# CDM: A Study of a Sustainable Growth Opportunity for India

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## Abstract

*Kyoto Protocol (1997) has designed three market-based "flexible mechanisms": Emissions Trading (ET), Joint Implementation (JI) and the Clean Development Mechanism (CDM). The CDM projects are developed in developing countries, assisted with technology and finance from investors of the industrialized countries who in return would get carbon credits called CER - for the reductions of Green house gas emission and can use those credits to meet their Kyoto target. Alternatively, project developers may generate emission reduction for sale in the international market. Three stakeholders are involved in the process, the industrialized country governments and companies who have undertaken emission reduction target, the developing countries where the CDM projects are developed and the global environment. The global environmental damages would get reduced by emission reduction of the CDM projects, no matter where the project is located. The developing countries get sustainable production due to CDM projects and either finance and/or technology for development of CDM projects cash flows from sale of CER. The industrialized countries and the companies get the required CER at economic price or cost of investment.Up to 12-02-2007 a total 506 projects have already been registered and 99 projects are requesting registration and another 845 projects are in the pipeline. The expected green house gas reduction in units of tons of carbon or equivalent by 2012 is 1.8 billion with average annual emission reduction of 113 million of $tCO_2e$. ($tCO_2e$ means one ton of carbon dioxide emission or equivalent) In 2005, 374 million tCO2e of Certified Emissions Reductions (CER), were transacted at a value of US$2.7 billion with an average price climbing over US$7.23 per CER. In the first three months of 2006, prices for project-based emission reductions soared with an average reported price of US$11.45 per tCO2e for the 79 million tons transacted in the first three months of 2006 alone, corresponding to a value of nearly US$0.9 billion.Starting on 08-March-2005 till 12-Feb-2007 India has 164 registered projects with annual estimated emission reduction of 1.567 millions of $tCO_2e$. Based on the risk adjusted conservative value of $6 only (offered by the World Bank) for the CER to be generated from the registered projects in India and taking the current rate of conversion of 1 USD for 44 ICU the potential monetary value of 'Additionality' in India comes to almost 4138 million rupees a year.In world ranking India is first in number of projects and third in annual volume of emission reduction. Out of 15 sectors only in 6 sectors CDM projects have been developed in India. Amongst 28 states of India only in 16 states in India CDM projects have been developed while other states and union territories are yet to open their account. Rajasthan shared 31% of total emission reduction*

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*through CDM and ranked first. CDM scheme appears to be a boon as it has the potential of adding to GDP by greening environment.*

## Introduction

**S**ustainable growth implies growth in output without damaging environment. Projects for use of pollution saving technology apparently hike the cost of production and reduce its financial feasibility. However, if the saving in pollution to be secured in the process can be converted into marketable instruments and sold in the emission market to earn revenue, financial feasibility of pollution saving projects will enhance. This idea of generating marketable instruments for pollution saved encourages setting up of new projects that will on one hand augment output and on the other hand reduce pollution. The 'flexible mechanisms' of Kyoto Protocol have materialized the idea and opened new horizons of sustainable production. India has taken the opportunity and already made a remarkable progress in setting up projects that would save pollution and increase production. This paper makes a study of the background and concepts of 'flexible mechanisms', the global progress in their implementation and Indian responses to the global developments.

**Flexible mechanisms:** Kyoto Protocol (1997) has designed three market-based "flexible mechanisms": Emissions Trading (ET), Joint Implementation (JI) and the Clean Development Mechanism (CDM). While different in operation, the three mechanisms are based on the same principle: that industrialized countries are allowed to pay for reducing emissions wherever in the world those reductions are cheapest, and then count those reductions towards their national target. ET is called "allowance-based" mechanism because allowances are allotted to the sources of the green house gas (GHG) emissions where as JI and the CDM are called "project-based" mechanisms because actual projects are undertaken for emission reduction; JI generally funds projects in Eastern Europe and the former Soviet Union, while CDM projects can only happen in developing countries which do not have an emissions reduction target under the Kyoto Protocol. As such, the CDM is the only part of the Kyoto Protocol which directly involves developing countries like India in reducing greenhouse gas emissions.

## The background:

The final rules for the CDM were agreed at the 7th Conference of Parties to the UNFCCC in Marrakech in 2001. The Marrakech Accords established an Executive Board to oversee the CDM. The Board makes the final decision on whether to register a CDM project, which allows it to begin generating carbon credits named as **Certified Emission Reduction (CER)**, and approves the issuing of credits. CER is the credit for GHG emission reduction of one ton of carbon dioxide equivalent.

Under CDM scheme a project that reduces greenhouse gas emissions have to be taken up in a developing country. The

project may be assisted with technology and finance by an investor from the industrialized country and in return they would get carbon credits - for the reductions of Green house gas emission and can use those credits to meet their Kyoto target. Alternatively, developers may be self-financing CDM projects and they may generate emission reduction in the developing countries seeking a buyer for the emissions reductions in the international market. Three stakeholders are involved in the process, the industrialized country governments and companies who have undertaken emission reduction target, the developing countries where the CDM projects have to be developed and the global environment. The global environmental damages would get reduced by emission reduction of the CDM projects, no matter where the project is located. The developing countries get sustainable production due to CDM projects and either finance and/or technology for development of CDM projects cash flows from sale of CER. The industrialized countries and the companies get the required CER at cheaper rate or with smaller amount of investment. Thus all the three parties are benefited from their respective angles.

An example:

A French company needs to reduce its emissions as part of national commitment under Kyoto Protocol. Instead of reducing emissions from its own activities in France, the company provides funding for the construction of a new biomass plant in India, leading to a reduction in greenhouse gas emissions in India. The French investor gets credit for those reductions and can use them to help meet their reduction target in France. Here France is the investor country and India is the host country, the biomass plant in India is the CDM project and CER is the unit of emission reduction.

The Kyoto protocol came into force on 16th February 2005 with its ratification by Russia in Montreal, when 157 countries, whose emissions represented 61.6% of the Annex I countries 1990's emissions levels, ratified, approved, accepted or acceded to it.

The Protocol set targets for industrialized countries to reduce six GHG emissions to be measured in ton of carbon dioxide equivalent.

## 3. Some basic aspects of CDM mechanism

**Greenhouse gases :** Greenhouse gases (GHGs) are trace gases that control energy flows in the Earth's atmosphere by absorbing infra-red radiation. Some GHGs occur naturally in the atmosphere, while others result from human activities. There are six GHGs covered under the Kyoto Protocol - carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride ($SF_6$).

**Global Warming Potential:** Global Warming Potential suggested by IPCC provides the equivalent measure in ton of carbon dioxide for every ton of GHG emission. The Table-1 presents the equivalent measure in units of $tCO_2e$ (one ton of carbon dioxide equivalent).

**Table1: Global Warming Potential of six Green House Gases**

| GHG | $tCO_2e$ |
|---|---|
| Carbon Dioxide ($CO_{2)}$ | 1 |
| Methane (CH4) | 21 |
| Nitrous Oxide (N20) | 310 |
| Hydrofluorocarbon (HFC) | 140-11700 |
| Perfluorcarbon (PFC) | 6500-9200 |
| Sulfur Hexafluoride (SF6) | 23900 |

**Scope or Sectors:** CDM projects can be developed in the following sectors**:**

1. Energy industries (renewable - /non-renewable sources)
2. Energy distribution
3. Energy demand
4. Manufacturing Industry
5. Chemical Industry
6. Construction
7. Transport
8. Mining and Mineral Production
9. Metal Production
10. Fugitive emissions from fuels (solid, oil, gas)
11. Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride
12. Solvent used
13. Waste handling and disposal
14. Afforestation andReforestation
15. Agriculture

**Base Line and 'Additionality':** The base line predicts the scenario that is most likely in the absence of the CDM project – i.e. What will happen under business as usual - and the likely greenhouse gas emissions that will occur in that scenario. The developers of CDM projects have to provide an estimate of what additional emission reductions the project is expected to achieve. That is known as 'Additionality'. The CDM projects get approval and earn certificates of emission reduction for 'Additionality'. The measurement of 'Additionality' is dependent on the measurement of base line. The success of CDM scheme is highly dependent on the proper measurement of 'base line' and 'Additionality'.

## 4. The global scenario:

**The World Statistics:** Up to 12-02-2007 a total 506 projects have already been registered and 99 projects are requesting registration and another 845 projects are in the pipeline. The expected green house gas reduction in units of tons of carbon or

equivalent by 2012 is 1.8 billion. The average annual emission reduction for the registered projects is 113 million of $tCO_2e$ and by 2012 the expected reduction is 740 million of $tCO_2e$. A summarized picture of the country wise emission reduction per annum under CDM is presented in table-2 and also shown in Figure- 1.

**Table-2: Annual emission reduction from registered projects in tons of Carbon dioxide equivalent: (source: UNFCCC, 12-02-2007)**

| Countries | No. of Projects | % | CER per year | % |
|---|---|---|---|---|
| China | 37 | 7.3 | 46,500,229 | 41.1 |
| Brazil | 88 | 17.4 | 15,846,288 | 14.0 |
| India | 164 | 32.4 | 15,674,534 | 13.9 |
| Republic of Korea | 10 | 2.0 | 12,370,928 | 10.9 |
| Mexico | 73 | 14.4 | 5.566.398 | 4.9 |

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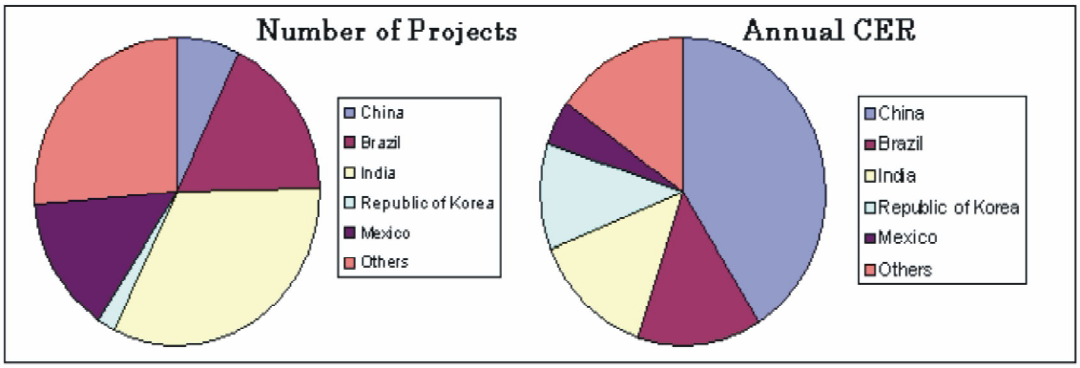


In project development and in CER generation China, Brazil and India have occupied a dominant part in the world scenario. Out of total of 506 projects registered 307 projects are jointly participated by the investor countries, which are supposed to use the CER for their own commitment or to make trading in international markets. The other projects are developed by the host countries for generating CER to be traded in the international markets.

**The CER Market:** Although the CER can be used for meeting emission reduction commitment of Kyoto Protocol from 2008, the European Union Emission Trading System (EU ETS) has started operation in 2005 and it allows the use of CER for EU ETS compliance. In 2005, 374 million tCO2e of Certified Emissions Reductions (CER), were transacted at a value of US$2.7 billion with an average price climbing over US$7.23 per CER.

## Indian Success:

Starting on 08-March-2005 till 12-Feb-2007 India has 164 registered projects with annual estimated emission reduction of 1.567 millions of $tCO_2e$. In India only in 6 sectors CDM projects have been developed. A summarized picture of sector wise distribution of projects has been made in Table-3.

**Table-3: Sector wise CDM projects in India**

| Sectors in India | No Of Projects | CER pa |
|---|---|---|
| Energy industries | 127 | 6525866 |
| Energy demand | 7 | 138976 |
| Manufacturing Industry | 27 | 1928583 |
| Fugitive emissions from production and consumption of halocarbons and sulfur hexafluoride | 2 | 6833566 |
| Waste handling and disposal | 8 | 150228 |
| Agriculture | 5 | 97315 |
| **Total** | **164** | **15,674,534** |

A state wise distribution of projects on the basis of the location of plants along with the measure of emission reduction is presented in Table-4. The States are ranked on the basis of annual emission reduction.

**Table-4: State wise project development and CER generation pa**

| Rank | Total | Number of projects | CER |
|---|---|---|---|
| 1 | Rajasthan | 17 | 4828434 |
| 2 | Karnataka | 19 | 3333251 |
| 3 | Gujrat | 11 | 3304725 |
| 4 | Chattisgarh | 15 | 1142170 |
| 5 | AndhraPradesh | 25 | 843866 |
| 6 | Punjab | 13 | 395865 |
| 7 | Tamilnadu | 9 | 363868 |
| 8 | Maharasthra | 15 | 262544 |

| | | | |
|---|---|---|---|
| 9 | Uttar Pradesh | 11 | 248368 |
| 10 | West Bengal | 11 | 243790 |
| 11 | Orissa | 6 | 240109 |
| 12 | Madhya Pradesh | 4 | 188742 |
| 13 | Uttaranchal | 1 | 109304 |
| 14 | Himachal Pradesh | 5 | 107606 |
| 15 | Jharkhand | 1 | 54340 |
| 16 | Kerala | 1 | 7552 |
| | **Total** | **164** | **15674534** |

If we attach monetary value to this volume of emission reduction we shall get an idea about the potential earning from these projects. We considered the risk adjusted conservative value of $6 offered by the World Bank[7] for the CER to be generated from the registered projects . Taking the current rate of conversion of 1 USD for 44 ICU the potential monetary value of 'Additionality' comes to almost 4138 million rupees in a year as presented in Table-5 below:

**Table-5: Sector wise annual revenue from CER in million of rupees.**

| Sectors in India | CER pa | Rs. Million |
|---|---|---|
| Energy industries | 6525866 | 1723 |
| Energy demand | 138976 | 37 |
| Manufacturing Industry | 1928583 | 509 |
| Fugitive emissions from production and consumption of halocarbons and sulfur hexafluoride | 6833566 | 1804 |
| Waste handling and disposal | 150228 | 40 |
| Agriculture | 97315 | 26 |
| Total | 15,674,534 | 4138 |

## Conclusion:

India has taken a leading role along with China and Brazil in developing CDM projects and generating CER. From the Project Design Documents of Indian developers it was observed that even on the basis of price of $6 per CER they have projected a satisfactory IRR for the CDM projects. Considering the fact that in European Union Emission Trading System (EU-ETS) $100 is the penalty for shortfall in committed emission reduction and that the EU-ETS emission permit named

European Union Allowance (EUA) representing one $tCO_2e$ is priced at about $29, the CER with equal emission credit per unit at a price of $6 has a very high potential for increased demand and upward move of price. India has made a considerable progress in development of emission reduction projects after Indian Government ratified the Kyoto in August 2002. In world ranking India is first in number of projects and third in annual volume of emission reduction. Out of 15 sectors only in 6 sectors CDM projects are developed in India. Amongst 28 states of India only in 16 states in India CDM projects have been developed while other states and union territories are yet to open their account. Rajasthan shared 31% of total emission reduction through CDM and ranked first. SRF, an Indian chemical company, earned 122.28 crores of rupees in the final quarter of 2006 by sale of CER generated by reducing the potent greenhouse gas HFC-23 in a project located in Rajasthan. The executive board of the CDM has so far issued SRF with 6.85 million CERs, the biggest volume of carbon credit earned by any one company. The project has the potential to generate 32 million CERs by 2013[8]. CDM scheme appears to be a boon as it has the potential of adding to GDP by greening environment.

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