

Kyoto Protocol : Implications/Opportunities for India

Prepared by Previr Rangroo

For AID Delhi

Presentation Layout

- ▶ Global Warming
- ▶ UNFCCC
- ▶ Kyoto Protocol : An Introduction
- ▶ The Kyoto Mechanisms
- ▶ Emissions trading
- ▶ Joint Implementation
- ▶ India in Kyoto Protocol
- ▶ Clean Development Mechanism
- ▶ Operating Details
- ▶ Project Cycle
- ▶ CER Market
- ▶ GHG Mitigation Potential
- ▶ Case Studies

Global Warming

- ▶ Global warming is a term used to describe an increase over time of the average temperature of the Earth's atmosphere and oceans.
- ▶ The scientific opinion on climate change, as expressed by the UN Intergovernmental Panel on Climate Change (IPCC) and endorsed by the national science academies of the G8 nations, is that the average global temperatures have risen $0.6 \pm 0.2^{\circ}\text{C}$ since the late 19th century, and that "most of the warming observed over the last 50 years is attributable to human activities", most prominently the emission of greenhouse gases such as carbon dioxide (CO_2).

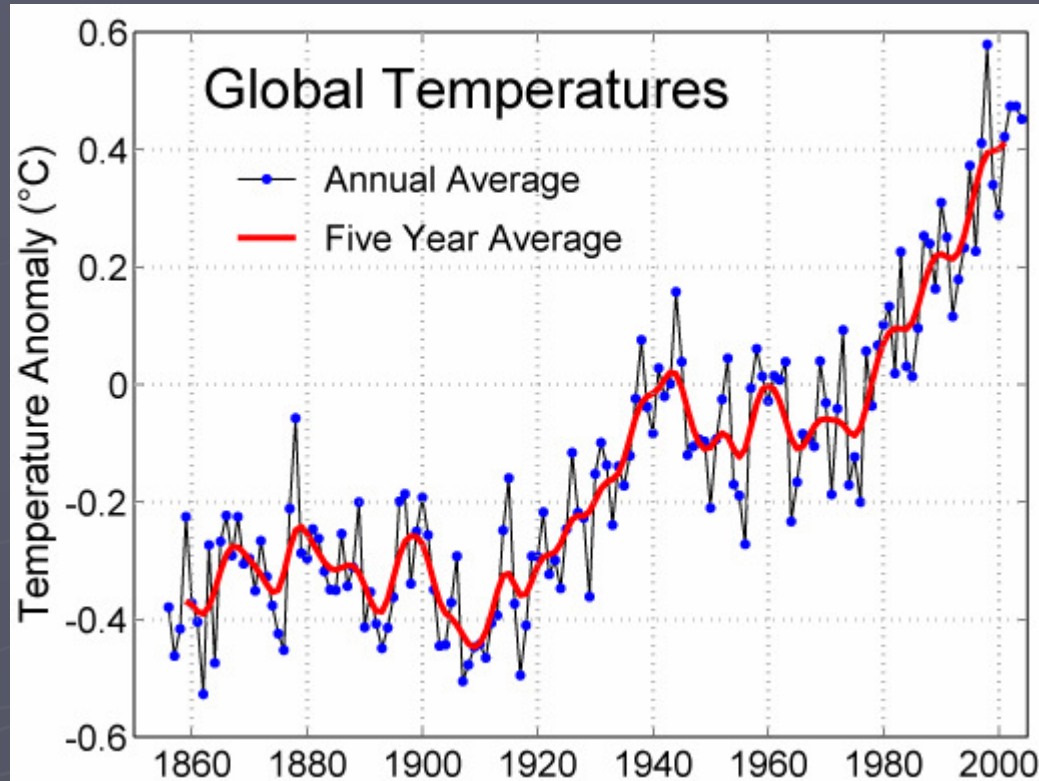


Figure :
Global mean surface temperatures 1856-2004

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Based on climate models referenced by the IPCC, temperatures may increase by 1.4°C to 5.8°C between 1990 and 2100. This is expected to result in other climate changes including: rises in sea level and changes in the amount and pattern of precipitation. Such changes may trigger detrimental events such as floods, droughts, heat waves, reduction of agricultural yields or even cause biological extinctions.

United Nations Framework Convention on Climate Change ...

The **United Nations Framework Convention on Climate Change (UNFCCC or FCCC)** is an international environmental treaty produced at the United Nations Conference on Environment and Development (UNCED), informally known as the **Earth Summit**, held in Rio de Janeiro in 1992. The treaty aimed at reducing emissions of greenhouse gases (GHGs), pursuant to its supporters' belief in the **global warming hypothesis**.

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- ▶ The treaty as originally framed set no mandatory limits on greenhouse gas emissions for individual nations and contained no enforcement provisions; it is therefore considered legally non-binding.
- ▶ Rather, the treaty included provisions for updates (called "protocols") that would set mandatory emission limits. The principal update is the **Kyoto Protocol**, which has become much better known than the UNFCCC itself.

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Signatories to the UNFCCC are split into three groups:

- ▶ Annex I countries (industrialized countries)
 - ▶ Annex II countries (developed countries which pay for costs of developing countries)
 - ▶ Developing countries.
- * India, as of date, comes under “Developing countries”.

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- ▶ Annex I countries agree to reduce their emissions (particularly carbon dioxide) to target levels below their 1990 emissions levels. If they cannot do so, they must buy emission credits or invest in conservation.
- ▶ Developing countries are not expected to implement their commitments under the Convention unless developed countries supply enough funding and technology, and this has lower priority than economic and social development and dealing with poverty.

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- ▶ According to terms of the UNFCCC, having received over 50 countries' instruments of ratification, it entered into force March 24, 1994. Since the UNFCCC entered into force, the parties have been meeting annually in **Conferences of the Parties (COP)** to assess progress in dealing with climate change.
- ▶ The **Kyoto Protocol to the United Nations Framework Convention on Climate Change** was adopted by **COP-3**, in December 1997 in Kyoto, Japan

Kyoto Protocol ...

“ The Kyoto Protocol is a legally binding agreement under which industrialized countries will reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990. The goal is to lower overall emissions from six greenhouse gases - carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, HFCs, and PFCs - calculated as an average over the five-year period of 2008-12. National targets range from 8% reductions for the European Union and some others to 7% for the US, 6% for Japan, 0% for Russia, and permitted increases of 8% for Australia and 10% for Iceland.”

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Opened for signature	December 11, 1997 at Kyoto, Japan
Entered into force	February 16, 2005.
Conditions for entry into force	55 parties and at least 55% CO ₂ 1990 emissions by UNFCCC Annex I parties.
Notable exceptions	United States and Australia.

The Kyoto Mechanisms

The Kyoto Protocol broke new ground by defining three innovative “flexibility mechanisms” to lower the overall costs of achieving its emissions targets.

- ▶ Emissions Trading (Article 6)
- ▶ Joint Implementation (Article 6)
- ▶ Clean Development Mechanism (Article 12)

These mechanisms enable Parties to access cost-effective opportunities to reduce emissions or to remove carbon from the atmosphere in other countries. While the cost of limiting emissions varies considerably from region to region, the benefit for the atmosphere is the same, wherever the action is taken.

Emissions trading ...

The Article 6 of the Kyoto Protocol says

“For the purpose of meeting its commitments under Article 3, any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy.”

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Each Annex I country has agreed to limit emissions to the levels described in the protocol, but many countries have limits that are set above their current production. These "extra amounts" can be purchased by other countries on the open market. So, for instance, Russia currently easily meets its targets, and can sell off its credits for millions of dollars to countries that don't yet meet their targets, to Canada for instance. This rewards countries that meet their targets, and provides financial incentives to others to do so as soon as possible.

Joint Implementation

- ▶ Joint implementation (JI) under Article 6 of the Kyoto Protocol provides for Annex I Parties to implement projects that reduce emissions, or remove carbon from the atmosphere (**Carbon sequestration**), in other Annex I Parties, in return for **emission reduction units (ERUs)**. The ERUs generated by JI projects can be used by Annex I Parties towards meeting their emissions targets under the Protocol.

So where does India come in all this?

India, being a “Developing Country”, is exempted from the framework of the treaty.

Following the principle of **common but differentiated responsibility**, it is under no obligation to reduce its emissions of GHGs.

It is expected to gain from the protocol in terms of transfer of technology and related foreign investments **and from something known as the ...**

Clean Development Mechanism (CDM)



Clean Development Mechanism

The Article 12 of the Kyoto Protocol defines the Clean Development Mechanism as

“The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.”

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The clean development mechanism (CDM) defined in Article 12 provides for Annex I Parties to implement project activities that reduce emissions in non-Annex I Parties, in return for certified emission reductions (CERs). The CERs generated by such project activities can be used by Annex I Parties to help meet their emissions targets under the Kyoto Protocol. Article 12 also stresses that such projects are to assist the Developing country host Parties in achieving sustainable development and in contributing to the ultimate objective of the Convention.

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Article 12 of the Kyoto Protocol identifies three specific goals for the CDM:

- ▶ to assist in the achievement of sustainable development,
- ▶ to contribute to the attainment of the environmental goals of the Framework Convention, and
- ▶ to assist Annex B parties in complying with their emissions reduction commitments.

CDM ... Operating Details

- ▶ CDM project activities must have the approval of all Parties involved and this may be gained from **designated national authorities (DNAs)** (to be set up by each Annex I and non-Annex I Party). CDM project activities must reduce emissions below those emissions that would have occurred in the absence of the CDM project activity.
- ▶ The CDM is supervised by the **CDM Executive Board**, which itself operates under the authority of the **COP**.
- ▶ The first report of the CDM Executive Board was considered at COP 8 and **decision 21/CP.8** was adopted. Under this decision, the COP adopted the rules of procedure of the Board and the **simplified modalities and procedures for small-scale CDM project activities**.

CDM ... Eligible Projects

Any project which reduces the emission of GHGs is eligible for **carbon credits**.

These can be broadly classified into following categories :

- ▶ Energy Efficiency.
- ▶ Renewable Energy.
- ▶ Fuel Switching.
- ▶ Waste to Energy.
- ▶ Industrial Process.

CDM ... Project Cycle (1)

Participants must prepare a “Project Design Document (PDD)” which includes

- ▶ description of the **baseline** i.e. the technology and the monitoring methodology to be used,
- ▶ an analysis of the environmental impacts,
- ▶ comments received from the carbon credit purchaser
- ▶ and a description of new and additional environmental benefits that the project is intended to generate.

CDM ... Project Cycle (2)

- ▶ The PDD is first submitted to the National CDM Authority (NCA).

* In India, the Ministry of Environment and Finance is the nodal ministry dealing with climate change and CDM issues. The ministry has established the DNA in 2003 as the NCA.

- ▶ After validation, the project is registered in the 'Host Country'.
- ▶ The PDD is then submitted to the UNFCCC after incorporating relevant public comments.
- ▶ After validation, the project is submitted to the CDM Executive Board for registration after which it is ready to be operationalised.

CDM ... Project Cycle (3)

- ▶ Once the project is running it is monitored by the host country throughout the project cycle.
- ▶ Successful compliance leads to certification and the issuance of Certified Emission Reductions (CERs).
- * A CER unit is equivalent to one tonne of CO₂
- ▶ Consultants for the validation of CDM Projects are Pricewaterhouse Coopers, DNV, Ernst & Young, TERI and WINROCK.

Sample List of Approved Projects in India

Company	Project	CER Units	Estimated Amount Receivable (Rs. Crores)
Torrent Power AEC	Energy Efficiency	11900752	199.9
Gujrat Fluro Chemical	Gas Capture	3380076	56.8
Indian Aluminium	Gas Capture	2553344	42.9
Lanco Group	Fuel Switching	2289478	38.5
Jaypee Associates	Energy Efficiency	1084469	18.2
Chennai Petroleum Refinery	Energy Efficiency	1010000	17.0
Balarampur Chini	Renewables	936289	15.7
Jindal Vijaynagar Steel	Energy Efficiency	575967	9.7
Orissa Sponge Iron	Energy Efficiency	424549	7.1
Kalpataru Power Trans.	Renewables	313743	5.3
Indo-Gulf Corp.	Energy Efficiency	245256	4.1
Grasim Industries	Energy Efficiency	242270	4.1

Source : Internet.

Assuming \$4 per CER unit and Rs. 42 per dollar.

So Who's Buying the CERs?

Carbon Credits are traded at

- ▶ CO2E Exchange in UK
- ▶ CDM Exchange in Europe
- ▶ Chicago Climate Exchange (CCX).

Buying organizations

- ▶ Japanese entities.
(41% in '03-04 and 21% in '02-03)
- ▶ Govt. of Netherlands entities.
(25% in '03-04)
- ▶ Carbon Finance Business (CFB)
(25% in '03-04)

Estimates of total demand (MTCO_{2eq}) CER Units in 2010

	<i>Government demand</i>		<i>Industry demand</i>		<i>Total demand</i>	
	<i>Natsource (2003)</i>	<i>Criqui and Kitous (2003)</i>	<i>Natsource (2003)</i>	<i>Criqui and Kitous (2003)</i>	<i>Natsource (2003)</i>	<i>Criqui and Kitous (2003)</i>
Australia and New Zealand		12		23		35
Canada	12.0-81.8	74	22.4	20	34.4-104.2	94
European Union 25	53.9-462.8	113	45.0-173.7	111	98.9-636.5	224
Japan	17.7-217.6	26	34.8-92.4	34	52.5-310	60
Norway and Switzerland		16		10		26
Total demand	83.6-762.2	241	102.2-288.5	198	185.8-1050.7	439

Source Haites (2004)

MTCO_{2eq} is Million Tonnes of CO₂ equivalent.

Indian Share in the International Market for CERs ...

- ▶ The National Communications released by the Annex 1 countries reveals a total demand of 415-1250 $\text{MTCO}_{2\text{eq}}$ per year to meet their reduction targets for the first commitment period ('08-12).
- ▶ The supply potential of JI ERUs is 365-1070 $\text{MTCO}_{2\text{eq}}$ per year.
- ▶ This implies that the total CDM market size is between 50-180 $\text{MTCO}_{2\text{eq}}$ per year.

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- ▶ An NSS (National Strategy Studies) report on CDM Implementation in India which uses a carbon market equilibrium model CERT (carbon emission reduction trade), estimates that India is likely to capture 10% of the global carbon market (5-18 MTCO_{2eq.}) per year.
- ▶ At \$1 to \$5 per TCO_{2eq.}, this implies revenues of 5-100 million USD per year.
- ▶ The analysis is captured in the following table.

CERT Model and Literature based analysis.

Global carbon market (Grubb 2003)	415-1250 MTCO _{2eq} /year
Global market carbon price range	1.3-6.1 \$/TCO _{2eq}
Global CDM volume	37.8-264.0 MTCO _{2eq} /year
Volume of Indian CER exports ^a	3.7-26.4 MTCO _{2eq} /year
India's export revenue	4.8-106.6 million \$/year
Share of India in CDM	10%

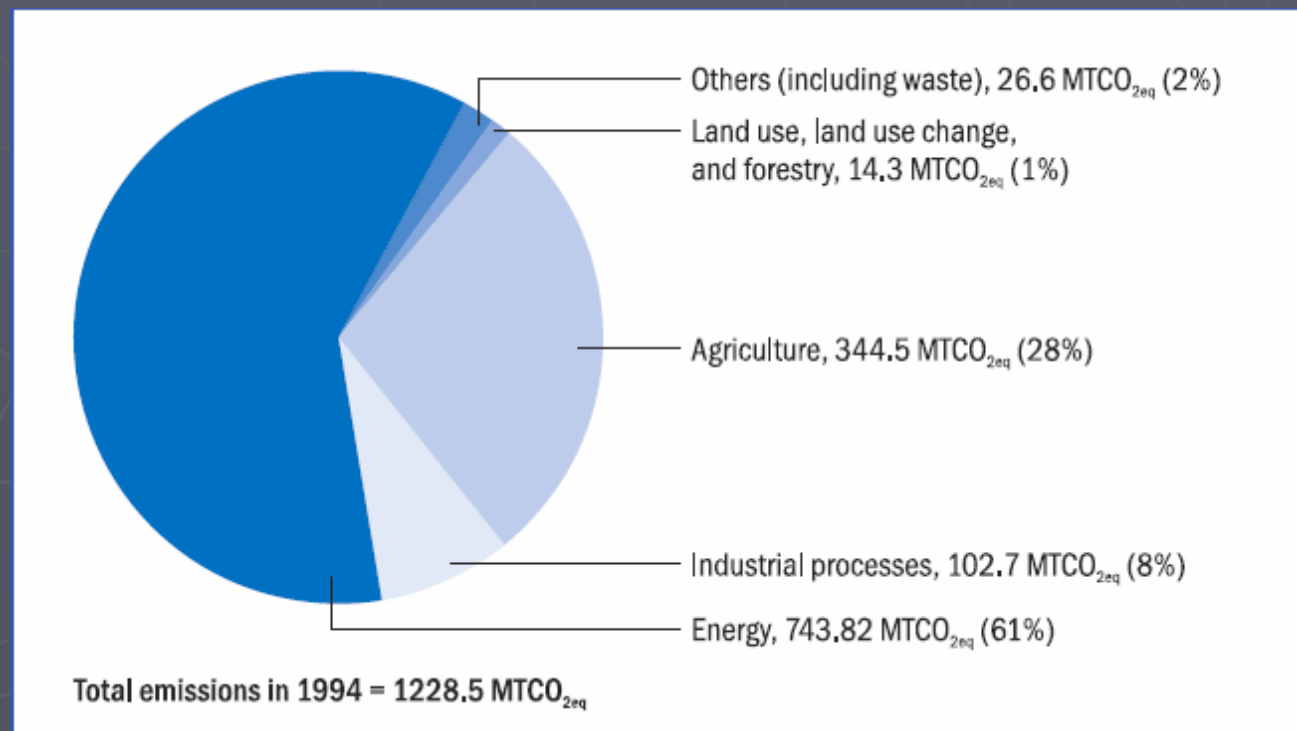
^a The global CDM market volume and market price, the volume of Indian CER exports, and India's export revenues and market share summarize the results of various CERT scenarios. The CER price of the scenario with the highest Indian CER exports is 4 USD/TCO_{2eq} only. Therefore, the resulting export revenues are 106.6 million USD.

GHG Mitigation (Emission Reduction) Potential of India (1)

The sectoral GHG emissions in India in 1994 were as shown in the figure.

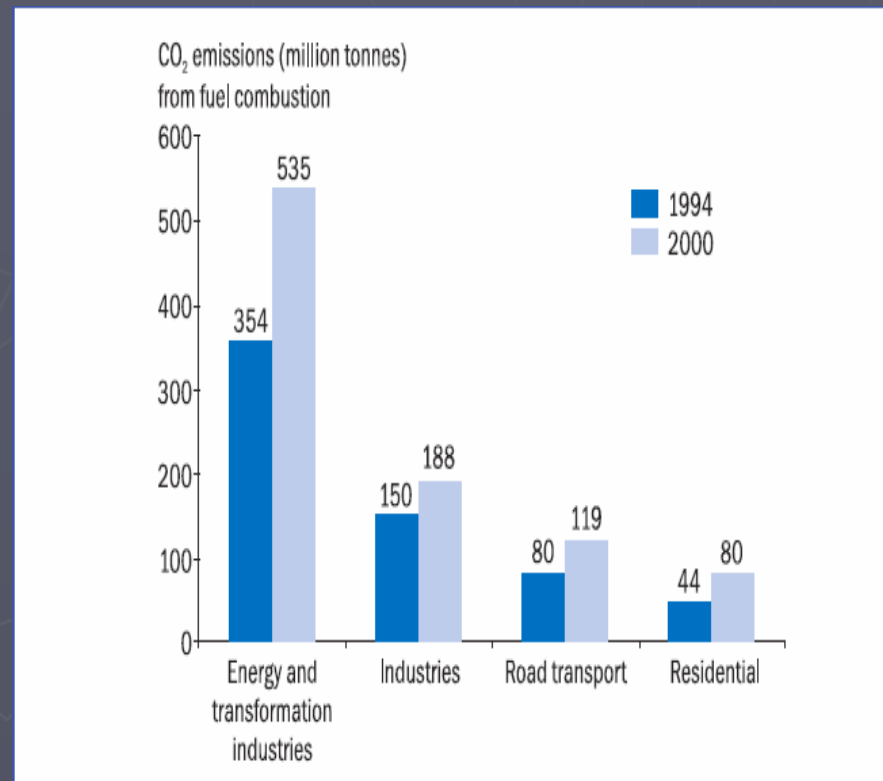
(Source: National Communications (2004))

- ▶ The Energy Sector contributed the largest share of GHG emissions from India in 1994.
- ▶ The next slide details the increase from 1994 to 2000 in the Energy Sector

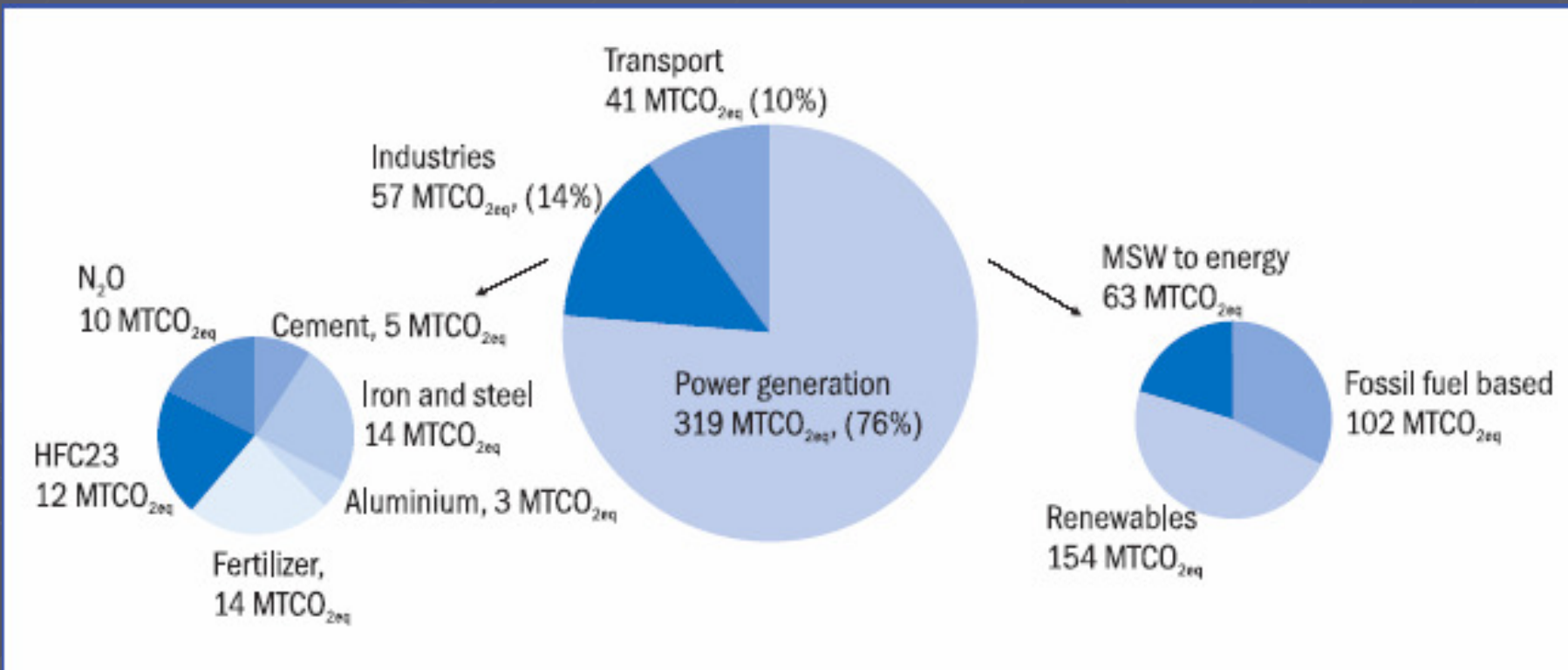


GHG Mitigation (Emission Reduction) Potential of India (2)

- ▶ This shows an increase from 744 to 922 MTCO_{2eq}.
- ▶ Bulk of this is due to the fuel consumed for power generation.
- ▶ The GHG mitigation potential for the whole sector is considered to be around 417 MTCO_{2eq} and is presented in the next slide.



GHG Mitigation (Emission Reduction) Potential of India (3)



GHG Mitigation (Emission Reduction) Potential of India (4)

The GHG mitigation potential of the power sector can be achieved through

- ▶ technologies such as **super critical power plant**,
- ▶ **IGCC** (integrated gasification combined cycle) and
- ▶ through **renovation and modernization of existing plants.**

GHG Mitigation (Emission Reduction) Potential of India (5)

For the renewables sector, the potential can be achieved through

- ▶ Municipal solid waste pelletization.
- ▶ Biomass-based power generation.
- ▶ Wind Energy
- ▶ Small Hydro Projects.

The industry sector can achieve GHG mitigation potential through

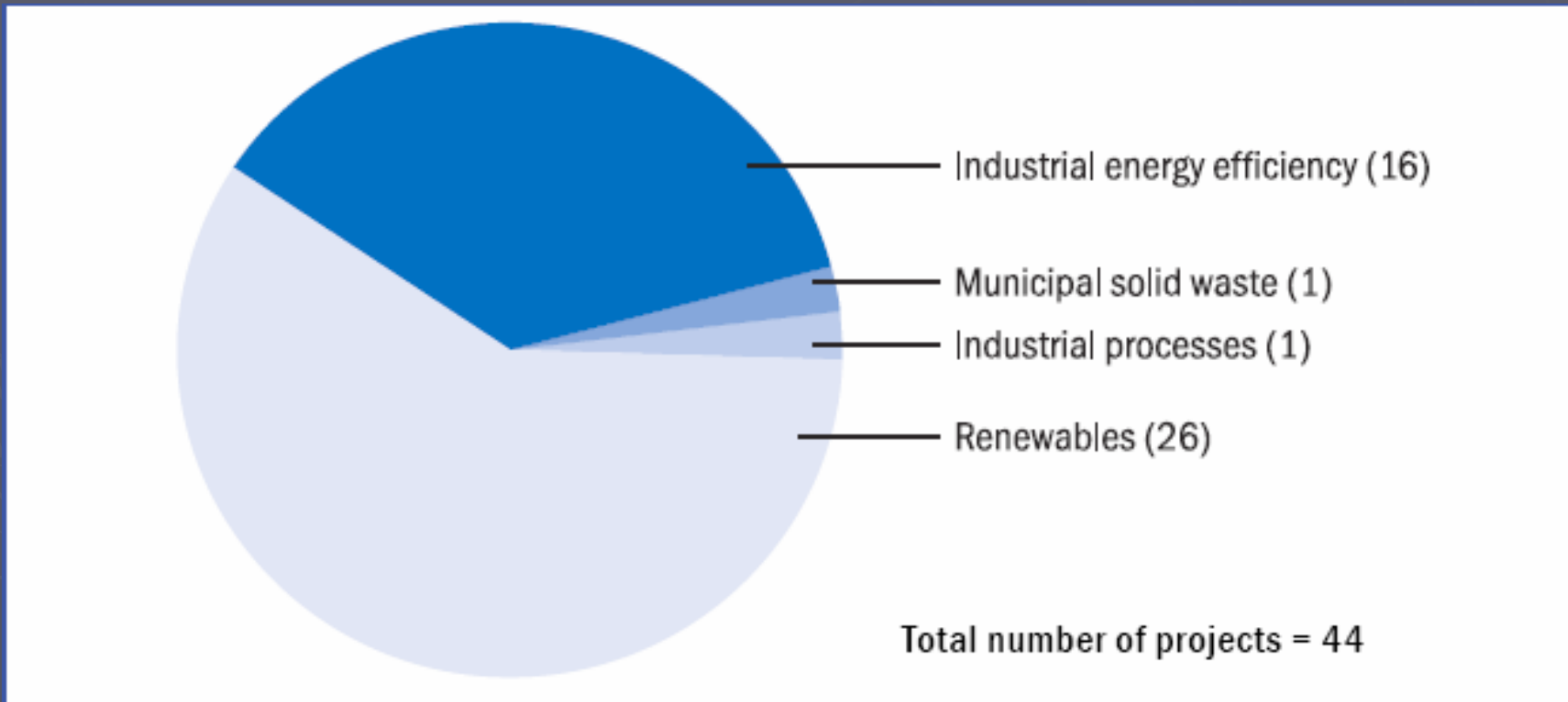
- ▶ Fuel Switching
- ▶ HFC waste stream incineration and N₂O emission reduction through thermal and catalytic destruction processes in adipic acid production.

The transport sector can achieve GHG mitigation potential through increased penetration of public transport.

GHG Mitigation (Emission Reduction) Actual Data (1)

- ▶ The estimates are mirrored in the data available from the actual projects approved by the National CDM Authority.
- ▶ The CDM project portfolio currently approved by the NCA is dominated by small-scale projects from the renewable energy sector.
- ▶ The data is presented in the next slide.

GHG Mitigation (Emission Reduction) Actual Data (2)



Source : NCA, India

Case Studies

The National Strategy Study on CDM Implementation in India produced by TERI has done a case study of five projects under CDM implementation in India. The next two slides present the brief summary.

Project	Location	Proponent	Annual CERs
12 MW Hydro Power Project	Kullu	DACL Energy Services P.Ltd	49537
Municipal Solid Waste to Pelletization Project	New Delhi	Renova Energy Ltd	92256
Small-scale Foundry	Rajkot	Rajkot Engineering Association	8302
Renewable Energy based Rural Electrification	Orissa	Annual CERs	4408
Municipal Street Lighting	Bangalore	Elpro Energy Dimensions P. Ltd.	1084

	<i>Actual projects under various stages of implementation</i>				<i>Case study</i>
	<i>Small-scale foundry</i>	<i>Small hydro</i>	<i>MSW to pellet</i>	<i>Municipal street lighting</i>	<i>Rural electrification</i>
Project description	Energy efficiency improvement in small-scale foundry units	Grid connected run-of-the-river small hydro (renewable energy) project	Recycling of MSW (municipal solid waste) into refuse-derived fuel	Energy efficiency in municipal street lighting	Rural electrification by decentralized distribution generation systems through a mix of renewable technologies
Technology	Energy-efficient DBC (divided blast cupola)	Small hydro turbine-based power generation	Pelletization of MSW into refused-derived fuel	ETrACS (energy tracking and control systems)	1. Biomass gasifiers and bio-oils; 2. Micro hydro; 3. Solar photovoltaics
Scale of project	190 foundries Saving of 0.03 GWh per year	12 MW (three projects)	150 T of MSW per day	Street lights in 110 km long national highway 3500 lights saving 1.4 GWh per year	149 villages Small hydro ~575 kW Biomass ~115 kW, and solar photovoltaics
Source of emission reduction	Reduction in consumption of coke as fuel	Displacement of fossil fuel based grid power	Avoidance of methane production from the MSW dumped in	Reduction in consumption of fossil fuel based grid power	Displacing kerosene for lighting and diesel generating sets

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	<i>Actual projects under various stages of implementation</i>				<i>Case study</i>
	<i>Small-scale foundry</i>	<i>Small hydro</i>	<i>MSW to pellet</i>	<i>Municipal street lighting</i>	<i>Rural electrification</i>
Annual emission reduction (TCO _{2eq})	8302	49537	92256	1084	4408
Small-scale CDM project category*	Type II D	Type I D	Type III E	Type II C	Type I A
Baseline methodology	Appendix B: Type II D Article 3 & 4	Appendix B: Type I D Article 7 (b): System Average	Appendix B: Type III E Article 3	Appendix B: Type II C Article 4 & 5	Appendix B: Type I A Article 4
Monitoring methodology	Appendix B: Type II D Article 6 (a, b & c)	Appendix B: Type I D Article 9	Appendix B: Type III E Article 5	Appendix B: Type II C Article 8-10	Appendix B: Type I A Article 8(b)
Leakage	No leakage as per article 60 of Type II C	No leakage as per article 30 of Appendix B as it is a new project	No leakage as per article 94 of Type III E	No leakage as no equipment are transferred from another activity	No leakage as per article 30 of Appendix B as it is a new project
Application of methodology	Applicable for all cluster level SMEs (bricks, glass, etc.) engaged in energy efficiency in reducing existing fuel consumption by installation of new furnaces/ systems	Applicable for all grid-connected projects having net export of power from the state grid to the regional grid and projects whose implementation does not delay the implementation of mega power fossil power projects	Applicable for all MSW projects producing fuel out of the MSW and not accounting for emission reductions from fuel switching	Applicable for energy efficiency in lighting projects in industries, university campuses and housing colonies	Applicable for electrification of rural and remote areas deprived of any kind of access to power through a mix of renewable energy technologies

Issues related to CDM Implementation in India ...

- ▶ At present, the development of CDM projects is largely driven by consultants and/or by international donors. It is not self propelled.
- ▶ The CDM project cycle has still some unresolved issues.
- ▶ Higher transaction costs make smaller projects unviable. A CDM project has to generate **at least 4000 CERs per year** in order to cover transaction costs alone.
- ▶ For small scale projects with relevant perspective of sustainable development, the CDM implementation could be done under **Community Development Carbon Fund (CDCF)** by World Bank.

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- ▶ USA, which is the largest emitter of the GHGs and potentially could have been the biggest buyer of carbon credits (CERs), has neither ratified nor withdrawn from the protocol. The protocol is non-binding over the United States unless ratified.

Last Words

The Kyoto Protocol is designed to not only undo the climatic ill-effects of industrialization but also to identify the economic beneficiaries of the same and make them more accountable in damage control. It deserves high applause for its flexible approach and concern in letting the business and economies continue while doing the damage control.