CDM/JI Initiative

Country Study

India

A CDM Market Overview

December 2008

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Imprint:
Published by:

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Technische Zusammenarbeit (GTZ) GmbH
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The Study was supported under the CDM/JI Initiative of the:

Federal Ministry for the
Environment, Nature Conservation
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Eschborn, December 2008

Foreword

The country report presented here is part of the CDM/JI Initiative launched by the German Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) to encourage the participation of German companies in the flexible mechanisms established under the Kyoto Protocol. At the same time, the Initiative aims to intensify bilateral co-operation with governments and institutions in the host countries for CDM and JI in order to support their respective national climate policies.

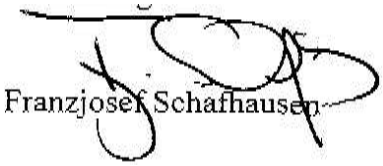
The initiative will help market players to maximize their use of the opportunities presented by the Clean Development Mechanism (CDM) and Joint Implementation (JI). It particularly targets small and medium-sized enterprises (SMEs) that participate in the EU emission trading scheme in Germany, but also technology providers. The SMEs often lack information about CDM and JI project implementation and relevant networks in host countries, which are needed to leverage investments for projects and to complete emissions-trading agreements. The activities conducted as part of the initiative take a long-term approach and pursue a clear objective of continuing cooperation efforts when the first Kyoto Protocol commitment period ends in 2012. Innovative instruments like the programmatic approach, with the potential to scale up the flexible mechanisms and to tap new sectors, are therefore also part of the scope of the Initiative.

On behalf of the BMU, GTZ aims to develop portfolios of CDM projects in India, China and Brazil that can be implemented before 2012. CDM projects in these countries operate in a very competitive environment, and specific market information provided by GTZ can facilitate the successful implementation of CDM projects. Other countries to be prioritized by the Initiative are in the Middle East and North Africa (MENA) Region, which has numerous sectors with considerable CDM potential.

As an initial step in its country activities, GTZ was assigned to prepare six CDM country studies in Brazil, China and India, as well as Egypt, Morocco and Tunisia in the MENA region.

The aim of the country studies is to identify information gaps and offer suggestions for overcoming these. The studies first present an overview of the national CDM market by analysing the CDM projects that have been submitted, approved and processed to date, together with the methodologies used. National institutions, international organisations and other relevant actors are taken into account, thereby providing a detailed picture of the national CDM market. Secondly, the study identifies untapped sectors and new potential for CDM projects. The studies provide a basis for developing a project portfolio that focuses particularly on high quality, innovative projects which still need support in order to gain market access.

We hope the reader finds this and the other five reports useful as an orientation for the CDM in the countries concerned.



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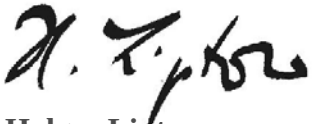

Holger Liptow

GTZ Coordinator of the CDM-Initiative

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List of Abbreviations

ADB	Asian Development Bank
APM	Administered Project Mechanism
BEE	Bureau of Energy Efficiency
BIS	Bureau of Indian Standard
BOOT	Build Own Operate and Transfer
CCE	Chicago Climate Exchange
CCFE	Chicago Climate Futures Exchange
CCI	Controller of Capital Issues
CDM	Clean Development Mechanism
CERs	Certified Emission Reduction
CFLs	Compact Florescent Lamps
CNG	Compressed Natural Gas
CPA	City Area
CVC	Central Vigilance Commission
DFIs	Development Financial Institutions
DMRTS	Delhi Mass Rapid Transport System
DOE	Department of Electronics
DSM	Demand Side Management
ECBC	Energy Conservation Building Code
ECBC	External Commercial Borrowing
ECX	European Climate Exchange
EIA	Environmental Impact Assessment
EPC	Equipment Procurement and Construction
ERUs	Emission Reduction Unit
ESCO	Energy Service Companies
EUAs	European Union Allowances
FI	Financial Institution
GDP	Gross Domestic Product
Gg	Greenhouse Gas (CO_2 equivalent)
GHG	Greenhouse Gas
HFC	Hydro Fluorocarbon
HUDCO	Housing and Urban Development Corporation
ICB	International Competitive Bidding
ICICI	Industrial Credit and Investment Corporation of India
IDBI	Industrial Development Bank of India
IDFC	Infrastructure Development Finance Company
IFCI	Industrial Finance Corporation of India
IFI	International Financial Institutions
IIFCL	India Infrastructure Finance Company Ltd
IL&FS	Infrastructure Leasing & Financial Services Ltd
IP	Intellectual Property
IREDA	Indian Renewable Energy Development Agency
JBIC	Japan Bank for International Corporation
JI	Joint Implementation
LFG	Landfill Gas
LIC	Life Insurance Corporation
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas

MERC	Maharashtra Electricity Regulatory Commission
MNRE	Ministry of New & Renewable Energy
MSCM	Million Standard Cubic Meter
MW	Megawatt
NABARD	National Bank of Agriculture & Rural Development
NB	National Bidding
NBC	National Building Code
NCDEX	National Commodity & Derivatives Exchange Limited
NELP	Navy Environmental Leadership Programme
NGAC	New South Water Greenhouse Gas Abatement Scheme
NSE	National Stock Exchange
NUTP	National Urban Transport Policy
OLG	Open General Licence
PA	Indian Patents Act
PDCOR	Project Development Corporation
PDD	Project Design Document
PE	Private Equity
PFC	Per Fluorocarbon
PFC	Power Finance Corporation
PIS	Patent Information System
PoA	Programme of Activities
PPPs	Private Property Partnership
PPPs	Public Private Partnership
PSU	Public Sector Undertaking
PV	Photo Voltaic
RBI	Reserve Bank of India
RE	Renewable Energy
REC	Rural Electrification Corporation
RTI	Right to Information
SEBI	Securities and Exchange Board of India
SERCs	State Electricity Regulatory Commission
SHP	Small Hydro Power
SIDBI	Small Industries Development Bank of India
SPV	Special Purpose Vehicle
TNUDF	Tamil Nadu Urban Development Fund
TRIPs	Trade Related Aspects of Intellectual Property Rights
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VERs	Voluntary Emission Reductions

Executive Summary

- India ranks second in the world of CDM and has 358 projects out of 1,167 registered projects, the highest number of projects, which have been registered with UNFCCC.
- India ranks second in the number of CERs issued by host countries. Out of a total 188,288,944 CERs issued by host countries, it accounts for 4,774,648, 25 % of total CERs issued by host countries.
- India has formulated an enabling policy and regulatory framework supported by an adequate institutional structure to develop the carbon market. The Government of India has prepared a national action plan on climate change and a roadmap of economic development by opening different sectors (energy e.g. electricity, oil and gas, coal; road) of the economy.
- The total national GHG emissions from India have been reported to be 1228.5 million tons of CO_{2e} where emissions from energy sector accounted for 61 %. About 96 % of the emissions from the energy sector came from fuel combustion and the remaining 4 % emissions came from fugitive emissions from fuels.
- Different sectors have been prioritized for investment based on three tier analysis. The high priority sectors include CFC/ PFC/HCFC/ HFCS, thermal power, energy efficiency (all sub-sectors) and transportation, while medium priority sectors include biogas/ biomass energy, fossil fuel switch, waste heat recovery/ waste gas usage/ fossil fuel usage reduction/ flare gas usage/ natural gas cogeneration / energy usage reduction and renewable energy. All other sectors are low priority sectors considering the year 2012, the end of first commitment period.
- Energy efficiency, renewable energy and biogas/ biomass/ related sub sectors have been identified as the major sectors for programmatic CDM project development. Energy efficiency (EE) is expected to drive the programmatic CDM projects in India.
- Considering the time line of 2012, market analysts are of the opinion that programmatic CDM activities can lead to over 100 million CERs per year from such activities in India. Since India has national missions, policy and regulatory structure which provide these programmes automatically fit and the levels of risks are automatically mitigated.
- About 70 % of the registered CERs from India offer potential for trading.
- Considering the total potential of 100 million CERs from 1092 projects from India, the potential is expected to grow by 40 % by the end of 2008. Industry analysts estimate that the additional CER availability potential will grow at an average rate of about 10 % every year from the current level of 48 million CERs.
- In addition to sector specific registered CDM projects, programmatic CDM projects offer potential of 100 million CERs per annum. It is also expected that the funds will move more towards programmatic CDM projects and other small scale projects.
- Technological transfer and investment and financing of clean energy technologies including renewable energy (RE) and energy efficiency (EE) can occur by a favorable investment and business environment supported by an adequate institutional structure.
- In the context of CDM projects, the technologies needs include specific technology transfers in the area of renewable energy, energy efficiency, waste recycling, biotechnology, biomass gasification and IGCC/ super critical thermal power plant technologies.
- Indian carbon market is likely to grow in a significant way that will reach a peak in 2025 and be an attractive destination for carbon investments. This is due to the fact that energy needs will continue to drive the national economy in a significant manner. It is expected that thermal power generation will contribute about 60 % of the expected installed capacity till 2020. Therefore, the current trends augur well for the Indian carbon market beyond 2012 and provide a way forward for external investors.

Chapter 1: Introduction and Background

1.0 Introduction

India has emerged as one of the major countries for development and registration of CDM projects in the world. It is one of the important CDM market for buyers from abroad. Therefore, on growing demand of European buyers, a country analysis has been carried out to bring out India's advantage over other regional markets. In this context, GTZ invited IRG systems South Asia Pvt. Ltd. (IRGSSA) to prepare a market report of CDM potential in India. The following sections describe the objectives, brief background about status of India's CDM portfolio vis. a vis other countries and the format of this report.

1.1 Objective

The major objectives of this market study are given below.

1. Enable the European Industry to understand the present market scenario in terms of Indian carbon market advantages over other regional markets.
2. To facilitate the procurement by private European companies of Certified Emission Reductions (CERs) from energy efficiency, renewable energy and waste management projects in India.
3. Explore programmatic CDM opportunities in SME's clusters.

1.2 Approach and methodology

IRGSSA has adopted a comprehensive approach to carry out this study. This approach is based on primary and secondary data survey followed by limited interviews of stakeholders. These include multilateral and bilateral agencies like World Bank, Asian Development Bank, GTZ, KFW, SDC, industry associations, sector associations, different ministries, government institutions e.g. BEE, DNA, brokering houses, financial institutions, registrars and NGOs like TERI etc. In addition to these IRGSSA has drawn on the strength of its IRG carbon business having global as well as local resources, networking and connectivity. The collected data has been compiled and analyzed by using gap and barrier analysis. In reference to CDM, this analysis includes analysis of external business environment, India's business environment, and main driver's of business, major barriers, strengths, weakness, opportunities and threats. This also includes profiling of 1000 + host country's approved projects as demonstration of CDM projects. IRGSSA has also carried out post 2012 (beyond Kyoto) scenario analysis and expected positioning of the country.

1.3 Brief status of India's CDM portfolio

India accounts for 31122524 tCO_2 of average annual reduction, which is 14 % of the total average annual reduction. It ranks second among the top ten countries in terms of average annual reductions from registered projects as shown in table 1.1.

Table 1.1: Expected average annual CERs from registered projects by host party (As of September 25, 2008)

Country	Average Annual Reductions	%	Country	Average Annual Reductions	%
Argentina	4,121,351	1.85	Indonesia	2,556,908	1.14
Brazil	19,433,547	8.70	Malaysia	2,560,924	1.15
Chile	4,325,867	1.94	Mexico	7,411,293	3.32
China	116,219,974	52.03	Republic of Korea	14,599,555	6.54
India	31,122,524	13.93	South Africa	2,557,984	1.15

Source: Carbon News, Volume I, Issued 5, October 2008 (www.unfccc.int)

India has 358 projects out of 1,167 registered projects accounting for 31 %, the highest number of projects, which have been registered with UNFCCC. India ranks second, next to China in the number of CERs issued by host countries. Out of a total of 188,288,944 CERs issued by host countries, it accounts for 4,774,648 CERs, 25 % of total CERs issued by host countries.
The above data shows that India offers a sound market potential for CDM projects, where foreign investors can invest in project development, technology transfer and CERs trading. This analysis provides strong background for market assessment of CDM in India.

1.4 Format of the report

A comprehensive CDM market report has been prepared comprising seven chapters. Chapter 1 describes the introduction and background for the market analysis. Chapter 2 describes the policy and regulatory environment related to CDM projects/ activities. Chapter 3 describes the detailed description of CDM portfolio, including analysis of opportunities category wise. Further, it also describes availability of CERs till 2012. Chapter 4 describes investment and tech transfer opportunities for foreign industries in CDM projects. It describes analysis and co-relation of CDM project sizes and general trends looking for foreign investor's technology transfer or sale of CERs. Chapter 5 attempts to identify barriers for bilateral projects for foreign investors in India and the benefits of advance match making of buyers and sellers. Further, it describes post 2012 market in India.

Chapter 2: Policies and Regulatory Environment

2.0 Introduction

The market potential of CDM projects can be realized only when there exists by an enabling policy and regulatory environment supported by an adequate institutional framework. The government of India has prepared a national action plan on climate change and a roadmap of economic development by opening different sectors of economy. The energy sector has been opened up and has witnessed regulatory reforms during the last decade. Subsequently, a number of new policy initiatives followed by creation of new institutions have occurred during this period. CDM projects fall under the purview of policy and regulations during project development stage and finally trading/ transactions during operation stage. Therefore, in this context, the following sections describe the key policies, laws, decrees/ plans, policy drivers at both development and operations stage.

2.1 Key policies, laws and decrees/ plans

Since CDM is a national and state subject, the broad policy framework and developmental plans are formulated by government of India. The state governments align their policy and development plans as per the national policy framework and action plans. The key policies/ laws and decrees/ plan statements relevant to energy development are shown in Table 1 of Annex 1. The salient features of these policies in the context of CDM projects covering conventional, renewable sources of energy and energy efficiency are given below.

National Action Plan on Climate Change: In order to achieve sustainable development the national action plan for climate change is guided by the following principles.

1. Protecting the poor and vulnerable sections of society through an inclusive and sustainable development strategy, sensitive to climate change.
2. Achieving national growth objectives through a qualitative change in direction that enhances ecologically sustainability, leading to further mitigation of green house gas emissions.
3. Devising efficient and cost effective strategies for end use demand side management.
4. Deploying appropriate technologies for both adaptation and mitigation of GHG emissions extensively as well as at an accelerated pace.
5. Engineering new and innovative forms of market, regulatory and voluntary mechanisms to promote sustainable development.
6. Effecting implementation of programme through unique linkages, including with civil society and local government institutions and through public private partnership.
7. Welcoming international cooperation for research, development, sharing and transfer of technologies enabled by additional funding and a global IPR regime that facilitates technology transfer to developing countries under the UNFCCC.

The way forward includes implementation of eight national missions given below.

1. National Solar Mission
2. National Mission for Enhanced Energy Efficiency
3. National Mission on Sustainable Habitat
4. National Water Mission
5. National Mission for Sustaining the Himalayan Ecosystem
6. National Mission for a Green India
7. National Mission for Sustainable Agriculture
8. National Mission on Strategic Knowledge for Climate Change

The national policy dOES not prescribe any target for emission cuts but states that the GHG emission from India will remain lesser than developed countries.

Integrated Energy Policy: Some of the key provisions are given below.

1. Promotion of energy efficiency in all sectors
2. Emphasis on mass transport
3. Emphasis of renewables including biofuels plantation
4. Accelerated development of nuclear and hydropower for clean energy
5. Focused R&D on several clean energy related technologies

National Electricity Policy 2005

1. By lowering the energy intensity of GDP growth through higher energy efficiency (EE) is critical to meeting India's energy challenge and ensuring its energy security. Some of the policy measures for improving EE are given below.

    - Make the expanded BEE responsible for accelerating efficiency improvements in energy-using appliances, equipment and vehicles through schemes such as the "Golden Carrot" incentives;
    - Implement EE standards and labeling of energy-using equipment, including financial penalties if equipments fail to meet minimum energy performance standards;
    - Establish benchmarks for energy consumption in energy intensive sectors;
    - Increase gross efficiency in power generation, including improvements of 10 % in existing generation and 5-10 % in new plants; and Promote urban mass transport, energy efficient vehicles, and freight movement by railways.

2. Increase progressively the share of electricity from non-conventional sources.

3. It states that purchase of power from renewable energy sources by distribution companies shall be through competitive bidding process at a preferential price fixed by regulatory commission.

Rural Electrification Policy

1. Goals include provision of access to electricity to all households by the year 2009, quality and reliable power supply at reasonable rates, and minimum lifeline consumption of 1 unit / household/day by year 2012.

2. For villages/habitations where grid connectivity would not be feasible or cost effective, off-grid solutions based on stand-alone systems may be taken up for supply of electricity. Where these also are not feasible and if only alternative is to use isolated lighting technologies like solar photovoltaic, these may be adopted.

3. State government should, within 6 months of its enaction, prepare and notify a rural electrification plan, which should map and detail the electrification delivery mechanism.

Tariff Policy 2006: The salient features of the tariff policy are given below.

1. The appropriate commission shall fix a minimum percentage for purchase of energy from renewable sources considering availability and its impact on retail tariffs.

2. Procurement of electricity from non-conventional source by distribution companies shall be done at preferential tariffs determined by the appropriate commission in the short term using competitive bidding. In the long-term, these technologies would need to compete with other sources in terms of full costs.

National Urban Transport Policy (NUTP)

The National Urban Transport Policy (NUTP) of the Ministry of Urban Development promotes integrated land use and transport planning in cities. It focuses on greater use of public transport and non-motorised modes by offering central financial assistance. The policy incorporates urban transportation as an important parameter at the urban planning stage.

MNRE has prepared a draft R&D policy (12 December 2006) based on which resource requirements have been estimated for the 11th five year plan. MNRE has also prepared draft RE policy, which identifies the strategies for increased deployment of grid interactive RE technologies. These policies are however yet to be approved.

The Electricity Act, 2003

The Electricity Act, 2003 was brought in to combine the various provisions of (a) The Indian Electricity Act, 1910; (b) The Electricity (Supply) Act, 1948; and (c) The Electricity Regulatory Commissions Act, 1998. This was necessitated by the rapid developments in the electricity sector mainly in the areas of reforms, regulation and technology development. The Act recognizes the role of renewable energy technologies for supplying power to the utility grid as well as in stand-alone systems. Some of the important provisions in the Act in this regard are given below.

- As per section 3 (1), the central government shall from time to time, prepare the national electricity policy and tariff policy, in consultation with the state governments and based on optimal utilization of resources like coal, natural gas, nuclear substances and renewable sources of energy.
- As per 1.0.2.2 Section 4, the central government shall, after consultation with state governments, prepare and notify a national policy, permitting stand alone systems (including renewable sources of energy and other non-conventional sources of energy) for rural areas.
- As per section 61 (h), the appropriate commission shall specify the terms and conditions for the determination of tariff, and in doing so, shall be guided by the promotion of cogeneration and generation of electricity from renewable sources of energy.
- As per section 86 (1) (e), one of the functions of the State Regulatory Commission is to promote co–generation and generation of electricity through renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any persons, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee. The section 86(1) (e) also makes it mandatory for the distribution companies to buy certain percentage of the total energy requirement from renewable sources of energy. The SERCs have been given responsibility of determining this percentage or a quota for renewable power.
- As per section 6, appropriate government endeavour is required to extend electricity supply to villages, hamlets.
- As per section 14, there is no requirement of license if a person intends to generate and distribute electricity in rural areas.

The Energy Conservation Act, 2001

The strategy developed to make power available to all by 2012 includes promotion of energy efficiency and its conservation in the country to augment the gap between demand and supply. In this context, the Energy Conservation Act, 2001 was passed and the Bureau of Energy Efficiency has been set up to carry out the various functions as envisaged under the Act. The Act provides for the legal framework, institutional arrangement and a regulatory mechanism at the central and state levels to embark upon energy efficiency drive in the country.

Legal framework for environmental compliance

The legal framework required for ensuring environmental compliance for a clean energy project has been briefly described in terms of “basic” requirement and “others”. “Basic” requirements need to be complied in order to obtain “Consent to Establish” and “Consent to Operate”. “Others” describes the specific requirement like dealing with hazardous chemicals storage. The application of each regulation at planning, construction and implementation along with the implementing agency has been described in table 2.1.

Table 2.1: Legal Framework for Clean Energy Project

	Planning	Construction	Operation	Central Government	State Government
Basic					
The Environment (Protection) Act 1986	√	√	√	√	√
Factories Act 1948/1987	√	√	√		√
EIA Notification 1994/2006	√	√	√	√	√
Air Act 1981/87/99	√	√	√		√
Water Act 1974/88	√	√	√		√
Others					
MSIHC Rules 1989/2000	√		√		√

The Factories Act, EIA Notification, Air Act, Water Act are applicable at all the three stages i.e. planning, construction and operation. Their application involves "Environmental Clearance, Consent to Establish, and Consent to Operate, Site Notification and On-site Emergency Plan Clearance".

Plans/ Guidelines/ Codes/ Other policies

The following items describe plan / guidelines / codes / other policies, which act as drivers for development of CDM project in respective sectors.

1. The National Building Code of India (NBC) provides guidelines for regulating building construction across the country and serves as a model code for all agencies involved in building. It contains administrative regulations, development control rules and general building requirements, fire safety requirements, stipulations regarding materials, structural design and construction (including safety), and building and plumbing services.
2. In March 2007, the conduct of energy audits was made mandatory in large energy-consuming units in nine industrial sectors. These units, notified as "designated consumers" are also required to employ "certified energy managers", and report energy consumption and energy conservation data annually. Further, Energy Conservation Building Codes (ECBC) have been prepared for each of the six climatic zones of India. The ECBC provide minimum requirements for EE design and construction of commercial buildings, including air conditioning, lighting, electric power and distribution, and service water heating and pumping. One of the measures undertaken/proposed by BEE to catalyze energy efficiency include formation of industry specific task forces, notifying more industries as "designated consumers", conduct energy audit amongst notified designated consumers, recording and publication of best practices (sectorwise), development of energy consumption norms and monitoring of compliance with mandated provision by designated consumers.
3. MNRE has prepared a renewable energy plan and a national master plan for development of waste to energy.
4. The Government of India adopted the Bio-Diesel Purchase Policy in 2005. This policy states that oil marketing companies in the public sector should purchase bio-diesel of prescribed Bureau of Indian Standards (BIS) specification from registered authorized suppliers at a uniform price to be reviewed every six months.
5. The National Auto Fuel Policy of 2003 provides a roadmap for achieving various vehicular emission norms over a period of time and the corresponding requirements for upgrading fuel quality. While it does not recommend any particular fuel or technology for achieving the desired emission norms, it suggests that liquid fuels should remain the main auto fuels throughout the country and that the use of CNG/LPG be encouraged in cities affected by

higher pollution levels so as to enable vehicle owners to have the choice of the fuel and technology combination.

6. The Working Group for eleventh five year plan on Coal has identified the need for energy efficiency and demand side management which has emerged from the various supply scenarios and by rising energy costs. The average gross efficiency of generation from coal power plants is 30.5 %. The best plants in the world operate with super-critical boilers and get gross efficiency of 42 %. If all the new plants operate at a gross efficiency of 38-40 % it can reduce coal requirement by 111 Mtoe of coal (278 Mts of Indian coal). The Working Group states that all new thermal power plant should be commissioned with a certified fuel conversion efficiency of at least 38-40 %. The power plants which are operating at less Plant Load Factor and higher Specific Coal Consumption are required to undertake comprehensive renovation and modernization of units / technology.

7. The Ministry of Power has introduced the scheme Rajiv Gandhi Grameen Vidhyutikaran Yojana (RGGVY) in April 2005, which aims at providing electricity in all villages and habitations in four years and access to electricity to all rural households. Under RGGVY, electricity distribution infrastructure is envisaged to establish Rural Electricity Distribution Backbone (REDB) with at least a 33/11KV sub-station, Village Electrification Infrastructure (VEI) with at least a Distribution Transformer in a village or hamlet, and stand alone grids with generation where grid supply is not feasible. Subsidy towards capital expenditure to the tune of 90 % will be provided, through Rural Electrification Corporation Limited (REC), which is the nodal agency for implementation of the scheme. Electrification of un-electrified Below Poverty Line (BPL) households will be financed with 100 % capital subsidy @ € 23 per connection in all rural habitations. The Management of Rural Distribution is mandated through franchisees. All these initiatives may catalyze programmatic CDM projects.

2.2 Legal Issues & Aspects Related to CERs

Current legal issues and aspects related to CER have an important impact on the CER market in India. This market deals with the operation of the CDM project. The following sections describe legal issues and aspects related to CERs and their trading/ transactions.

2.2.1 Nature of CERs

The precise legal nature of the “emissions reduction” created under the Kyoto Protocol is unclear and uncertain in India. Therefore, it is important to identify the legal nature of emissions reduction. This particular aspect is significant for identifying risk, title, and taxation-related issues in any CER sale and purchase transaction. There is no law to commoditize CERs through appropriate legislation, which will facilitate international trade. Within the current legal framework, CERs may be termed as intangible assets that are capable of being transferred, bought, or sold. In certain areas, the trading of emissions reduction is regulated under securities or financial laws. The term, “securities”, (under Indian law) does not include emission reduction.

2.2.2 Title to CERs

In the absence of any law in India defining legal nature of CERs, there is uncertainty on the ownership of CERs. One view subscribes that CERs are actually owned by the countries in which they are produced, because they are instruments of an international treaty in which member states are the sole parties. But another view is that it is the investors in the CDM project who are the legal owners of any CERs produced from such projects. If the Indian government were to take the former view, owners of Indian CDM projects would have to obtain a certificate relinquishing ownership from the Indian government to prove ownership of the CERs that they have produced. If the latter view were to be adopted, however, owners of Indian CDM projects would have the exclusive right to deal with such CERs. This will impact the ability of public and private entities of non-Annex I Parties to own and/or sell CERs independent of any involvement of the host country.

2.2.3 Contractual issues in carbon trading contracts

Until the CDM-related laws are enacted in India, foreign investors in Indian CDM projects who intend to transact in CERs generated from such projects would have to rely on contractual mechanisms with provisions of adequate safeguards, which may be detrimental to promoting easy trade.

2.3 Policy Drivers for CDM project development

In view of the above policy and regulatory environment, major policy drivers have been identified. These policy drivers offer opportunities for the development of CDM projects.

1. Eight national missions under national action plan on climate change provide guidance and direction to achieve GHG emission reduction.
2. According to integrated energy policy, "to deliver a sustained growth of 8 % through 2031, India would, in the very least, need to grow its primary energy supply by 3 to 4 times and electricity supply by 5 to 7 times of current consumption. If no alternative arrangements are made to reduce the requirement of coal, an annual coal requirement is expected to be 2040 mt. by 2010, which will lead to substantial increase in GHG emissions.
3. The power sector is expected to add over 150,000 MW over the next fifteen years, of which at least 10 % is expected to come from renewable energy technologies.
4. Implementation of Section 86 (1) (e) of the Electricity Act 2003 and Section 6.4 (1) of the national tariff policy are underway. Different states are in the process of issuing tariff orders for renewable energy based electricity generation and specifying quota/share for power from renewable energy in accordance with the provisions of the "Electricity Act 2003'.
5. Other major renewable energy initiatives include (1) installment of 1 million household solar water heating systems; (2) electrification by renewable mini-grids for 24,000 villages without electricity; (3) deployment of 5 million solar lanterns and 2 million solar home lighting systems; (4) and establishment of an additional 3 million small biogas plants.
6. Integrated energy policy, sets a goal of a 25 % reduction in India's energy intensity from current levels. The major areas where EE can play a key role are mining, electricity generation, transmission and distribution, water pumping, industrial production processes, building design, construction, heating, ventilation, air conditioning, lighting, and household appliances. As of date nearly 25,000 MW of capacity creation through energy efficiency in the electricity sector alone has been estimated in India. The energy conservation potential for the economy as a whole has been assessed as 23 % with maximum potential in industrial and agricultural sectors. ECBC will make it mandatory for buildings not to exceed 140 kilowatt/hour per square meter annually. The thrust areas identified by BEE to promote energy efficiency are; (i) Indian industry programme for energy conservation (ii) Demand side management (iii) Product standards and labelling program (iv) Energy efficiency in buildings and establishments (v) Implementation of energy conservation building codes (vi) Professional certification and accreditation (vii) Manuals and codes (viii) Energy efficiency policy research programme (ix) School education (x) Delivery mechanisms for energy efficiency services.

   A financial requirement of about € 126 million has been projected for the eleventh five year plan for energy efficiency related initiatives.
7. Ethanol and bio-diesel have been identified as the key focus areas. Both are at the early stages of commercialization. In 2004, government mandated 5 % blending of petrol with ethanol, subject to certain conditions. An autonomous National Biodiesel Board is being created to promote, finance, and support organizations that are engaged in the field of oilseed cultivation and oil processing leading to bio-diesel production.
8. Emerging regulations defining CERs as a commodity, their ownership and buying and selling mechanism.

9. Response of international trade related to CERs in the existing and emerging regulatory regime.
10. Technology transfer and investments for CDM projects in India.

Chapter 3: CDM Market Potential in India

3.0 Introduction

This chapter describes the CDM market potential in India. First India's GHG inventory has been described followed by CDM project development till date in the country. An assessment has been carried out based on potential tapped in different segments and identification of segments, where new CDM projects are required to be developed. This will help in identifying focused areas of intervention defining market opportunities. Market potential is followed by description of CER marketing channels available globally and locally in India. Further, availability of CERs in India has been described in the context of market potential and availability of marketing channels. The following section describes each of these items both quantitatively and qualitatively.

3.1 GHG Inventory Estimates vs. Mitigation Potential

CDM market potential in India has been described in terms of GHG inventory estimates, mitigation potential and the development of CDM projects. As per the national communication (NC), total national GHG emissions from India have been reported to be 1228540 Gg of CO_2 equivalent, where emissions from energy sector accounted for 61 % followed by 28 % from agriculture sector, 8 % by industrial process and the remaining from waste, land use and others. About 96 % of the emissions from the energy sector came from fuel combustion and the remaining 4 % emissions came from fugitive emissions from fuels. This assessment provided the potential for reducing the GHG emissions and identified the sectors for development of CDM projects. The national strategy study also identified 100 large point sources consisting of 73 fossil fuel power plants, 7 steel plants, 16 cement plants, 3 fertilizer plants and one petrochemical plant, which accounted for 57 % of the total CO_2 emissions in the country. At a micro level, industrial sectors were identified, where CDM projects could be developed. e. g. iron, steel and cement sectors were the frontrunners in developing CDM projects in India.

3.2 Market Potential and Opportunities

Market potential and opportunities have been identified based on a three tier analysis. The first tier analysis is based on host country approved projects. This analysis describes the sectors, which have been tapped for CDM projects in India. The second tier analysis is based on UNFCCC registered projects. This analysis describes the sectors, which have given successful CDM projects in terms of registration at UNFCCC. The third tier analysis is based on market analysis from secondary sources. The period of analysis has been taken till the year 2012, the first commitment period.

After the establishment of designated national authority (DNA), a number of CDM projects were initiated. At the moment there are about 1000 CDM projects, which have received host country approval. A review of about 957 CDM projects, which have received host country approval, has been carried out in terms of segments and tCO_2 equivalent abatement addressed summarized in annex 1. The summary of this review is described in table 2 in annex 1. In this table, renewable energy sectors include solar (PV and thermal), hydro, wind, bagasse/ biomass cogeneration/ gasification. Energy efficiency include waste heat recovery/ waste gas usage/ fossil fuel usage reduction/ flare gas usage/ natural gas based cogeneration/ energy usage reduction/ thermal energy and process modification/ utility/ retrofitting. Further, an effort has been made to assess the CDM project opportunities by reviewing the profile of UNFCCC registered projects from India and summarized in table 3.1.

Table 3.1: Profile of registered UNFCCC registered CDM projects from India

	No of Projects	Annual Emission Reduction (tCO_2/y)	Total ERs by 2012 (tCO_2)	Amount of Issued CERs (tCO_2)
Biomass	119	4,164,842	29,753,919	4,208,573
Wind power	56	2,122,814	17,673,572	2,120,362
Waste gas/heat utilization	50	4,816,998	31,796,172	6,529,379
Hydro power	43	3,271,569	12,817,102	964,551
Energy efficiency	42	1,005,127	7,529,638	677,261
Cement	17	1,973,310	16,806,437	945,758
Fuel switch	10	4,136,607	21,002,502	794,329
Biogas	9	264,308	1,097,283	292,945
HFC reduction	4	10,174,879	80,751,326	28,814,392
Methane avoidance	3	368,893	1,282,448	0
Methane recovery & utilization	1	64,599	569,990	75,896
Transportation	1	41,160	236,811	0
Other renewable energies	1	562	3,936	0
Total	**356**	**32,405,668**	**222,131,136**	**45,423,446**

A comparative analysis of sectors in table 2 of annex 1 and table 3.1 is summarized in table 3.2. This comparative analysis describes the CDM projects, which have received host country approval, their success rate for registration by UNFCCC and tCO_2e abatement potential certified with respect to potential available for trading in each sector.

Table 3.2: Comparative analysis of sectors

Sr. No.	Sector	Host Country Approved Projects		Registered Projects		Analysis (%)	
		No of CDM Projects	tCO_2e Abatement Potential	No of CDM Projects	tCO_2e Abatement Potential certified	No of CDM Projects	tCO_2e Abatement Potential certified vs abatement potential
1	Renewable energy (Solar, hydro, wind)	291	93,257,665	94	5,394,945	32	5.78
2	Bagasses/ Biomass Cogeneration/ Generation / Gasification	235	82,086,691	128	4,429,150	54	5.4
3	Waste heat recovery/ Waste gas usage/ Fossil fuel usage reduction/ Flare gas usage/ Natural gas cogeneration / Energy usage reduction / Thermal energy/ Energy Efficiency	185	94,297,442	96	6,255,617	51	6.6
4	Gas Based/ Thermal Power Plants/ Transmission & Distribution	14	816,383				
5	Process Modification / Utility/ Retrofitting	106	42,409,867				
6	Fuel Switch	48	36,179,404	10	4,136,607	21	11.4
7	CFC/ HCFC/ PFC/ HFC 23	6	84,305,559	4	10,174,879	66	12
8	Transportation	3	5,722,583	1	41160	30	0.71
9	Cement			17	1,973,310		
10	CFL	5	7,207,570				
11	Construction Materials	21	16,998,119				
12	MSW / Waste water / Waste / Sludge	36	11,584,993				
13	Afforestation	5	735,315				
14	Agriculture	1	299,644				
15	Mines and Mineral	1	735,315				

The above analysis helps in developing criteria for identifying sectors, which will be attractive for CDM projects till 2012. This criterion includes

(i) number of projects in the sector,
(ii) their success rate in terms of registration,
(iii) CO_2e abatement potential and (iv) lead time. The analysis of the sectors is summarized in table 3.3.

Table 3.3: Sector Identification

Sr. No.	Sector	Criteria				
		Low number of projects	High number of projects	Success rate of registration	High potential	High lead time in development
1	Renewable energy (Solar, hydro, wind)		√	√	√	√
2	Bagasses/ Biomass Cogeneration/ Generation / Gasification		√	√	√	
3	Waste heat recovery/ Waste gas usage/ Fossil fuel usage reduction/ Flare gas usage/ Natural gas cogeneration / Energy usage reduction / Thermal energy/ Energy Efficiency		√	√	√	
4	Gas Based/ Thermal Power Plants/ Transmission & Distribution	√			√	
5	Process Modification / Utility/ Retrofitting		√		√	
6	Fuel Switch		√	√	√	
7	CFC/ HCFC/ PFC/ HFC 23	√		√	√	
8	Transportation	√		√	√	
9	Cement		√	√		
10	CFL	√				
11	Construction Materials	√				√
12	MSW / Waste water / Waste / Sludge	√				√
13	Afforestation	√				√
14	Agriculture	√				√
15	Mines and Mineral	√				√

The sectors, which have been identified, are given below:

1. Bagasse / Biomass Cogeneration/ Generation / Gasification
2. Waste heat recovery/ Waste gas usage/ Fossil fuel usage reduction/ Flare gas usage/ Natural gas cogeneration / Energy usage reduction / Thermal energy/ Energy Efficiency,
3. Fuel Switch
4. CFC/ PFC/HCFC/ HFCS
5. CFL
6. Transportation
7. Thermal Power
8. Process Modification
9. Renewable Energy

The third tier analysis is based on market analysis from secondary sources as described in table 3.4.

Table 3.4: Total expected kilo CERs (certified emissions reductions), by 2012, by sector, from clean development mechanism projects

Type	World	India
Afforestation	1,808	0
Agriculture	44,282	96
Biogas	42,767	4,987
Biomass energy	160,146	66,475
Cement	30,536	19,599
Coal bed/mine methane	110,901	0
Energy distribution	1,053	234
EE households	988	471
EE industry	25,491	15,680
EE own generation	229,088	58,976
EE service	216	144
EE supply side	18,082	6,775
Fossil fuel switch	168,743	40,858
Fugitive	55,469	4,393
Geothermal	11,802	0
HFCs	501,209	78,457
Hydro	305,711	19,012
Landfill gas	226,065	1,991
N_2O	257,021	0
PFCs	944	0
Reforestation	4,213	984
Solar	1,678	1,021
Tidal	1,104	0
Transport	3,474	303
Wind	148,693	38,185
Total	2,351,481	358,639

EE – energy efficiency; HFC – hydro fluorocarbon; N_20 – nitrous oxide; PFC – per fluorocarbon
Source: www.cd4cdm.org

The analysis of table 3.4 indicates that Biogas/ Biomass Energy, EE (all sub-sectors), Fossil fuel switch, HFCs/ PFCs, Transport and Renewable Energy are the sectors, which are expected to give maximum number of CERs from CDM projects. Therefore, the analysis of table 3.3 and table 3.4 matches and provide guidance to investors to develop CDM projects or trade CERs in the identified sectors.

The high priority sectors include CFC/ PFC/HCFC/ HFCS, thermal power, energy efficiency 9all sub-sectors) and transportation, while medium priority sectors include biogas/ biomass energy, fossil fuel switch, waste heat recovery/ waste gas usage/ fossil fuel usage reduction/ flare gas usage/ natural gas cogeneration / energy usage reduction and renewable energy. All other sectors are low priority sectors considering the end of first commitment period.

3.3 Programmatic POA opportunities in India

Under the national action plan, India has identified eight national missions to address climate change. These missions include national solar mission, national mission for enhanced energy efficiency in industry, national mission on sustainable habitat and national mission for green India, which provide basis for development of programmatic CDM in India. At a broad level, *renewable energy and energy efficiency* will continue to dominate programmatic CDM projects in India. Some of the projects identified, which can fit into PoA till 2012 are given below.

1. As per table 2 of annex 1 solar (PV and Thermal) is one of the sectors, which has been least tapped for CDM projects. Programmatic CDM for sub-sector solar PV and thermal offers great potential in India.
2. BEE has an ambitious programme of incandescent lamp replacement by CDM under "Bachat Lamp Yojana", where it is the coordinating agency. This scheme is supported by IGEN/ GTZ and has already led to a number of programmatic CDM projects in different states of India.
3. BEE also has an ambitious building energy efficiency program to promote energy efficiency in residential and commercial sectors. This sector also offers good potential for programmatic CDM projects.
4. EE potential exists in more than 1000 SME clusters in India. The description of important clusters as per UNIDO is given in Annex 2.
5. Municipal street lighting system in urban areas is one of the upcoming sectors for programmatic CDM especially in Gujarat and Tamil Nadu.
6. Community based rural biogas sector may also lead to a number of programmatic CDM projects e.g. Bagepalli biogas CDM project in Karnataka. The Bagepalli biogas project, sponsored by the Bangalore-based group utilized the CDM framework to secure financing that allowed individual households in the village to switch from traditional fuels to cleaner-burning biogas. Women in the participating households had been burning highly polluting fuel wood and kerosene for daily cooking needs, resulting in emissions equivalent to 3.6 CERs per year. The investor advanced € 1.1 million to build 5,500 biogas plants for local households. Through the use of the plants, which convert cow dung into cooking gas, an estimated 19,800 CERs were saved and traded on the carbon market with industry buyers in the industrialized world.
7. DSM programs and solar PV pumps schemes in rural areas

Considering the time line of 2012, market analysts are of the opinion that such activities can lead to over 100 million CERs per year from such activities in India. Since India has national missions, the policy and regulatory structure which provide these programs automatically fit and the levels of risks are automatically mitigated.

<u>Specific Sectors for programmatic CDM programme in India</u>

Energy efficiency, renewable energy and biogas/ biomass/ related sub sectors have been identified as the major sectors for CDM project development. Energy efficiency (EE) is expected to drive the programmatic CDM projects in India. The major reasons in this regard are given below.

- Assessments indicate that EE could account for 65 % of the energy-related emission reductions attainable through policies and measures currently under consideration in developing countries (IEA 2006). Emission reduction activities in these areas are often dispersed, have high transaction costs, and relatively low credit flows. The structure of CDM programs is well suited to EE projects, which is one of the most promising sectors for improving the adequacy and reliability of the power system, increasing energy security, and reducing emissions in developing countries. *This is applicable in the case of India, where it has identified potential to achieve EE as part of its efforts to achieve energy security in the coming decade.*
- In the EE sector, improved technology deployment does not typically occur on an individual basis but rather on a gradually collective basis as the result of intentional programme. These programme are able to reach a large number of individual households and smaller industrial firms, offering them improved technology (cooking stoves, appliances, lighting, motors, air conditioners, etc.) installed according to the client's purchasing power and willingness to pay. Thus CDM programme open the benefits of the CDM to many small users. *This is applicable*

in the case of India, where DSM projects in agriculture/ municipal / water supply and municipal lighting/ household lighting, EE projects in SMEs are yet to take off.

3.4 Present scenario of CERs marketing channels

A number of procurement vehicles have been used since 1997 to invest in emission reduction projects as well as CER trading activities. At first, AIJ project activities were started followed by prototype carbon fund. A number of tenders were floated by different governments globally to develop emission reduction projects and procure CERs. The Prototype Carbon Fund from the World Bank was the first carbon fund to be established in 1999. Since then the growth in terms of number of carbon funds and procurement vehicles has been significant, resulting in around 47 procurement vehicles operating in the carbon market until mid-2005, consisting of 16 government tenders or procurement programme and 31 funds, pools and other investment vehicles available for private sector investors. The list of such initiatives, which took off are given below. These include project development vehicles as well as trading vehicles to facilitate compliance.

1. Public-private initiatives
    - Bio Carbon Fund (World Bank)
    - Community Development Carbon Fund (World Bank)
    - Danish Carbon Fund (World Bank)
    - European Partnership Carbon Fund
    - Italian Carbon Fund (World Bank)
    - KfW Carbon Fund
    - Spanish Carbon Fund (World Bank)
    - Umbrella Carbon Facility
    - Carbon Partnership Facility
2. Private initiatives
    - EcoSecurities – Standard Bank Carbon Facility
    - European Carbon Fund
    - Japan GHG Reduction Fund
    - Merzbach Mezzanine Fund 1
    - Private purchasing pools
    - GG-CAP (Natsource)
    - ICECAP
3. Multilateral initiative
    - Multilateral Carbon Credit Fund
4. European climate exchange (ECX)
5. NordPool Market under European Union Allowances
6. New South Wales Greenhouse Gas Abatement Scheme (NGAC)
7. Multi commodity Exchange (MCX)
8. National Commodity & Derivatives Exchange Limited (NCDEX)

In addition to the above trading platforms, Montreal Climate Exchange, the Green Exchange and TZI in New Zealand have come into existence during 2008. A comparison of carbon procurement vehicles in terms of items 1 to 3 is described in table 3 of annex 1. Prototype Carbon Fund as well as Community Development Carbon Fund is closed.

Source: http://wbcarbonfinance.org

Some of the new initiatives in 2008 include Regional Green House Gas Initiatives (RGGI), Western Climate Initiative; Midwestern Greenhouse Gas Accord in USA will catalyze special funds and emission reduction mechanisms globally. The description of CER/ VER trading vehicles till 2012 is given below.

European climate exchange (ECX)

ECX was launched by CCX in 2005 and is operating in European Union Emission Trading Scheme. ECX manages the product development and marketing for ECX Carbon Financial Instruments such as “Futures” and “Options” contracts, listed and admitted to trading on the ICE Futures electronic platform. More than 65 leading businesses, including global companies and banks trade ECX products in addition to several hundred clients can access the market daily via banks and brokers.

NordPool Market under European Union Allowances

In 2005 Nord Pool became the first exchange in the world to start trading in European Union Allowances (EUAs) and CERs for CO_2 emissions.

New South Wales Greenhouse Gas Abatement Scheme (NGAC)

This is the Australian exchange established in the state of New South Wales, which covers power plant GHG emissions in the state. Also carbon offsets from qualified Australian forestry projects are eligible to trade in this exchange.

Multi commodity Exchange (MCX)

MCX launched trading of carbon credit futures on its nationwide electronic platform in January 2008 in India. It has a license agreement with CCX to leverage its emissions market expertise for establishing the trading mechanism of carbon credits.

National Commodity & Derivatives Exchange Limited (NCDEX)

NCDEX launched the trading of CERs futures contracts expiring in December 2008, on 10 April 2008 in India.

Voluntary Markets

Voluntary markets have developed over the years in the light of emergence of several regional and national programme. In 2007, it grew three times in terms of $MtCO_2$ traded to reach 65 $MtCO_2$ and € 257 million in value from 21 $MtCO_2$ in 2006 and ten times from 10 $MtCO_2$ in 2002. About two-thirds of the transactions were through over-the-counter (OTC) transactions and the remaining was through the CCX. Over 50 % of the transactions in 2006 were concentrated among developers, wholesalers and aggregators. In 2007, brokers accounted for a growing share of the transactions, accounting for approximately 40 % of the trades. The growing role of brokers within the voluntary trades suggests a shift from end-use to capital gains. The growth of the voluntary market is based on projects, which either fail to register with UNFCCC or originate from countries, which are not party to UNFCCC. Therefore, a number of issues like standards, additionality and methodology plagued the growth of this market. In 2007, it appeared that there was increased convergence around a few accepted standards. Over a quarter of the credits in 2006 were retailer specific standards. Virtually all of these retailers switched to other accepted standards in 2007. The voluntary carbon standard (VCS) was the most widely used standard in transactions in 2007 and was used in approximately 30 % of the reported trades. Voluntary emission reduction prices reportedly varied significantly by project type and were widely dispersed. Traded volume weighted price averages ranged from € 2.1 to € 9.5 /tCO_2. Credit prices appear to reflect the underlying project development costs. CCX and CCFE are the major voluntary markets of the world.It is expected that this market will grow further, thereby providing opportunities to CDM project developers and traders to deal in projects which have not been registered with UNFCCC. The operation of exchanges has resulted in the expansion of customer base since it provides alternate mechanism to customers to hedge their risks by using a variety of instruments including future and options contracts on CERs and EUA in US and Europe.

According to the report of Environmental Finance Publications, operational carbon vehicles have committed to amass € 10.03 billion, while those actively raising capital were estimated to bring additional € 4.28 billion during the current year. The role of private sector has increased from zero in 1999 to more than 20 % in 2008. The emergence of dedicated carbon funds seeks opportunities that offer technological solutions and credit options. Most of the trading is happening for low risk projects from JI and CDM because investors are very careful to invest money upfront due to high risks. Therefore, only 40 % of the available funds were utilized during current year. Since these low hanging fruits have already been picked, the future trends show that the available funds will move towards projects with high risks, which require more capital and effort in project development process. The global situation described above is likely to get replicated in the Indian context, where the funds will move more towards programmatic CDM projects and other small scale projects.

3.5 Availability of CERs and Implications on India

India started early with development of CDM projects and usage of different vehicles. It had 7 projects registered under AIJ initiative in 1997-98, 1 with PCF, 6 projects under Finnish CDM tender, 5 under CERUPT, 1 each under Swedish Energy Agency and Japan Ministry of Environment. In India, during 2007-8, the trading volumes have remained thin both in MCX and NCDEX. As per FICCI estimates, by August 2008, Indian CDM portfolio of registered projects was 356 projects with an estimate of 48 million CERs per year. This does not include trading of voluntary emission reductions (VERs) from Indian companies. Considering the total potential of 100 million CERs from 1092 projects, the potential is expected to grow by 40 % by the end of 2008. As per FICCI estimates, less than 30 % of CER from 356 registered projects had been sold or contracted. The volume of CERs from Indian companies, which has been traded in 2007 is less than 10 % of the total potential. This means that 70 % of the registered CERs from India offer potential for trading. The contracts have traded in the range of € 18 to € 27 per CER till date. Indian projects, which have failed to register with UNFCCC, have already started applying to CCX for VERs. However, those projects, which have failed to register on account of additionality and baseline considerations are not likely to get registered even as VER at CCX.

Industry analysts estimate that given the national power development plans in the coming decade, it can be safely assumed that the additional CER availability potential will grow at an average rate of about 10 % every year from the current level of 48 million CERs. In addition to sector specific registered CDM projects, programmatic CDM projects offer potential of 100 million CERs per annum.

Chapter 4: Technology Transfer Opportunities & Investment for Foreign Industries in CDM Projects

4.0 Technology transfer

Technologies required to mitigate the GHG emissions with an aim to sustain the world's energy needs over the next fifty years are currently operational in different parts of the world. These technologies are summarized in table 4.1. The biggest challenge is the scaling up of these technologies and overcoming of barriers. The technology transfer needs in the context of climate change projects in India are diverse. Technology transfer in both solar thermal and the PV technologies is required in respect of cost-effective and efficient technologies suitable for use in India e.g. solar evacuated tubular panel technology. The energy efficient lighting and space conditioning technologies developed internationally are superior in comparison to those available in India and needs to be transferred. Other technological needs include energy efficient buildings and building components, development of energy efficient windows, development of low cost insulation material, energy efficient appliances, and development of low cost light emitting diode based lamps for space lighting. There is also a need for biomethanation technology for waste to energy including its decentralized application for segregated waste streams. A need has been identified to upgrade plastic waste recycling technologies to reduce occupational and environmental hazards. India also needs recycling technologies for construction and demolition wastes, e-waste streams and automobiles. In agriculture sector, technology related to use of genetic engineering to convert C-3 crops to the more carbon responsive C-4 crops to achieve greater photosynthetic efficiency for obtaining increased productivity at higher levels of carbon dioxide in the atmosphere or to sustain thermal stress has been identified. There is a need for development of crops with better water and nitrogen use efficiency which may result in reduced emissions of GHG or greater tolerance to drought or submergence or salinity. In the power sector, supercritical and ultra-supercritical technologies, which can achieve efficiencies of 40 to 45 % compared to 35 % achieved by subcritical coal based power plants is required. Materials for use in steam generators tubes, main steam piping, and high pressure turbines, which can withstand high pressure and temperatures and are resistant to oxidation, erosion and corrosion need to be developed. There is a requirement for IGCC technology, which can improve efficiency by 10 % of coal based power plants. Technology transfer is needed for compaction of different types of biomass and improved boiler design to enable the use of multiple biomass feedstocks. There is a need for development of hotgas cleaning systems and their optimum integration with the gasifiers. Other technological needs are development of gasifier systems based on charcoal and pyrolized biomass.

Further needs, which have been identified are circulating fluidized bed, bubbling fluidized bed and pressurized fludized bed biomass gasifiers. Underlined technologies in table 4.1 indicates the type of technology transfer required in India. No technology is available in India for CO_2 capture and storage. Similarly the numbers of CDM projects, which have been developed for non CO_2 greenhouse emissions are very small. Recycling technologies need to be upgraded by using different types of scraps in feedstock as well as to attain material efficiency. The type of technologies required for renewables sector have been identified in table 4.1. New technologies for technological upgradation are also required across different sectors with respect to energy efficiency, power recovery and fuel switching.

Table 4.1: Examples of industrial technology for reducing greenhouse gas emissions (not comprehensive)

	Energy efficiency	Fuel switching	Power recovery	Renewables	Feedstock change	Product change	Material efficiency	Non-CO_2 greenhouse gas	CO_2 capture and storage
Sector Wide	Benchmarking; energy management systems; efficient motor systems, boilers, furnaces, lighting and heating / ventilation / air conditioning; process integration	Coal to natural gas and oil	Cogeneration	Biomass, biogas, photovoltaics, wind turbines, hydropower	Recycled inputs				Oxy fuel combustion, CO_2 separation from flue gas
Iron and steel	Smelt reduction, near net shape casting, scrap preheating, dry coke quenching	Natural gas, oil or plastic injection into the blast furnace	Top-gas pressure recovery, by-product gas combined cycle	Charcoal	Scrap	High strength steel	Recycling, high strength, steel, reduction process losses	N/A	Hydrogen reduction, oxygen use in blast furnaces
Non-ferrous metals	Inertanodes, efficient cell designs				Scrap		Recycling, thinner film and coating	PFC (perfluorocarbon)/sulphur hexafluoride controls	
Chemicals	Membrane separations, reactive distillation	Natural gas	Pre-coupled gas turbine, pressure recovery turbine, hydrogen recovery		Recycled plastics, bio-feedstock	Linear low density polythylene, high-perf, plastics	Recycling thinner film and coating, reduced process losses	N_2O(nitrous oxide), PFCs, CFCs (chlorofluorocarbons) and HFCs (hydrofluorocarbons) control	CO_2 storage from ammonia, ethylene oxide processes
Petroleum refining	Membrane separations, refinery gas	Natural gas turbine, hydrogen recovery	Pressure recovery	Biofuels	Bio-feedstock		(reduction transport not included here)	Control technology for N_2O/CH_4 (methane)	From hydrogen production
Cement	Precalciner kiln, roller mill, fluidized bed kiln	Waste fuels, biogas, biomass	Drying with gas turbine, power recovery	Biomass fuels, biogas	Slags, pozzolanes	Blended cement geo-polymers		N/A	Oxyfuel combustion in kiln
Glass	Cullet preheating, oxyfuel furnace	Natural gas	Air bottoming cycle	N/A	Increased cullet use	High-strength thin containers	Recycling	N/A	Oxyfuel combustion
Pulp and Paper	Efficient pulping, efficient drying, shoe press, condebelt drying	Biomass, landfill gas	Black liquor gasification combined cycle	Biomass fuels (bark, black liquor)	Recycling, non-wood fibres	Fibre orientation, thinner paper	Reduction cutting and process losses	N/A	Oxyfuel combustion in lime kiln
	Efficient drying, membranes	Biogas, natural gas	Anaerobic digestion, gasification	Biomass, by-products, solar drying			Reduction process losses, closed water use		

Source: Table V, page 405, TERI Energy data directory 7 Yearbook 2007

4.1 Investment needs, current/ future investments

There is a need for massive investment in clean energy sector in India. Table 4.2 shows the summary of the RE power generation and the investment requirement till the end of eleventh plan period (2007-2012).

Table 4.2: Potential targets and investments required to meet the targets

	Potential (MW)	Installed capacity till March 2007 (MW)	Target of addition in 11 plan (MW)*	Total expected capacity by 2012 (MW)	Investment required from 2007-2012 (million €)
Small Hydro	15,000	1,976	1,400	3,376	1,761.84
Wind	45,000	7,092	10,500	17,592	13,217.76
Solid Biomass	19,500	569	500	1,069	419.04
Bagasse CHP	-	615	1,200	1,815	941.76
Waste to energy	1,700	43	400	443	251.28
Total		**10,297**	**14,000**	**24,295**	16,591.68

* Source: Report of the working group on New and Renewable Energy for 11 Five Year Plan

The projected need for investment requires massive mobilization of financial resources. An assessment of these resources has been carried out in the following sections.

4.2 Investment Environment

Investment environment with respect to clean energy has been described in terms of funding/ financial mechanism, business and procurement environment. Funding/ financial mechanism describes the sources of finances; business environment describes the issues of taxation and subsidies, while procurement environment describes contractual mechanisms.

4.2.1 Funding/ financial mechanism, capital markets/ financial institutions

Funding/ financial mechanism has been described in terms of government funding/ financing, capital markets, developmental financial institutions, international financial institutions and private sector. Currently government funding drives the financing of clean energy projects in India. Government funding is available at three levels i.e. national, state and local (municipal). Other sources of finance include capital markets, financial institutions both national and international and private sector through equity.

Central government: The finance ministry, Government of India with the help of Planning Commission is responsible for planning the budget and allocating the funds to the various ministries. It provides equity for project agencies; offers guarantee mechanisms and funds/programme for capacity building, promote fiscal incentives and fuels bond markets with governmental borrowings. The budgets of line ministries have been growing during the past years. The budget of MNRE increased from € 30.4 million in 2005-2006 to € 58.5 million in 2006-2007. These line ministries are providing financial assistance to states, districts and organizations within them directly and via various programme.

State government: The states are expected to match contribution of central government through state funding.

Local (Municipality/ Urban Local Body): The sources of finances for municipalities include grants and devolutions from central government via state governments, state government grants and their own revenues generated through local taxes. ULBs suffer perennially from lack of funds. They receive only a portion, around 40 %, of their share of transfer from the states. This is due to deductions by state government for items like overdue power charges and loan payments. Revenue generation from local taxes and individual services is very low due to low value of service delivery and partial recovery of taxes.

Capital Markets: India's debt and equity markets were equivalent to 130 % of GDP at the end of 2005. This is an impressive growth starting from just 75 % in 1995, suggesting issuers' growing confidence in market based financing. At nearly 40 % of GDP, the size of India's government bond segment is comparable to many other emerging market economies. India boasts a dynamic equity market. The sharp rise in India's stock markets since 2003 reflects its improving macroeconomic fundamentals. India's debt markets are divided into two segments the corporate and the government. The government bond segment is the larger with the central government, nearly accounting for 90 % of the total and the remaining by state governments. The corporate bond market consists of Public Sector Undertakings (PSU), corporates, financial institutions and banks. Asset-backed Securities (ABS) are the predominant asset class in India's securitised segment. The ABS market has risen exponentially since 2002, and was roughly € 3.9 billion in 2005. At the institutional level, the Securities and Exchange Board of India (SEBI) protects investors and usher improvements into the micro-structure of capital markets. The Reserve Bank of India (RBI) is the government's debt manager and regulator of government-issued papers.

Development financial institutions/ Commercial banks: Development financial institutions (DFIs) at central, state and municipal level, provident funds, commercial banks and export credit agencies provide funding for infrastructure projects. These agencies provide loans, work as financial intermediary, arrange loans from other sources, provide guarantees and assume an advisory role. DFIs usually provide the largest share of financing for large scale projects. Apart from debt, some of the DFIs also invest in equity. Among the types of financing, project financing dominates in the sector because of the capital intensive nature with long gestation periods. Corporate financing is generally provided in low-risk projects with prominent corporate entities. Hybrid finance through equity/quasi equity is occasionally provided. The major domestic DFIs operating in the clean energy sector in India are;

(i) Industrial Finance Corporation of India (IFCI)
(ii) Industrial Development Bank of India (IDBI)
(iii) Life Insurance Corporation (LIC)
(iv) Small Industries Development Bank (SIDBI)
(v) Infrastructure Development Finance Company (IDFC)
(vi) Housing and Urban Development Corporation (HUDCO)
(vii) India Infrastructure Finance Company Ltd (IIFCL)
(viii) L&T Finance
(ix) Infrastructure Leasing & Financial Services Limited (IL&FS)
(x) Indian Renewable Energy Development Agency Ltd (IREDA)
(xi) National Bank for Agriculture & Rural Development (NABARD)

International financial institutions (IFI): Major financial institutions, which are involved in clean energy and related activities are given in table 4.3.

Table 4.3: Summary of major donor's clean development activities

	Demand Side EE	Supply Side EE	Renewable Energy	Clean Fossil Fuels	Clean Transport
IFC	√				√
ADB	√	√	√		√
USAID	√	√	√	√	√
World Bank	√	√	√		√
JBIC		√	√	√	√

Source: USAID ECO-Asia Clean Development and Climate Program, 2006

IFC South Asia has a € 1.2 billion lending portfolio covering India, Sri Lanka, the Maldives, Bhutan, and Nepal. India alone accounts for three-fourths of this portfolio. The Asian Development Bank is financing several clean energy-related projects in India, including EE/ CDM projects on supply and demand side, urban infrastructure projects, hydro electric projects, and roads and transportation services. USAID India has sponsored India-US cooperation on energy development since the 1980s. Three key areas include

(i) building regulatory capacity at the State level in order to implement sector reform;
(ii) asset-based reform and commercial capacity building focused on utilities, and;
(iii) relating public policy (e.g., the Electricity Act of 2003 and the Energy Conservation Act of 2001).

The major programme on energy efficiency being implemented is "Energy Conservation and Commercialization, ECO III project. The World Bank has a large project focused on improving EE in coal-fired power generation through rehabilitation (€ 35 million GEF, € 122 million IBRD). The World Bank is also supporting EE improvements in the urban sector. A new programmatic CDM effort with € 59 million in GEF financing for India has also been launched by the bank. Japan Bank for International Cooperation projects include phase 2 of the Delhi Mass Rapid Transport System (DMRTS), two new large supercritical coal power plants, a hydro power scheme, and a pumped storage scheme.

Private sector participation: The private sector is involved in implementation of projects on BOOT (Build Own Operate and Transfer) and BOO (Build Own and Operate) basis. This model is actively followed in SHP sector. The government is also promoting public private partnership (PPPs) in infrastructure development including waste to energy and solid waste management through. PPP projects with at least 51 % private equity receive support from this facility through 'viability gap funding'. Primarily, this facility is meant to reduce the capital cost of projects by credit enhancement, and to make them viable and attractive for private investments through supplementary grant funding. Viability gap funding can take various forms e.g. capital grant, subordinated loans, O & M support grants or an interest subsidy. The majority of companies involved in PPPs across sectors like water, waste water and solid waste management have been to a large extent domestic. This trend indicates the increasing participation of domestic private companies in this sector paving way for foreign companies to enter either through joint venture or equity participation.

4.2.2 Business Environment

Business environment in the context of clean energy has been explained below in terms of subsidies and partially controlled regime regulating the fossil fuel based energy supply.

Coal: Coal price was decontrolled but the restructuring of coal sector is still being debated. The coal linkage committees still operated for controlled distribution of coal during 2005-06. Coal continues to be included in the Essential Commodities Act 1955. However, as per the present import policy, coal can be freely imported under open general licence by consumers according to their needs. The pricing of coal was fully deregulated after Colliery Control Order, 2000, was notified with effect from 1 January 2000, superseding the Colliery Control Order, 1945. Since then, the coal price has been fixed on cost-plus basis.

Oil/ Gas and Natural Gas: Crude oil prices have been deregulated. After deregulation, the domestic exploration and production companies are free to negotiate with refiner's price for their crude oil. Government has successfully implemented a new exploration licensing policy (NELP) since the last decade, where privatization of oil and gas fields has taken place. Both national and international companies have been allotted exploration blocks. During 2007/08, the domination of public sector companies (PSUs) in the marketing of petroleum products continued. With the dismantling of the administered pricing mechanism (APM) in April 2002, prices of various petroleum products were to be effectively linked to the international prices, and pricing of petroleum products was requirement to be done on import parity basis. Some of the current trends, which have emerged after April 2002, are given below.

- Petroleum products are governed by international prices except diesel, kerosene and liquefied petroleum gas (LPG).
- The government decreased the customs duty on petrol and diesel from 10 % to 7.5 %.
- For encouraging the import of liquefied natural gas (LNG), it has been placed under open general licence (OGL) list and 100 % foreign direct investment (FDI) has been permitted.
- There is no uniform method for determination of gas prices. With deregulation of the gas market, both market determined and administered pricing co-exist in the sector.

Bio-diesel: Since 1 January 2006, major oil public sector companies are mandated to purchase bio-diesel. This policy, inter alia, identifies 20 purchase centers all over India where these companies would purchase bio-diesel that meets the standards prescribed by the Bureau of Indian Standards. The initial purchase price of bio-diesel is about € 5 per litre, which may be reviewed by the companies every six months.

Ethanol: Indian Oil Corporation Ltd. has finalized a deal to source ethanol from sugar mills at € 0.36 per litre ex-distillery, which was arrived at on the basis of bids quoted.

Clean Energy: The broad policy framework for financing of clean energy is formulated by the central government, which is implemented at state level by state level nodal agencies. Each state provides token or matching contribution to facilitate clean energy project development and implementation.

Tariffs

Fifteen states Andhra Pradesh, Haryana, Himachal Pradesh, Jammu & Kashmir, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal have declared buy back tariffs from SHPs. Eight states Andhra Pradesh, Gujarat, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Tamil Nadu have issued orders for determining tariffs from wind power. Twelve states namely Andhra Pradesh, Chattisgarh, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh have issued orders for determining tariffs from biomass.

Financing and Subsidies

Small Hydro Power (SHP): Currently, most SHP capacity addition is being achieved through private investment. State nodal agencies provide assistance for obtaining necessary clearances e.g. in allotment of land. The MNRE has been providing subsidy for public sector as well as private sector SHP projects. For private sector, subsidy is released after successful commissioning and commencement of commercial generation from the project. The subsidy is given for the purpose of offsetting it against the term loan provided to the developer. Projects are also required to be tested for performance by an independent agency to receive the subsidy. Various financial institutions namely, IREDA, Power Finance Corporation (PFC), Rural Electrification Corporation (REC) provides loan assistance for setting up of SHP projects. Loans are also available from IDBI, IFCI, ICICI, and other nationalized banks.

Wind energy system: Several financial and fiscal incentives, which are available to wind energy systems include;

(i) Tax holidays for wind power generation projects
(ii) 80 % accelerated depreciation on the equipment during the first year
(iii) Concession on custom and excise duties
(iv) Liberalized foreign investment procedures
(v) Preferential tariffs for wind power. Major national financial institutions such as IDBI (Industrial Development Bank of India), ICICI (Industrial Credit and Investment Corporation of India), REC (Rural Electrification Corporation), and PFC (Power Finance Corporation) also finance wind power projects.

Baggasse-based cogeneration: MNRE provides interest subsidy for cogeneration projects. In addition, it also provides capital subsidy to bagasse based cogeneration projects in cooperative and public sector sugar mills. State governments also provide various fiscal and financial incentives.

Biomass gasifiers: MNRE provides subsidies for installation of biomass gasifier systems. Financial incentives worth € 23,400 per 100 kWe are provided for 100 % producer gas engines with biomass gasifier systems for both off-grid and grid-interactive applications.

Energy from urban and industrial waste: The Twelfth Finance Commission has recommended that at least 50 % of the grants provided to ULBs through states should be utilized to support the cost of collection, segregation, and transportation of waste.

Solar photo voltaic system: Implementation of the water pumping program was continued through the state nodal agencies and IREDA. Subsidy is provided under the scheme at € 59 per watt of SPV array used, subject to a maximum of about € 936 per system.

Solar water heating systems: The Government of India, through MNRE, has provided various interventions in terms of subsidy and other fiscal benefits to promote solar water heating systems.

Renewable energy technology for distributed generation: Under the RVE programme, MNRE provides financial assistance for meeting up to 90 % of the project costs and for comprehensive maintenance for periods up to 10 years.

The bankers consider strong project sponsors, appropriate contractual structuring, equipment suppliers with proven track record, appropriate fuel supply agreements, cost competitiveness and project viability on stand-alone basis and adequate mitigation off-take, payment risk as major factors for lending to RE projects. General financing trends of RE & EE projects, emerging through commercial banks, are given below.

- A high debt/ equity ratio of about 2:1.
- An increasing trend of financing on a non-recourse/ limited recourse basis. This is on account of the evolution of the contractual framework in implementing RE project.
- Long project implementation period of 2 to 4 years. This implies a delay in equity returns and a moratorium period for principal repayment.
- Longer repayment period (10 -15 years) of maturity of debt.

4.2.3 Environment related to procurement/ contracts

The existing procurement mechanisms and routes in India are described below.

1. Financing instruments like letter of credit (LC), security deposits, bank guarantees facilitating export and import trade are extensively used both at national and state level. Standard contractual guidelines of government of India for export and import are also applicable for RE and EE projects.
2. Procurement of services and products in specialized sectors follow open international and national competitive bidding (ICB/NB) procedures at both national and state level.
3. Increasing implementation of projects under public private partnership (PPP) with developed concession/ revenue sharing contractual agreements and securitization of payments by ensuring payments through ESCROW account is an indicator of developing market.
4. Standardization in developing and implementing power purchase agreement.
5. Inclusion of performance guarantees and liquidated damages in the standard contractual mechanism.
6. Inclusion of arbitration clause taking recourse to UNICITRAL or other international mechanism provides safeguard mechanism.
7. Increasing non-recourse financing through project financing route in RE.
8. ESCO financing is yet to emerge due to scattered and unconsolidated EE market.

4.2.4 Patent Enforcement

In India, the patent regime is governed by the Patent Act, 1970. The 1970 Patent Act was enacted as an outcome of various previously existing patent legislations including the Patents & Designs Protection Act, 1872, the Protection of Inventions Act, 1883. The Patent Act, 1970 provides for the enforcement of patents by way of suits for infringement. In dealing with these suits, the Indian courts follow the traditional principles and procedures of civil litigation. However, after enforcement of the TRIPs agreement since 1995, various methods have been adopted to improve the enforcement measures with regard to patents. The most significant amendment introduced in the Act by the 2002 Amendment with regard to the enforcement of patents was the introduction of Section 104-A. As per this section, in any suit for infringement of a patent, where the subject-matter of patent is a process for obtaining a product, the court may “direct the defendant to prove that the process used by him to obtain the product, identical to the product of the patented process, is different from the patented process if, the subject-matter of the patent is a process for obtaining a new product; or there is a substantial likelihood that the identical product is made by the process, and the patentee or a person deriving title or interest in the patent from him, has been unable through reasonable efforts to determine the process actually used: Provided that the patentee or a person deriving title or interest in the patent from him, first proves that the product is identical to the product directly obtained by the patented process”. A patent can now be granted in less than three years, as opposed to an average of five to seven years, which it used to take only a few years ago. The patent offices are being upgraded with the use of the Patent Information System (PIS), based in Nagpur.

4.3 Treatment of Transactions Involving CERs

This section describes treatment of CER transactions including taxation in India. This will indirectly impact the investment climate of CDM project considering CERs will constitute a steady flow of revenue from the project.

4.3.1 Business asset vs. capital asset

Lack of clarity on the precise legal nature of emission reduction makes it difficult to conclusively comment on whether the income received from the sale of CERs would be treated as business income or as capital gain. Although the revenue stream generated from the sale of CERs would normally be viewed as business income, it could also be treated as a capital gain subject to capital gains tax.

Business asset and business income : The term "business asset" is not defined under the Income Tax Act but it includes all assets (such as stock-in-trade) which, when sold in the ordinary course of business, generate a revenue receipt. Profits made on such revenue receipts are taxed as business income in accordance with the provisions of the Income Tax Act. Typically, when a person disposes of a part or whole of his assets in the ordinary course of business or as part of a trading/business (ongoing revenue generating) transaction, the profits earned by such disposal are taxable as business income. Further, in the event that a transaction of sale is intrinsically related to the normal business of the taxpayer, profits arising from such transaction are assessable as business profit. Therefore, the likelihood of the tax authorities treating CERs as a business asset and any income generated from sale of such CERs as business income may be influenced by the fact that CERs produced by a CDM project would be intrinsically related to the normal business of the investor/project owner. CERs could also be equated to "import licences" that are granted to persons in the course of their export and import activities. Profits made on the sale of such import licenses are taxed as business income in accordance with the Income Tax Act.

Taxation of business income: As indicated earlier, the business income of an Indian company is taxed under the heading "profits and gains of business or profession" at the rate of 35 % plus surcharge.

CERs as a capital asset

The Income Tax Act defines a "capital asset" to mean property of any kind held by an assessee, whether connected or not with business or profession, except for the following:

- Any stock-in-trade, consumable stores, or raw materials held for the purpose of the assessee's business or profession,
- Personal effects,
- Agricultural land of the type specified in this section, and
- Certain bonds specified in the section.

Therefore, unless it can be shown that CERs would fall under these exceptions, it is likely that CERs would be treated as capital assets. The term "stock-in-trade" would also not apply to CERs since Indian courts have interpreted this term to include all goods and commodities in which an entity deals in the sense of buying and selling in the course of its business activity.

Capital gains: Under the Income Tax Act, any profit or gain arising from the transfer of a capital asset is chargeable to income tax under the head "capital gains". Accordingly, in the event that CERs are treated as capital assets, all payments received on account of the transfer of such CERs would be taxed as capital gains. In this regard, it may be noted that the term "transfer" has been defined under the Income Tax Act to include, *inter-alia* sale, exchange, or relinquishment of an asset. Thus, from the above definition it is clear that not only a "sale" of CERs, but any form of "relinquishment" of such CERs or "extinguishment" of any right therein, would be treated as a "transfer" for the purpose of computing capital gains under the Income Tax Act.

Computation of capital gains: Under the Income Tax Act, capital gains are computed by deducting from the full value of the consideration received or accruing as a result of the transfer of the capital asset as per the following:

- The expenditure incurred wholly and exclusively in connection with such transfer; and
- The cost of acquisition of the capital asset and the cost of improvement thereto.

In 1981, the Supreme Court of India held that if it were not possible to ascertain the cost of acquisition and/or the cost of improvement of an intangible capital asset, the gains made on the transfer of such an asset would not be taxable under the Income Tax Act. This decision was interpreted to mean that gains made on the transfer of any "self-generated asset" (such as CERs) would not be chargeable to capital gains tax since the cost of acquisition/improvement of such assets would not be ascertainable. In response to this decision of the Supreme Court, the Income Tax Act was amended to provide that to compute capital gains, the cost of acquisition/improvement of certain specified self-generated assets such as goodwill, trademark, brand name of a business, is to be taken as "nil". Therefore, the entire consideration received for the transfer of these specified self-generated assets is charged to tax as capital gains. Accordingly, if a part of the capital invested in a CDM project is specifically capable of being attributed to the objective of generating CERs, it may be possible to allocate a portion of such capital investment towards the cost of acquisition of the CERs, which might result in the transfer of CERs being chargeable to capital gains tax. If, in the future, CERs are brought within the purview of the specific list of self-generated assets, the above logic could be used to structure the investment in a CDM project in a manner that would reduce the incidence of capital gains tax.

4.4 Financing/ Investment Drivers, Opportunities and Barriers

Major financing/ investment drivers which offer opportunities for the development of clean energy sector are described below:

1. Continuous demand for clean energy due to environmental and social concerns eg. climate change
2. Expansion of supply base of RE and EE
3. Rising prices of fossil fuel based energy delivery
4. Financing of RE and EE projects will be a major driver (Emerging trends in RE financing are summarized in table 4.4).
5. Carbon credit market
6. Recently, India created a foreign investment policy to facilitate joint ventures (JVs) and offer support in finding Indian partners for RE power generation projects. Policies to encourage increased FDI and private investment include duty concessions, tax holidays, depreciation allowances, and soft loans.
7. Donor activity to develop clean energy market in India.
8. Potential offered by Indian capital markets for financing of RE & EE projects. A well-developed corporate bond market would give companies greater flexibility to define their optimum capital structure. Structured finance offers immense potential. Securitization is an attractive growth segment in India's debt markets. This market is still in its nascent stages, where current activities primarily occur between banks, non-bank financial institutions and asset reconstruction companies through private placements.

Table 4.4: Emerging trends in financing

S. No.	Existing Approach	Emerging Trends
1.	Conventional lending through debt and equity	Financing through subordinated debt, PE funds and Insurance companies
2.	Debt through rupee term loans	Inflows through external commercial borrowings, external credit agencies and multilateral lending agencies
3.	Limited exit options for lenders	"Buy Out' clause in concession agreement
4.	Difficult risk mitigation mechanism	Innovative financial engineering for risk mitigation

Chapter 5: Barriers to CDM projects In India and post 2012 Scenario

5.0 Introduction

This chapter describes key issues and risks associated with CDM project as a whole followed by sector level risks. Further, advantages of advanced matchmaking of buyers and sellers under bilateral projects have been described in the context of identified risks. Finally, post 2012 scenario has been described.

5.1 Key Issues and Risks Associated with CDM

Sector Specific Risks/ Project Risks

These include the risks associated with design and implementation of CDM project, which include risks related to the construction, operation, financial viability, credit worthiness of counterparties, environmental and social impacts and *force majeure*. Since renewable energy and energy efficiency sectors are the major drivers, which will drive the Indian CDM market, the risks associated with them have been described at sector level in sections 6.2 and 6.3.

Transaction Costs

In Indian context, these costs during project development, validation and operations are very high in comparison to value of CERs generated by CDM projects. This is true for projects which either involve new methodology or belong to a new sector.

Risks associated with additionality and baseline fixation

A number of projects get rejected by UNFCCC in the absence of lack of demonstration of additionality and baseline fixation. This is evident from the fact that only 33 % of total number of CDM projects from India have been registered by UNFCCC.

Approved methodology

Development and registration of CDM project gets delayed in the absence of methodology. This risk may be applicable in those sub-sectors, where no such project had been undertaken/ registered earlier e.g. very few CDM projects in transportation, programmatic (CFLs & others) forestry mines and minerals and agriculture sector have been developed in India.

CER price risk

This risk is related to the volatile market price for CERs. The CER market is usually driven by supply and demand for amount of emission reduction credits (ERUs, CERs) e.g. the CER future prices in NCDx in India has come down from € 27 in August 2008 to € 17 in November 2008.

CER quantity risk

The amount of CERs generated in a project cannot be precisely determined which poses a potential risk. The amount of CERs expected from a project can vary or change actual project emissions unexpectedly due to changes in the activity level of the project. A change in the activity level could result from a change in demand for the project output, business interruption etc. Some of the potential CDM projects in cogeneration sector in India could not progress further on account of this reason.

Country risk

Country risk contains the risk of expropriation, breach of contracts for political reasons and the risk that emission reductions might not be transferred to an Annex B country. Absence of a law defining CERs, lack of clarity on the precise nature of CERs, contractual issues in carbon trading contracts as defined in section 2.2 of Chapter 2 and section 4.3 describing treatment of transactions involving CERs from chapter 4 describe country risks.

Post Kyoto risks

Due to uncertainty in continuation of CDM regime beyond 2012, the new and existing CDM projects in India face an uncertain future.

Risks associated with programmatic CDM

Stage wise PoA related risks in the context of India are summarized below.

Programme Preparation

- Concept development, CDM documentation, contractual structure, assessment and decision making
- Long timing/ high cost
- Use of an approved CDM methodology
- Risk mitigation is step by step and involves development of partnership.

Programme Implementation

- Set up of internal and external operational capacities
- CDM registration
- Long timing/ high cost
- Risk mitigation: step by step implementation (including potential pilot phase) after CDM registration, development partnership.

Risks during operation and funding

- Require regulatory and political backing
- Require clear business plan
- Incentive payments to programme participants against CER ownership
- Monitoring and verification of emissions reductions. Require high quality monitoring procedures
- Selling of CERs and use of revenues to finance programs
- Require seed funding with appropriate type and dimension of incentive.

5.2 Barriers to renewable energy projects

Technology Barriers

- Solar technologies are perceived to be relatively mature, but lack techno-economic viability. Current silicon solar technologies demonstrate a conversion efficiency of roughly 15 %, which when coupled with high capital costs does not lend itself to economic viability for large-scale use (i.e., megawatts). In the solar thermal electric sector, major barriers are the early stage technology, primarily prototypical, which is not economically competitive.
- In the area of wind energy, major barriers are intermittent and unreliable resource, and critical component failures, which makes it less competitive with coal and conventional energy sources.
- Though biomass is substantial, its threshold size for economical applications is 5–10 MW, which implies considerable costs in terms of gathering the input fuel. In biomass power and the gasifier sector, major barriers are fuel supply availability and variability, resource price variability, and environmental liabilities.
- The small hydropower sector often encounters delays in project development and implementation due to geological risks; project delays due to land acquisition; issues of resettlement; disputes between states over shared water resources; resource variability with flow, flooding, and offsite monitoring resulting in prolonged breakdown and long response time; and environmental issues in manipulating natural river flows and associated ecosystems.
- In waste-to-energy projects, the major problem is availability of waste, non-segregation of municipal waste, lack of demonstration of successful projects, and failure of scaled-up demonstration projects.
- In geothermal and tidal energy sectors, there are risks associated with the lack of data availability, and technology development to harness the energy resources.
- Lack of availability of energy efficiency data at national, state, and sector levels is another risk. Further, energy service companies (ESCOs) in India have not made much progress due to non-mature markets and other policy and financing barriers.
- Logistical barriers due to lack of grid connectivity in remote areas.

Apart from the above, there is also lack of awareness and capacity in the entire renewable energy and energy efficiency project supply chain. One also finds lack of staff and organization at state-level designated agencies.

Policy Barriers

- Perceived lack of coordination/integration of policy: India has a centralized energy sector which is dominated by state-owned enterprises. In this context, there appears a perceived lack of coordination/integration on how renewable energy and energy efficiency policies apply across Indian government ministries, states, and sub-sectors, as well as how they align with broader development issues.
- Market Distortions of Fossil Fuels vs. Renewables: The major distortion is lack of accounting for externalities (both environmental and socioeconomic) in conventional fossil fuels, price distortions, uneven subsidies and tax structures, and capital cost accounting versus lifecycle accounting. Some distortions may arise due to uneven price setting across and within sub-sectors, lack of price level guarantees, and lack of price rationalization.

- Weak or Unclear Legal/Regulatory Environment: The enforcement of the legal and regulatory environment in India has been estimated to be a significant barrier for enhanced private sector participation in the renewable energy market.
- Confusion in Implementation of Renewable Energy Projects/Need for Standardization: There is considerable confusion at the state level regarding implementation of the Electricity Act and requirement for a renewable energy portfolio standard to be institutionalized by each SERC.
- Lack of Policy Guidelines for Waste-to-Energy Projects: In waste-to-energy projects, there is lack of clear policy guidelines from state governments with respect to allotment of land, supply of garbage, power purchase arrangements, and evacuation facilities.
- Lack of Strategic Review of Energy Efficiency at the National and State Levels: In the energy efficiency sector, there is a lack of strategic review to assess priorities for initiatives on energy efficiency development in the future. At the sub-national level, most of the state-designated agencies for energy efficiency have been formed fairly recently. Therefore, they lack capacity and infrastructure to develop state-level action plans for future implementation, and as a result, no areas for energy efficiency interventions have been prioritized in the states.

Investment Barriers

- Project Developer Risks: Due to the higher ratio of initial capital costs to operating costs for many renewable energy projects, there is a need for longer-term financing instruments at affordable rates. Some of the barriers faced by project developers are:
  (1) projects are predominantly balance sheet funded, where financing terms are based on the credit-worthiness and strength of the borrower rather than on merits of the project;
  (2) borrowers are typically exposed to unlimited personal liability, if they are able to obtain the required financing; and
  (3) renewable energy technologies are often new to project developers and sponsors and this lack of experience can lead to higher completion and operational risk, further reducing the creditworthiness of the potential borrower resulting in higher transaction costs.
- Financiers' Unfamiliarity: In India, banks provide funding to their existing customers, based on past relationships, trust, and credit history; they are often hesitant to extend financing to new and unfamiliar clients. This occurs due to the weak regulatory environment and lack of legal enforcement, where they have no firm guarantee of legal recourse.
- Lack of Equity: Domestic and international venture capital and private equity investors have comparatively little expertise in investing in the Indian renewable energy sector. Therefore, small-scale renewable energy project sponsors lack sufficient personal funds to invest as equity in the project or as collateral for banks to extend credit.
- Lack of Long Term Loans: Long-term loans have not been made available to renewable energy projects because the banks face a mismatch in Asset Liability Management (ALM). The financial institutions like insurance companies/pension funds, which would not face ALM issues, are not very active in the area of infrastructure financing due to limited institutional capabilities.
- Limited Reach of Bond Market: Bond markets, which offer long-term loans at fixed rates, actively trade in government securities and "AAA" rated companies. The secondary markets have very limited liquidity for other securities thereby offering major constraints to finance projects through bonds.
- Consumer Finance: On the consumer side, access to retail finance and microfinance are in their infancy in India. The initial capital cost to install renewable energy systems is often prohibitive without tailored finance packages, which currently do not exist. Due to the distributed nature of end-users of distributed generation technologies, they often reside outside of the formal credit system, thus creating creditworthiness issues at the consumer level.

- Constraints in External Commercial Borrowing (ECB) for Debt: The major constraints in availing ECBs include: refinancing of rupee term loans by ECBs; absence of ECBs having tenor beyond 5–7 years; inflexibility to prepay loans beyond € 312 million; and inability of Indian banks to act as financial intermediaries for ECB.

Other Barriers

Market distortions and uneven fiscal incentives are significant barriers to commercial viability of renewable energy adoption and uptake. The Government continues to support fossil fuels with subsidies, regulations, and laws that benefit conventional energy generation. It has been pilot tested through e-auction that real market prices of coal are about 40 % higher than prices at which coal is sold to national utilities. The major reasons for higher costs of RE projects versus commercial projects include the following:

- Failure to account for environmental and socioeconomic externalities in the price of conventional fossil fuel energy sources.
- Non-recognition of RE portfolio value in price stability.
- Subsidies and tax structures on fossil fuels make energy portfolios heavily biased toward conventional forms of energy.
- Energy generation project costs are often viewed in cost-per-unit basis (€/MW installed) rather than on a lifecycle accounting basis which includes initial cost, fuel cost, operation and maintenance cost, equipment lifetime, and decommissioning cost.

5.3 Barriers to Energy Efficiency Projects

The barriers/ constraints have been classified into market risks, financing risks, technology risks, project implementation risks and miscellaneous risks. Miscellaneous risks consist of risks perceived by intermediaries and venture capitalists. The entire risk profile has been summarized in table 5.1.

Table 5.1: Risk Profiling of energy efficiency projects

S. No.	Risks	Constraints/ Barriers
1.	Market Risks	➢ Size of EE project. High transaction cost involved in relatively small EE projects. ➢ Reluctance to lend to unfamiliar businesses due to perception of high risk, unfamiliar with technologies and businesses and lack of policy guidance. ➢ EE does not fall in the priority sector declared by the government and Reserve Bank of India though SMEs fall in the priority sectors. ➢ EE not main line of business and involvement of entrepreneurs in other issues including day to day production issues, equipment maintenance, marketing, raw material procurement, accounts receivable, accounts payable etc.
2.	Financing Risks	➢ SME sector does not have strong balance sheet/ financial documentation. They are evaluated for their background, credit-worthiness, financial health/ status and the ability to make timely repayments of loan. ➢ Credit-worthiness of the promoter i.e. inability of the end user to raise debt. ➢ Reluctance to bear upfront transaction costs by the project proponents. ➢ EE projects are non-conventional lending since it is not the main line of business of majority of EE market segments and lending for projects by banks to improve business efficiency and increase productivity is not common.

S. No.	Risks	Constraints/ Barriers
		➢ Banks do not entertain new clients e.g. non client SMEs. They entertain SMEs/ existing clients with satisfactory credit ratings. Only those clients/ SMEs are entertained, which do not have any loan ability to any other bank. ➢ No established methodology for appraising EE projects. ➢ Evaluation of viability of EE projects based on basic financial indicators like collateral and minimum stipulated DSCR. ➢ Financing based on balance sheet rather than project cash flow based financing. Banks require collateral in case of debt or high percentage of equity participation to ensure promoter contribution. ➢ Non availability of innovative financial product to mitigate EE project financing risks. ➢ Non availability of project risk mitigation techniques/ instruments for EE projects
3.	Technology Risks	➢ Very little EE technology demonstration in Indian conditions leading to doubts on effectiveness and reliability of the technologies. o Is the technology viable? o Is it capable of generating energy savings as promised in the project reports? o Is the choice of EE equipment, processes and methods appropriate and reasonable with reference to suitability, performance and price? o Is the equipment competitive vis-à-vis available choices? o Are the soft costs necessary and reasonably period? ➢ No robust monitoring & verification protocols exists for projects
4.	Project Implementation Risks	➢ Little understanding of business models (EE & ESCOs) in the industry and technology performance. ➢ Delay in project conceptualization, project financial closure and delay in implementation
5.	Miscellaneous Risks	➢ ESCO exists in infancy stage with limited technical and financial capacity. ➢ Technical competence of the energy auditors, consultants and ESCOs. ➢ Venture capitalists belief that ESCO business is not scalable due to longer time taken by even small projects to go through. It is due to the fact that performance contracts are not standardized.

5.4 Benefits of advance match making under bilateral CDM Projects

Bilateral CDM projects involve one or more developed country investors who develop, finance and possibly implement the CDM project. Contract details are agreed directly between partners on a project-by-project basis. Similar to conventional foreign direct investment FDI, this approach is attractive to corporations in industrialized countries desiring maximum flexibility and minimum bureaucratic interference. Some of the benefits in advance buyer seller matchmaking mechanism under bilateral project, in view of the above mentioned CDM project related and sector related risks, which get mitigated are described below.

- Reduced host country risks – since the local project developer will be in a better position to perceive the potential economical and political threats which can affect the carbon market.
- Project development risks gets minimized. New areas under programmatic CDM approach can be developed through technical assistance.
- Reduced project development and transaction costs for project developers since it will lead to foreign direct investment.

- Developed countries provide capacity building support for the countries from which they want to buy CERs.
- Buyer has access to the total quantity of CERs, which are generated by the project. Hedging mechanism exist for both price and quantity of CERs.
- Technology transfer and foreign direct investment is facilitated, which is win-win situation for both the parties.
- Host country risks also gets minimized due to participation of the seller.
- Access to CER trading markets abroad.
- Post Kyoto risks also get mitigated to some extent due to sharing of risks and uncertainty bilaterally.

  It may be concluded that any contractual mechanism between buyer and seller under a bilateral project is capable of mitigating the above mentioned risks through provisions of contracts.

5.5 Post 2012 Market in India

The first commitment period is expiring in 2012. Therefore, there is an uncertainty of carbon market beyond 2012. During meeting of COP in Bali held in December 2007, it was decided that a framework for a post 2012 agreement should be negotiated. The meeting also made the US party to the future road map. Bali action plan reaffirmed the UN goal of common but differentiated responsibility and respective capabilities and calls on developing countries to undertake nationally appropriate mitigation actions, supported and enabled by technology, financing and capacity building and the national mitigation action plan should be measurable, reportable and verifiable. It is expected that meeting of COP 15 at Copenhagen in December 2009 will develop strategy for post 2012 scenario. In the light of these positive developments, the recent global trends are summarized below.

- Carbon markets will continue to expand
- Demand for credits will expand rapidly, possibly five times
- EU-ETS continues post 2013 with reduction target of 20 % by 2020
- Australia, New Zealand, Japan are also developing carbon markets and USA is likely to have cap and trade mechanism
- Asian Development Bank plans to buy carbon credits post 2012. This fund will have about € 158 million to finance about 40 carbon reduction projects.
- The World Bank and the European Investment Bank in partnership with four European banks have announced the creation of a post 2012 fund.
- Voluntary initiatives will expand alongside compliance market.

5.6 Post 2012 scenario in India

The international trends described above will impact the Indian carbon market. If post 2012 carbon market continues, the Indian carbon market will also continue to grow. In such a situation, if India is allowed to increase emissions then the emission market will grow till 2050. However in the scenario of limited flexibility, then emissions will reach peak levels around 2025 and then reduce. In such a scenario, CDM market will continue to grow till 2025 and then India has to commit to GHG reduction within a given time frame i.e. from host country it gets transitioned into a developed country. Some of the expected trends in such a scenario are summarized below.

- India will continue to be recipient of funds/ incentives/ low carbon technologies till 2025.
- Special funds will be required to finance long term capital intensive CDM projects in the area of agriculture, afforestation, buildings, carbon capture and storage, transport improvements, clean coal technologies and bio-fuel plantations.
- Long term financing instruments and insurance covers will be required to enable suitable financing. Special equity funds will be required for development and commercialization of technologies.

- CER trading mechanism will grow and mature leading to better inter state, as well as company to company trading, which will improve liquidity and help to develop financial instruments for long term financing.
- India's national action plan envisages a market for sectoral energy efficiency as well as a market arising from renewable portfolio obligations. Sector specific technologies, selection of technologies, financing mechanism, sharing of best practices and capacity building will occur with respect to Indian market.
- Technologies, which will play a crucial role will include CCS, IGCC, solar, fast growing bio fuels, fuel cells, lighting (LEDs), green buildings, avoided deforestation and afforestation.
- Energy efficiency will continue to grow as it will solve both carbon and energy security needs.
- Renewables/ de-carbonized energy will meet 45 % of energy requirements.
- Indian carbon market will link across different countries and trading of carbon across private participants will occur.
- India's performance may be measured, reported and verified.
- India will create a large market for services including carbon qualification, carbon asset management, carbon footprinting, neutrality, risk management and carbon labeling.

5.7 Conclusions

Indian carbon market is likely to grow in a significant way. This is due to the fact that energy needs will continue to drive the national economy in a significant manner. It is expected that thermal power generation will contribute about 60 % of the expected installed capacity till 2020. Despite the current financial slow down in the global economy and post Poznan (Poland) outcome, Indian energy market will continue to grow and be an attractive destination for carbon investments. In this scenario, even conservative estimates indicate that Indian market will reach a peak in the year 2025. Therefore, the current trends augur well for the Indian carbon market beyond 2012 and provide a way forward for external investors.

Annexure 1: List of Miscellaneous Tables

Table 1: Summary of clean energy related policies

Year	Title	Main Thrust
Major Policies		
2008	**National Action Plan on Climate Change**	Policy document, which drives national policy on climate change and GHG abatement.
2006	**Integrated Energy Policy**	National energy policy, which aims to develop energy sources and provide energy security to the country.
2006	**Rural Electrification Policy**	Established a national goal for universal access, assigns responsibilities for implementation, and creates new financing arrangements
2006	**National Environment Policy**	Provides guidance on air pollution reduction, climate change and GHG mitigation, CDM, promotion of clean technologies, environmental resource usage and efficiency per unit of economic output.
2006	**National Urban Transport Policy**	Encourages integrated land use and transportation planning in cities
2006	**National Tariff Policy**	Provides guidance on establishing power purchase tariffs by State Electricity Regulatory Commissions
2006	**MNRE (Draft) R&D Policy**	Establishes resource requirements for the 11 Five Year Plan.
2006	**MNRE (Draft) Renewable Energy Policy**	Draft renewable energy (RE) policy identifies the strategies for increased deployment of grid interactive RE technologies.
2005	**National Electricity Policy**	Provides guidelines for accelerated development of the power sector
Major Acts		
2003	**Electricity Act**	Legislates a comprehensive reform and liberalization process for the power sector
2001	**Energy Conservation Act**	Provides the legal framework and institutional arrangements for embarking on a national energy efficiency drive
1986	**Environment (Protection) Act**	Provides broad objectives, goals and guidance for environmental compliance

Table 2: CDM project profile in India (host country approved)

Sr. No.	Sector	No of CDM Project	tCO_2e Abatement Potential
1	Solar PV	1	230,390.00
2	Solar Thermal	3	308,676.00
3	Hydro	110	46,076,380.00
4	Wind	177	46,642,219.14
5	Bagasses/ Biomass Cogeneration/ Generation / Gasification	235	82,086,691.00
6	Waste heat recovery/ Waste gas usage/ Fossil fuel usage reduction/ Flare gas usage/ Natural gas cogeneration / Energy usage reduction / Thermal energy	185	94,297,442.90
7	Process Modification / Utility/ Retrofitting	106	42,409,867.35
8	Transportation	3	5,722,583.00
9	Construction Materials	21	16,998,119.00
10	CFL	5	7,207,570.00
11	Fuel Switch	48	36,179,404.00
12	MSW / Waste water / Waste / Sludge	36	11,584,993.00
13	Afforestation	5	735,315.00
14	Gas Based/ Thermal Power Plants/ Transmission & Distribution	14	34,816,383.00
15	CFC/ HCFC/ PFC/ HFC 23	6	84,305,559.00
16	Mines and Mineral	1	40,160.00
17	Agriculture	1	299,644.00
	Total	**957**	**50,994,1396.4**

Table 3: Comparison of procurement vehicles

Procurement Vehicle	Advantages	Disadvantages	Remarks
BioCarbon Fund	Strong and high capacity organisational support	• Predicted high operational costs • Dependence on public accepted sink projects • Vague methodologies	Applicable to all developing countries including India
Community Development Carbon Fund	Strong and high capacity organisational support	• Predicted high operational costs • Credit payment above market rate	Applicable to all developing countries including India
Danish Carbon Fund	• Strong and high capacity organisational support • Government support	• Low organisational transparency • Limitation of investors	Applicable to all developing countries including India
EcoSecurities – Standard Bank Carbon Facility	Good Track Record in Carbon Market	• Low organisational transparency	Applicable to all developing countries including India
European Carbon Fund	• Experience in carbon market • Strong and high capacity organisational support • High transparency	Unable to reap possible profit from early stage project investment	Applicable to all developing countries including India
European Partnership Carbon Fund	Organisational backing	• Limited carbon market experience • No track record	Applicable to all developing countries including India
GG-CAP	• Experience in carbon market • Strong and high capacity organisational support • Reasonably transparent	Unable to reap possible profit from early stage project investment	Applicable to all developing countries including India
ICECAP Ltd	• Experience in carbon market • Strong and high capacity organisational support	Limited transparency	Applicable to all developing countries including India
Italian Carbon	• Strong and high capacity organisational support	Limitation of investors	Applicable to all developing countries including India
Fund	• Government support		Applicable to all developing countries including India
Japan GHG Reduction Fund	• Strong and high capacity organisational support	• Possible high transaction costs • Not guaranteed delivery • Limited carbon market experience • Unclear investment strategy	Applicable to all developing countries including India
KfW Carbon Fund	• Strong and high capacity organisational support • Government support • Transparent	Limitation of investors	Applicable to all developing countries including India
Merzbach Mezzanine Carbon Fund 1	• Reasonably transparent	• Limited organisational capacity • Untested approach	Applicable to all developing countries including India
Multilateral Carbon Credit Fund	• Strong and high capacity organisational support • Outsourcing of procurement	• Possible high transaction costs • Not yet open to private sector	Applicable to all developing countries including India
Spanish Carbon Fund	• Strong and high capacity organisational support • Government support	Limitation of investors	Applicable to all developing countries including India