India Pvt. Ltd	Biomethanation
55	NSS_WTE_06	Waste-to-energy	MSW to energy	EDL India Pvt. Ltd	EDL India Pvt. Ltd	Biomethanation
56	NSS_WTE_07	Waste-to-energy	MSW to energy	EDL India Pvt. Ltd	EDL India Pvt. Ltd	Biomethanation

Capacity	*KP : GHG*	*CER volume* (million per annum)	*Location*	*Project cost* (million rupees)	*CER price* (USD/CER)	*Status**	*Baseline status***	*GoI subsidy*
20 furnaces	CO_2	0.0085	Firozabad, UP	77.00	16.30	Demonstration completed: yet to be implemented on full scale	A	NA
90 foundaries	CO_2	0.013745	Kolhapur, Maharashtra	16.00	2.60	Ready for implementation	A	NA
190 foundaries	CO_2	0.01325	Rajkot, Gujarat	35.00	6.00	Ready for implementation	A	NA
–	CO_2	0.072	Karnataka and Maharashtra	559.00	13.10	Ready for implementation	A	NA
Street lights in 110 km stretch	CO_2	0.0012	Bangalore-Tumkur highway, Karnataka	–	–	B	A	NA
–	CO_2	0.3	Gujarat, Chhattisgarh, Maharashtra, Himachal Pradesh, West Bengal, and Punjab	–	5–10	D	C	NA
150 MT of RDF per day	CH_4, CO_2	0.06	New Delhi	180.00	5.00	B	A	Available
1.5 MW and 40 tonnes of biomanure	CH_4, CO_2, and N_2O	0.075 (0.05 from CH_4, and 0.011 from grid CO_2 and 0.013 from fertilizer CO_2)	Namakkal, Tamil Nadu	169.00	6.00	D	C	Capital subsidy (21% of project cost)
5 MW power; 75 tpd of organic manure	CH_4, CO_2	Year 1 : 125 738 tonnes of CO_{2eq} Years 2–5 : 113 164 tonnes of CO_{2eq} Years 6–10 : 88 017 tonnes of CO_{2e}	Barielly, UP	700.00	4.00	A	C	Nil
8 MW electricity 125 tpd of organic manure	CH_4, CO_2	Year 1: 209 563 metric tonnes of CO_{2eq} Years 2–5 : 188 607 metric tonnes CO_2 equivalent Years 6–10 : 146 694 metric tonnes of CO_{2eq}	Bhopal, Madhya Pradesh	1150.00	4.00	A	C	Nil
8 MW electricity 125 tpd of organic manure	CH_4, CO_2	Year 1 : 209 563 metric tonnes of CO_{2e} Years 2–5 : 188 607 metric tonnes CO_{2e} Years 6–10 : 146 694 metric tonnes of CO_{2eq}	Kanpur, UP	1150.00	4.00	A	C	Nil
8 MW electricity 125 tpd of organic manure	CH_4, CO_2	Year 1 : 209 563 metric tonnes of CO_2 equivalent Years 2–5 : 188 607 metric tonnes CO_{2eq} Years 6–10 : 146 694 metric tonnes of CO_{2eq}	Meerut, UP	1150.00	4.00	A	C	Nil
16 MW power; 250 tpd of organic manure	CH_4, CO_2	Year 1 : 419 126 tonnes of CO_{2eq} Years 2–5 : 377 213 metric tonnes of CO_{2eq} Years 6–10 : 293 388 metric tonnes of CO_{2eq}	Mumbai, Maharashtra	2200.00	4.00	A	C	Nil

Continued

No.	*Reference code*	*Sector*	*Project*	*Proponent*	*Developer*	*Technology*
57	NSS_WTE_08	Waste-to-energy	MSW to energy	EDL India Pvt. Ltd	EDL India Pvt. Ltd	Biomethanation
58	NSS_WTE_09	Waste-to-energy: chemical industry	Power generation from biogas and supply to grid	Associated Distilleries Ltd	Surya-Tech Consultancy Services	Gas cleaning system for H_2S removal
59	NSS_WTE_10	Waste management	Methane capture from distillery waste water	Associated Distilleries Ltd	Surya-Tech Consultancy Services	Biomethanation
60	NSS_WTE_11	Waste-to-energy-poultry Litter + Biomass	Grid-connected poultry based biomethanation power project	Raja Bhaskar Power Generation Ltd	Raja Bhaskar Power Generation Ltd	Biomass direct combustion and condensing turbine (Rankine cycle)
Building sector						
61	NSS_BUILD_01	Building: alternate building material technology	Manufacture of Gypcrete building panel as a replacement for brick	Gypcrete Building India (P) Ltd	Gypcrete Building India (P) Ltd	Rapid flow calciner technology, Gypcrete or Rapidwall technology
62	NSS_BUILD_02	Building : alternate building material	Use of stabilized earth blocks in a housing project	Kulkarni Constructions Pvt Ltd	Kulkarni Constructions Pvt. Ltd	Cement stabilized earth blocks
Transport sector						
63	NSS_TRANS_01	Transport : fuel-switch	Switching to LPG as automotive fuel	E F Energy Ltd	EF Energy Ltd	'First-of-its-kind' RDIF technology for monitoring CO_2 reduction from vehicles
64	NSS_TRANS_02	Transport : fuel-switch	Production of anhydrous ethanol from sugar mill as an alternative automotive fuel for petrol, as a blend fuel	Shree Renuka Sugars Ltd	Agrienergy Ltd	Dehydration technology
Fuel-switch sector						
65	NSS_FUELSW_01	Fuel-switch : fertilizer unit	Feed stock switching from naptha to natural gas	DCM Shriram Consolidated Ltd	DCM Shriram Consolidated Ltd	Technology from Denmark
66	NSS_FUELSW_02	Fuel-switch : cement units	Fuel-switching from coal to biomass: bundling	Gujarat Ambuja Cements Ltd	Gujarat Ambuja Cements Ltd	Fuel-switching
67	NSS_FUELSW_03	Fuel-switch : steel rolling	Fuel-switching from furnace oil to biomass	Not disclosed	Surya Tech Consultancy	Fuel-switching
68	NSS_FUELSW_04	Fuel-switch : LPG	Fuel-switching from fuelwood, crop residues, kerosene, dung cakes and biomass	Hindustan Petroleum Corporation Ltd	South Asia LPG Company Pvt. Ltd	Fuel-switching by facilitating underground cavern LPG storage facility
Agricultural sector						
69	NSS_AGRI_01	Agriculture : elevated CO_2	Agro ecosystems responsive to elevated CO_2	IARI (Indian Agricultural Research Institute)	IARI	CO_2 enrichment technology (open top chambers and free air CO_2 enrichment technologies being used at IARI)

Notes

* A – feasibility report completed; B – under financial closure; C – financial closure achieved; D – under implementation; E – commissioned

** A – under simplified procedures for small-scale CDM projects; B – methodology approved by CDM executive board; C – methodology yet to be developed; D – methodology pending approval from CDM executive board; E – methodology rejected by CDM executive board

KP:GHG – Kyoto Protocol greenhouse gas; GoI – Government of India; PIN – Project Information Note; CER – Certified Emission Reduction

IREDA – Indian Renewable Energy Development Agency; RREC – Rajasthan Renewable Energy Corporation Ltd; APITCO – Andhra Pradesh Industrial and Technical Consultancy Organization; IFFCO – Indian Farmers Fertiliser Cooperative Limited; USD – United States dollars

Capacity	*KP : GHG*	*CER volume* (million per annum)	*Location*	*Project cost* (million rupees)	*CER price* (USD/CER)	*Status**	*Baseline status***	*GoI subsidy*
8 MW electricity 125 tpd of organic manure	CH_4, CO_2	Year 1 : 125 738 metric tonnes of CO_{2eq} Years 2-5 : 113 164 metric tonnes CO_{2e} Years 6-10 : 88 017 metric tonnes of CO_{2eq}	Varanasi, UP	700.00	4.00	A	C	Nil
5.476 Mwe	CO_2 , N_2O nominal	0.035	Mansurpur (UP), Hisar (Haryana), Samalkha (Haryana), Bherod (Rajasthan)	164.30	5.00	A	C	Nil
3 units: 17 000 m^3/day of biogas 1 unit 22 700 m^3/day of biogas	CH_4	0.391	4 distilleries in UP or Bihar	100.00	5.00	A	C	Nil
7.5 MW and 11000 metric tonnes of ash per annum	CH_4, CO_2, and N_2O	0.28942	Bellary, Karnataka	386.00	–	B	A	NA
0.7 million sq.m/ plant/year	CO_2	20 000 tonnes/plant	Madurantakam, Kancheepuram, Chennai	203.00	7.00	D	C	None
150 housing units	CO_2	65 kg/sq.m	Maharashtra	56.00	10.00	D	C	None
1500 retail outlets	CO_2	0.336	Cities in 10 coastal states	271.7 million USD	6.00	B	C	NA
55 000 litres/day	CO_2	0.038	Belgaum, Karnataka	67.00	5-7	E	A	NA
–	CO_2	0.164	Kota, Rajasthan	415.00	4-12	C	C	NA
–	CO_2	0.6-0.8	Gujarat, Chhattisgarh, Maharashtra, Himachal Pradesh and Rajasthan	–	–	A in progress	C	NA
–	CO_2	0.058	Mandi Govind Garh, Punjab	–	–	A	C	NA
60 000 metric tonnes LPG storage facility	CO_2	1.92	Visakhapatnam, Andhra Pradesh	–	–	D	A	NA
–	CO_2	Not estimated	IARI	–	–	A in progress	C	NA

ANNEXE

15

Summary sheets of PINs finalized for PDD development

1 Small hydro sector	
Project Code	NSS RE 16
Sector	Small hydro
Industry	Decentralized power (bundling)
Location	Kullu, Himachal Pradesh, North India
Capacity	3 projects of capacities 4.5 MW, 4 MW and 3.5 MW totalling 12 MW
Project developer	DSCL Energy Services
Project promoter	DCM Shriram Consolidated Ltd
Technology	Pelton and Francis turbines, horizontal shaft synchronous type generators, state-of-the-art controls and instrumentation (involving technology transfer) for remote monitoring of operation of power plant
Kyoto Protocol greenhouse gas	CO_2
Project cost	715 million rupees
Annual CER volume	0.5 million
Expected commissioning	Pre-project activities are in progress, construction activities should start by December 2004 and should complete by 2006
Expected CER delivery	2006
Reasons for selection	■ Project involving a new concept – bundling of small-scale projects ■ High sustainable development benefits ■ Eligible under small-scale category ■ Potential for replication in other areas ■ Strong promoters background

2 Foundry sector	
Project code	NSS EE 15
Sector	Small-scale industry cluster
Industry	Small-scale foundry (bundling)
Location	Rajkot (Gujarat), Western India
Capacity (number of foundries)	190 foundries
Project developer	Industrial Energy Area of T E R I
Project promoter	Rajkot Engineering Association
Technology	Changing the conventionally designed melting furnaces (cupolas) of foundry units at Rajkot to energy efficient designs of DBC (divided blast cupola)
Kyoto Protocol greenhouse gas	CO_2
Project cost	35 million rupees
Annual CER volume	0.01325 million
Expected commissioning	Mid 2004
Expected CER delivery	Early 2005
Reasons for selection	■ PDD requires bundling of technology improvement activities at number of units (factories) ■ CERs (certified emission reductions) will make technology switchover attractive. Banking institution may then support(cost to individual factories not very large; 0.15 to 2.20 million rupees) ■ Good replicability prospects for other cluster of industry to follow. ■ Status: industry's survey done by T E R I under a SDC (Swiss Agency for Development and Cooperation) funded project. ■ Rajkot Engineering Association (the promoter) are very active and have experienced staff. Should be able to steer the change to efficient technology. ■ Sustainable development: for wider group of dispersed industry. ■ Besides CO_2 reduction in particulate emissions, reduced coke requirement leading to reduced load on coke ovens and railways, and correspondingly reduced pollution.

3 Municipal street lighting	
Project code	NSS EE 17
Sector	Energy efficiency
Industry	Municipal street lighting
Location	Bangalore, Karnataka, Southern India
Capacity	Energy savings per annum is 1.5 million units
Project developer	Elpro Energy Dimensions Pvt Ltd
Project promoter	Bangalore Development Authority
Technology	ETrACS (Energy Tracking and Control System) – basically a computer-based energy monitoring and control system for controlling and monitoring a maximum of 50 000 energy consuming nodes spread in a wide area (any Distance).
Kyoto Protocol greenhouse gas	CO_2
Project cost	18.71 million rupees
Annual CER volume	1200 CO_2
Expected commissioning	2004 Pre-feasibility study finished / feasibility study finished / statutory clearances in process/statutory clearances obtained/ financial closure in process
Expected CER delivery	2004
Reasons for selection	■ Project based on effective energy management and conservation techniques. ■ Very high potential for replication in similar municipal corporations. ■ Project based on ESCO concept associated with high degree of operational responsibility and hence reliable performance.

4 Rural electrification through renewable energy	
(Case study: rural electrification by decentralized distribution generation systems through mix of renewable energy technologies)	
Project code	NSS RE 27
Sector	Rural electrification
Industry	Renewable energy
Location	Orissa
Capacity	4–5 MW (About 200 unelectrified villages of Orissa)
Project developer	T E R I
Project promoter	■ To be finalized during the development of the case study ■ Case study being developed in close association with Gram Vikas Trust, a leading local NGO in the state of Orissa.
Technology	Mix of renewable energy technologies : ■ solar photovoltaic systems ■ biomass gasification/combustion ■ small hydro ■ bio-oils
Kyoto Protocol greenhouse gas	CO_2
Project cost	Not available
Annual CER volume	To be estimated during the development of the case study
Expected commissioning	–
Expected CER delivery	–
Reasons for selection	■ very high sustainable development benefits ■ very high potential for replication ■ demonstration of CDMability of rural-based projects ■ analysis of application of new and innovative finance delivery models under such government subsidies predominant programme

5 Waste-to-energy sector	
Project code	NSS WTE 04
Sector	Waste-to-energy
Industry	Methane capture and power generation from MSW (municipal solid waste)
Location	New Delhi
Capacity	500 tonnes per day
Project developer	Renova Energy Ltd
Project promoter	Amrit NCES Ltd
Technology	Pelletization
Kyoto Protocol greenhouse gas	CH_4, CO_2
Project cost	180 million rupees
Annual CER volume	60 000
Expected commissioning	October 2004
Expected CER delivery	2005
Reasons for selection	■ project utilizing MSW and reducing urban pollution ■ very high replication potential throughout the country ■ high sustainable development benefits ■ proven technology

ANNEXE

16

Methodology of PIN selection for PDD development

A nation-wide call for PINs (project information notes) was launched as part of the NSS (National Strategy Study), through the following means.

- NSS launch event in October 2003
- Project website <www.teriin.org/nss>
- Contacts with various stakeholders (industrial associations, state energy development agencies, non-governmental organizations, equipment manufacturers, consultants, project developers, project promoters, technology suppliers, financial institutions and bilateral and multilateral agencies).

There was an overwhelming response with 69 PINs received from various sectors (in the first month and dedicated only to this process).

In shortlisting PINs for PDD (project design document) development, the NSS-India team aimed for a good distribution of projects, both in terms of geographical coverage and project type. Further, given the emphasis of NSS-India on capacity building and project development, the study team also endeavoured to consider projects for which the methodological basis is relatively less developed. In this context, the guidance of the Steering Committee and TAG (Technical Advisory Group) at their first meeting was considered vital, which is reflected in the following criteria.

- Cover more than one sector from the following list: conventional power, renewable energy, energy efficiency in industry and buildings, waste to energy, transport, and agriculture
- Select at least one project that results in the mitigation of a Kyoto gas other than CO_2, for instance CH_4 or halocarbons
- Recognize that NSS-India is a valuable means of extending CDM (clean development mechanism) capacity building to different parts of the country, and ensure that shortlisted projects are from different regions

Select a project from the country's remote areas, which are otherwise neglected from the perspective of investment, infrastructure, and institutional capacity

Select at least one project from a new area that has not received much attention for CDM project development in India.[1]

A phased selection process was designed, with all PINs evaluated on the following parameters.

- Greenhouse gas abatement
- Sectors
- Location
- Technology
- Project cost
- New type of project/sector
- Project status
- Project replication
- Promoter's capability to implement the project
- Sustainable development benefits
- Data availability for PDD development.

Projects fulfilling the first set of criteria were prioritized on the basis of the following.

- Potential for replication
- Technical viability
- Status of project development vis-à-vis data availability for PDD development
- Potential volume of GHG abatement[2]

A balanced approach was essential in shortlisting the final set of project ideas for PDD development. In the shortlisting process, no specific considerations were given to those projects that may be ideal for CDM only in theory or projects with higher likelihood of implementation.

The NSS team also recognized that certain sectors like transport, building efficiency, HFC (hydrofluorocarbon) reduction, and agriculture are not adequately represented in the set of PINs received. Hence, in addition to the regular call for PINs, the team attempted to invite PINs from selected project developers.

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[1] One example is to explore new approaches for project formulation such as bundling, the ESCO concept, or other government programmes that may benefit from CDM funds. Another could relate to sectors like transport, agriculture, or small and medium enterprises, where baselines are relatively less established. These could offer the opportunities for value addition in methodologically complex projects. A third example could be of new technologies, which are desirable from the country's perspective, including fuel and material switching projects.

[2] Though large CER volume projects are attractive, small projects should be encouraged as executive board procedures are also better established in the latter case.

The details of the receipt of PINs and the overall analysis of application of the criteria for selection of PINs were presented to the TAG in their second meeting in February 2004. The TAG experts recommended shortlisting projects in the following sectors for PDD development.

- Small hydro
- Small foundries
- Waste-to-energy

Owing to the national importance and methodological complexity of the sector, the host ministry, MoEF (Ministry of Environment and Forests) suggested

- Project on energy efficiency in municipal street lighting, and
- Case study on rural electrification through renewable energy

It may be noted that the rural electrification project was developed as a case study to examine and demonstrate CDM ability of such rural-based projects, which are quintessential for rural development in the country, an area being accorded the highest priority by the government.

For the projects shortlisted, a MoU (memorandum of understanding) was signed with the project promoters of the selected PINs. The MoU outlined the scope and limitation of work offered by NSS team, provision of data for PDD development and so on. It also provided the clarity on the role of the NSS team in developing the project upto the PDD level and clearly delineated that the quality of the PDD developed is contingent on information (quantitative and qualitative) provided by the project promoter.

Subsequently, PDDs were developed for all the five projects with inputs from the project developers.

ANNEXE

17

Gazette notification for National CDM Authority

Ministry of Environment and Forests
(Climate Change Division)
ORDER

New Delhi, 16 April 2004

S.O.515(E) – *whereas, India is a Party to the United Nations Framework Convention on Climate Change (UNFCCC) and the objective of the Convention is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system;*

And whereas, to strengthen the developed country commitments under the Convention, the parties adopted Kyoto protocol in 1997 which commits developed country Parties to return their emissions of greenhouse gases to an average of approximately 5.2% below 1990 levels over the period 2008-12;

And whereas, the Kyoto protocol provides for quantified emission limitations and reduction commitments for the developed countries and mechanisms to facilitate compliance with these targets, reporting and reviews and it lists six greenhouse gases – Carbon dioxide (CO_2), Methane (CH_1), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6);

And whereas, India acceded to the Kyoto Protocol in August 2002 and one of the objectives of acceding was to fulfill prerequisites for implementation of Clean Development Mechanism (hereinafter referred to as CDM) projects, in accordance with national sustainable priorities, where-under, a developed country would take up greenhouse gas reduction project activities in developing countries where the costs of greenhouse gas reduction project activities are usually much lower with the purpose to assist developing country parties in achieving Sustainable Development and in contributing to the ultimate objective of the Convention and to assist developed country Parties in achieving compliance with their quantified emission limitation and reduction commitments;

And whereas, the CoP-7(seventh Conference of Parties) to the UNFCCC decided that parties participating in DCM should designated a National Authority for the CDM and as per the CDM project cycle, a project proposal should include written approval of voluntary participation from the Designated National Authority of each country and confirmation that the project activity assists the host country in achieving sustainable development;

And whereas, the Central Government considers it necessary and expedient to constitute a National Clean Development Mechanism (CDM) Authority for the purpose of protecting and improving the quality of environment in terms of the Kyoto Protocol;

Now, therefore in exercise of the powers conferred by sub-sections (1) and (3) of section 3 of the Environment (Protection) Act,1986 (29 of 1986), the Central Government hereby constitutes the "National Clean Development Mechanism (CDM) Authority" with the following composition, namely:-

1.	Secretary (Environment and Forests)	Chairperson
2.	Foreign Secretary or his nominee	Member
3.	Finance Secretary or his nominee	Member
4.	Secretary, Industrial Policy and Promotion or his nominee	Member
5.	Secretary, Ministry of Non-conventional Energy Sources or his nominee	Member
6.	Secretary, Ministry of Power or his nominee	Member
7.	Secretary, Planning Commission or his nominee	Member
8	Joint Secretary (Climate Change), Ministry of Environment and Forests	Member
9.	Director (Climate Change), Ministry of Environment and Forests	Member-Secretary

II The National Clean Development Mechanism (CMD) Authority shall exercise and perform the following powers and functions, namely:-

(i) to take measures with respect to matters referred to in the clauses (viii), (ix), (x), (xii) of sub-section (2) of section 3 of the said Act and may issue directions under section 5 thereof.

(ii) (a) To receive projects for evaluation and approval as per the guidelines and general criteria laid down in the relevant rules and modalities pertaining to CDM in addition to the guidelines issued by the Clean Development Mechanism Executive Board and Conference of Parties serving as Meeting of Parties to the United Nations Framework Convention on Climate Change.

(b) The evaluation process of CDM projects would include an assessment of the probability of eventual successful

implementation of CDM projects and evaluation of extent to which projects meet the sustainable development objectives, as it would seek to prioritize projects in accordance with national priorities.

(iii) (a) To recommend certain additional requirements to ensure that the project proposal meet the national sustainable development priorities and comply with the legal framework so as to ensure that the projects are compatible with the local priorities and stakeholders have been duly consulted.

(b) To ensure that in the event of project proposal competing for same source of investment, projects with higher sustainable development benefits and which are likely to succeed are accorded higher priority.

(iv) Financial review of project proposals to ensure that the project proposals do not involve diversion of official development assistance in accordance with modalities and procedures for Clean Development Mechanism and also ensure that the market environment of the CDM project is not conducive to under-valuation of Certified Emission Reductions (CERs) particularly for externally aided projects.

(v) (a) To maintain a registry of CDM projects approved, and their Certified Emission Reduction potential and confirm that these have been realized.

(b) To carry out activities to ensure that the project developers have reliable information relating to all aspects of Clean Development Mechanism which include creating databases on organizations designated for carrying out activities like validation of CDM project proposals and monitoring and verification of project activities, and

(c) To collect, compile and publish technical and statistical data relating to CDM initiatives in India.

III The Member-Secretary of the National Clean Development Mechanism (CDM) Authority shall be responsible for day-to-day activities of the Authority including constituting committees or sub-groups to coordinate and examine the proposals or to get detailed examination of the project proposals conducted through experts or by consulting organizations for consideration by the Authority or to engage or hire any consultant or specialist on contract basis on such remuneration as may be approved by the Central Government and submission of report to UNFCCC and other authorities.

IV The National Clean Development Mechanism (CDM) Authority shall have power

(a) to invite officials and experts from Government, financial institutions, consultancy organizations, non-governmental organizations, civil society, legal profession, industry and commerce, as it may deem necessary for technical and professional inputs and may co-opt other members depending upon need.

(b) to interact with concerned authorities, institutions, individual stakeholders for matters relating to CDM.

(c) to take up any environmental issues pertaining to CDM or Sustainable Development projects as may be referred to it by the Central Government, and

(d) to recommend guidelines to the Central Government for consideration of projects and principles to be followed for according host country approval.

V The National Clean Development Mechanism (CDM) Authority shall furnish report about its activity at least once in three months to the Central Government.

[F. No. 4/52003-CCC]
R K Vaish, Jt Secretary

ANNEXE

18

Nature of CERs: a discussion note

In physical terms, CERs (certified emission reductions) represent the quantifiable value of one metric tonne of CO_2 (carbon dioxide) reduced or sequestered from the atmosphere. This is produced through an investment in a CDM project, which would reduce the CO_2 levels in the atmosphere.

It is imperative that this physical act be transcribed within a legal regime, enabling the creation of legal rights to the CERs. Emission reduction means any right, interest, credit, entitlement or benefit accruing in the present or in the future, arising from the removal, limitation, reduction, sequestration or mitigation of GHGs (greenhouse gases) by the project.

It is important to mention however that the determination of the physical category, under which the CERs fall, will affect their legal status – do the CERs fall in the category of natural resources, goods, financial instruments, electronic rights like shares and derivatives, etc. The nature of the CERs and the concomitant ownership regimes associated with it has been briefly analysed in the following discussion.

a) *Natural resources*

Regarding the argument that the CERs are 'natural resources', it has been contended that the reduction of GHGs is in effect the management of a natural resource. The rationale underlying this contention is that, since the baseline will be constructed in terms of the present level of emissions, which is primarily arising from the naturally derived fossil fuels, it is therefore the responsibility and the property of the host country.

The term 'natural resource' is denoted to mean a resource, which is naturally present on earth or in the atmosphere. This is not true in the case of CERs. This argument is also fallacious because unlike any other natural resource, for example wood, water, minerals, etc., the CERs cannot be used in their existing physical state. When electricity is generated from a hydroelectric turbine, though water is a natural resource, electricity falls in the category of manufactured goods. Similarly CERs are largely a legal creation in the sense that they would not have any physical presence (at least substantively) without a law recognizing them as such. Therefore, they do not fall within the category of natural resources.

This conclusion thus necessarily denies the government the legal basis for ownership of CERs by way of the fact that these are 'natural resources'.

The other argument that has been advanced is that GHGs per se being a natural resource, if the government is managing such a resource (by undertaking facilitative mechanisms for enabling the CDM projects to operate), it should have an ownership in the CERs being produced. In this case too, it would be the CDM project developer who would be contributing substantially to GHG reductions by undertaking the project. The role of the government would be complementary but not decisive. Thus the government could charge a fee, but it would be impossible to establish ownership for the type of services rendered by the government.

b) *Goods*

CERs could be defined as manufactured goods also, since these are primarily industrial goods, that is, products (or by-products as some would argue) from an industrial activity. This is also supported by the fact that, generally in the absence of any specific legislation or regulations, the emission reductions can be bought and sold as commodities. The EU and the US Emission Trading Schemes treat emission reduction as tradable commodities. In such a case, the GATT (General Agreement on Tariffs and Trade) would come into play and India would be bound by its obligations under the WTO (World Trade Organization) (with respect to CERs).

c) *Financial instruments*

However, CERs are not 'pure' physical commodities, rather they are more like financial instruments (such as shares, securities, promissory notes, export credits), or intangible assets (such as business goodwill, trademark, brand name, import licences, etc.). However given the nature of CERs as that of electronic rights, it seems more appropriate to treat them as financial instruments rather than intangible assets.

d) *Capital asset*

An accompanying issue is whether a CER is a capital or a business asset. Generally speaking, intangible assets and many financial instruments (for instance shares and import licenses etc.) would fall in the capital asset category, while commodities would fall in the business asset category. Consequently the CER is a hybrid product: it is a commodity, a financial instrument, and a business asset. Experts suggest that, for various practical reasons, it is advisable that CERs be treated as a financial commodity.

This hybrid nature reflects the view that income from CERs constitutes a revenue stream resulting from the sale of this financial commodity. This would mean the allocation of ownership rights would primarily be a derivative of terms of the contractual agreement.

ANNEXE

19

Proposed functions of DNAs in a few other countries

	Functions	
Country	*Regulatory*	*Promotional*
Peru	■ Project verification and approval ■ Framing and coordinating national laws and policies ■ Follow up on National Strategy Study implementation ■ Register CDM activities in the country ■ Participate in international negotiations and comply with international procedures	■ CDM (clean development mechanism) project investment promotion ■ Create national and international capacity for CDM ■ Coordinate with national and international agencies for funding ■ Administer and update national database for CDM ■ Support spreading of CDM information to create local capacity for the development of national DOEs ■ Coordinate necessary actions to overcome barriers for CDM implementation
China	■ Reviewing and coordinating national CDM policies ■ Approve members for PEB (Project Examination Board) ■ Examining CDM projects ■ Presenting and revising proposals for operational rules and procedures for CDM ■ Issue official DNA (designated national authority) approval	■ Not clearly included in DNAs' mandate, at present. ■ Several barriers addressed, (bundling of small projects, enabling unilateral CDM, lack of awareness at different levels, etc.) ■ Setting up an arrangement to facilitate promotional activities is suggested
Indonesia	■ Project evaluation and approval ■ Administrative functions of DNA ■ Preparing eligibility list of CDM projects for each sector. ■ Evaluating CDM proposals ■ Facilitating inter-sectoral communication	■ The secretariat takes up some promotional activities
Egypt	■ Implement and regular review of performance of CDM unit ■ Form national policy for CDM ■ Implementation and transfer of CERs ■ Issuing guidelines for CDM projects and defining the national criteria for project approval, final approval of CDM projects ■ Maintain national registry of CDM projects ■ Assisting the committee in its activities	■ Awareness and promotion of CDM ■ Monitor international market for GHG offsets and strengthening of investor relations ■ Facilitating matchmaking between potential hosts, investors, technology suppliers, etc. ■ Acquiring approvals on behalf of CDM hosts ■ Assisting the committee in its activities

Country	*Functions*	
	Regulatory	*Promotional*
Philippines	■ Forming policies for CDM ■ Determine project approval criteria ■ Sectoral prioritization of projects ■ Formulate project evaluation and approval process ■ Assess and issue final approval to projects ■ Secretariat ■ Administrative roles ■ Assisting DNA in project evaluation and approval process	■ Promotional roles incorporated in DNAs' mandate ■ DNA assesses, develops and implements capacity building programmes for key stakeholders with the help of NGOs, research institutions, educational institutes, finance promotion institutions, etc.
South Africa	■ To develop an approval system ■ To set criteria for host country approval	■ Several national and international institutions are identified for different promotional roles
India	■ To evaluate and approve projects as per guidelines and criteria laid down in relevant rules related to CDM modalities, in addition to guidance of the CDM EB and CoP/MoP ■ Evaluation to include probability of successful implementation of a project, meeting national sustainable development priorities, compliance with legal framework, financial review to ensure no diversion of ODA	■ To undertake activities (such as creating databases) to ensure that project developers have reliable information ■ Compiling and publishing technical and statistical data

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Significant developments have taken place nationally and internationally as the CDM (clean development mechanism) has evolved from idea to fruition. In recognition of this, the NSS-India study was designed to be in tune with the new capacity-building programme of the World Bank, namely CF-Assist (capacity building and technical assistance for carbon finance).

The study builds upon the considerable body of existing knowledge on the subject, and focuses more on facilitating the operationalization of the CDM in India through strategic analysis, capacity building, and development of CDM projects. The study examines the international demand for certified emission reductions, the supply potential from India, and the application of CDM methodologies in the Indian context by developing five project design documents. It also presents the elements of a facilitative framework for CDM implementation in India.