

CLIMATE CHANGE & INDIA

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Greenhouse Gases: Origin

Carbon dioxide CO₂

- Fossil Fuels
- Cement Productions
- Deforestation

Coal : oil : gas : Hydrogen. nuclear
26 : 20 : 14 : 0

Methane

CH₄

- Wet Paddy
- Livestock
- Natural Gas flaring or leakage
- Coal Mines

CFC, aerosols, N₂O, Water Vapour, SO_x

Global Carbon Budget

Emitted	→	30	bt
Fossil Fuels	→	21	bt
Sink Capacity	~	15	bt
Accumulation	→	15	bt
Concentration	→	2752	bt
	→	27-30	bt
		(C Equiv.)	
Per Capita			
USA	→	21	t/cap
India	→	1	t/cap
Europe	→	9	t/cap
World Average	→	4	bt

**60% GHG
Reduction Required
to keep conc. to**



**Permitted emissions
11 to 15 bt in future**

Adaptation and Damages

- **Frequent storms, floods and other extreme events**
- **Change in cropping patterns**
- **Loss of livelihood from fishing and farming**
- **Uprooting and migration due to submergence**
- **Incur increased cooling costs.**

What does it mean in per capita terms?

Compared to an average Indian citizen, an average U.S.A. citizen consumes.

*Equiv. popn. of USA

6	times	Cereal	1470
4	times	Milk	980
52	times	Meat	12740
6	times	Fertilizers	1470
7	times	Cement	1715
6.4	times	Cotton & wood fabrics	1568
245	times	Copper	60025
22	times	Iron and Steel	5390
85	times	Aluminium	20825
54	times	Organic Chemicals	13230
28	times	Inorganic Chemicals	6860

Contd..

What does it mean in per capita terms?

Compared to an average Indian citizen, an average U.S.A. citizen consumes.

***Equiv. popn. of USA**

320	times	Cars	78400
102	times	Commercial Vehicles	24990
14	times	Solid Fuels	3430
61	times	Liquid Fuels	14945
227	times	Gas	55615
46	times	Electricity	11270
35	times	Total Energy	8575
27	times	Total Carbon dioxide	6615
		Emissions	

*** Equivalent USA population =**

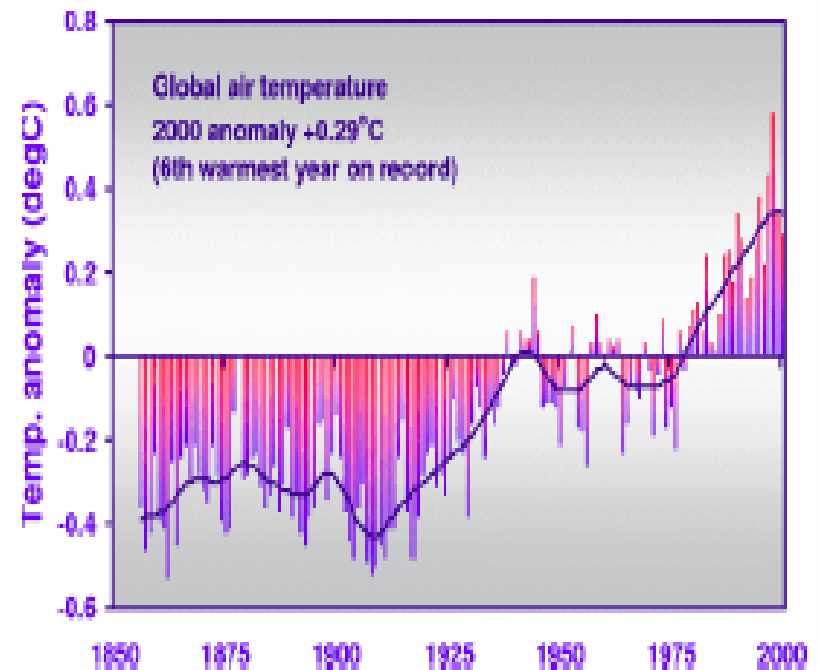
**population x
a commodity**

Per cap. cons. of USA

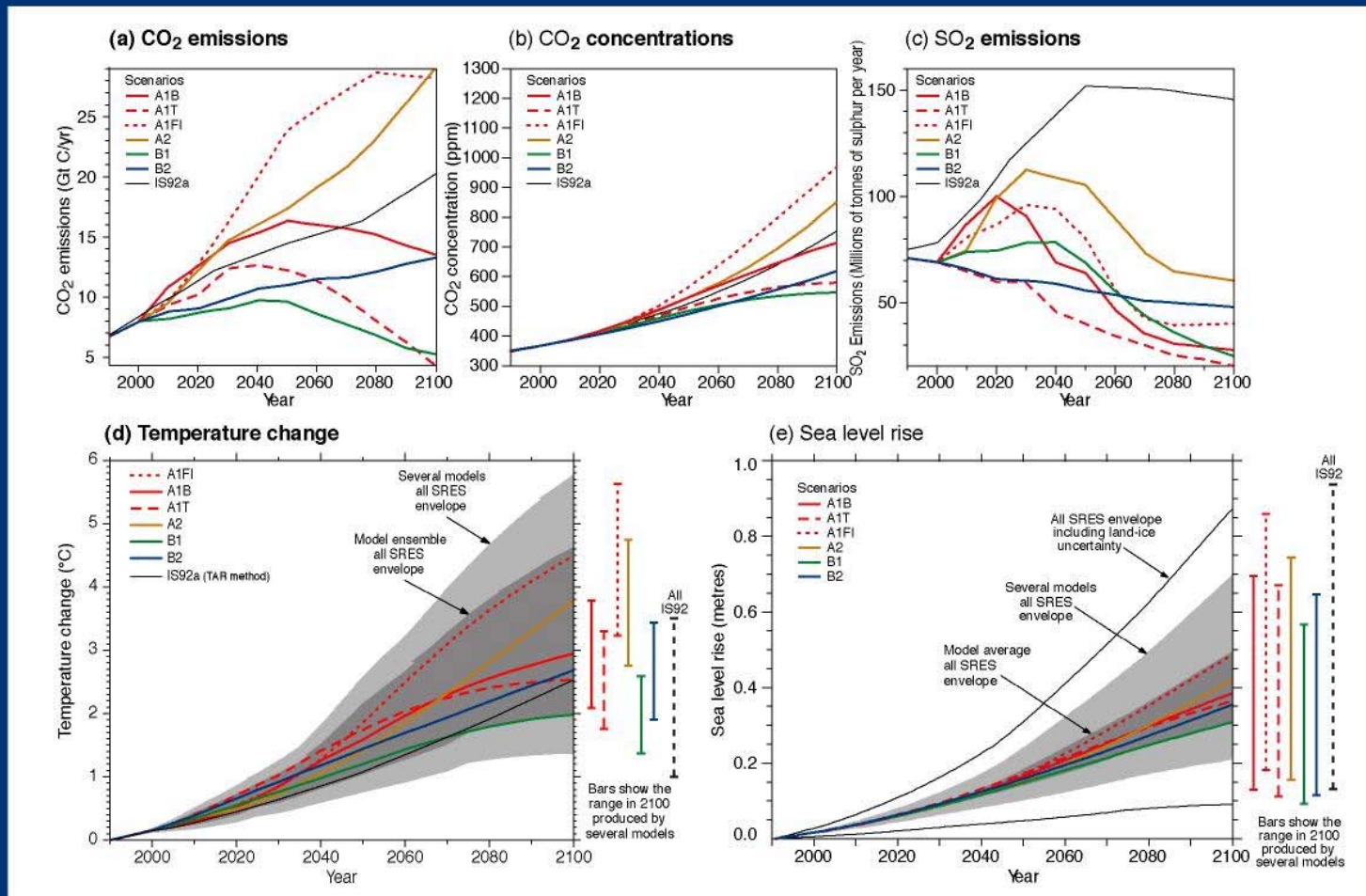
Per cap. cons. of India

GLOBAL CLIMATE CHANGE IN THE 20TH CENTURY

- global av. surface temperature has increased by 0.4°C to 0.8°C
- No set pattern in change in global precipitation in 20th century, however,
 - 0.5-1% increase in mid to high latitudes per decade
 - 0.2-0.3% increase per decade in over the tropics (10N-10S) decrease by 0.3% in sub tropical region (10N-30N)
- Global av. Sea level has risen between 0.1 - 0.2 m during 20th century per decade



The global climate of the 21st century



WG1 - SPM FIGURE 5

Some Questions Related to Climate Change

- **What should be the concentration of GHG that can be tolerated at different times by weaker sections of the world?**
- **By how much should emissions be reduced to achieve these chosen levels of tolerable concentrations?**
- **How should the burden of abatement be distributed, taking into account responsibility for current concentration and development needs?**
- **What kind of global and national policies will achieve the desired reductions of concentrations of GHG, and in turn the emissions?**
- **What should be the precautionary policies?**

INDIAN SCENARIO

Why should India be Concerned about Climate Change?

Risk of Lower Agricultural Production

- Without considering the carbon dioxide fertilization effects **yield losses for rice and wheat vary between 32 and 40%, and 41 and 52%, respectively (Kumar and Parikh (2001a))**
- **GDP would drop by 1.8 to 3.4% (Kumar and Parikh (2001a))**
- With a temperature change of +2°C and an accompanying precipitation change of +7 %, farm level total net-revenue would fall by 9%, whereas with a temperature increase of +3.5°C and precipitation change of +15%, the fall in farm level total net-revenue would be nearly 25 %. (*Kumar and Parikh (2001a)*)

Why should India be Concerned about Climate Change?

Risk of Sea Level Rise

- Total area of 5763 km² along the Coastal States of India - ***0.41% could be inundated*** and almost ***7.1 million - 4.6% of coastal population could be affected*** for one meter sea level rise (*TERI, 1996*)
- Intrusion of sea-water in the ground water.
- Temperature can reduce agricultural and fishing incomes.
- One-meter sea level rise it would displace 7 million persons in India (*ADB, 1995*).

Risk of Extreme Events

In the cyclone in Andhra Pradesh in India in 1996, more than 1,000 people died and there was huge property loss.

Percentage share of coal in total energy consumption in the major coal consuming sectors

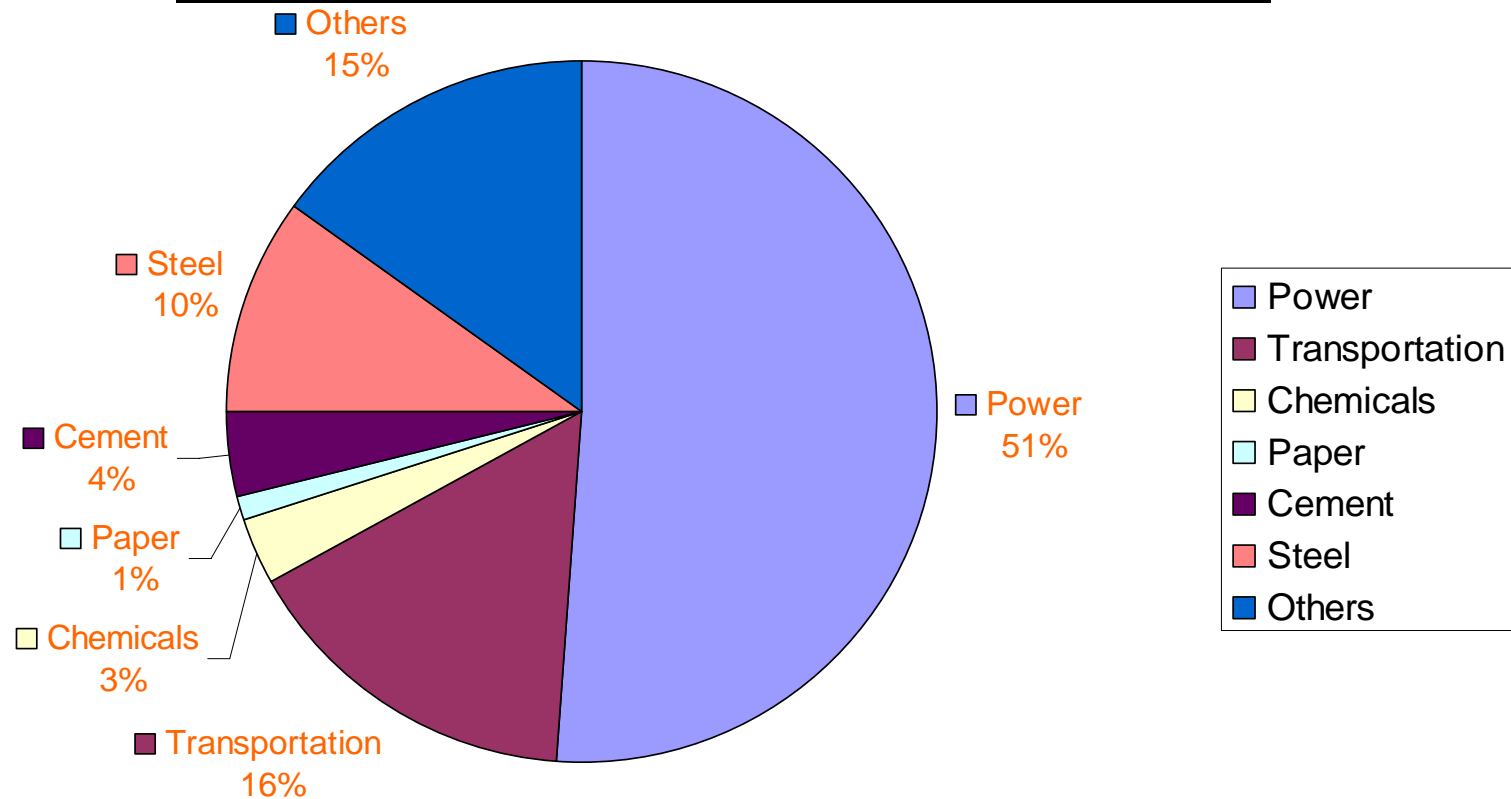
Year	1980	1985	1990	1993
Power	81.3	87.6	89.6	90.9
Transport	30.7	19.4	7.7	4.5
Industry	73.0	68.5	64.7	63.6
Economy	44.9	41.3	35.6	34.8

Data Sources:

1. Coal Directory of India, (1993-94), Coal Controller of India, Ministry of Coal
2. Monthly Abstract of Stry of Planning and Implementation
3. Operational Statistics, 1994-95, Coal India Ltd., Coal Directory of India, Coal Controller of India, Ministry of Coal
4. Annual Survey of Industries, (1979-80 to 1993-94), Central Statistical Organization, GOI
5. United Nations Energy Statistics Yearbook.

Beneficiary Sectors-Potential

INDIAN INDUSTRIAL SECTOR : CARBON DIOXIDE EMISSIONS



Carbon Dioxide emission as of the year 1995

SOURCE : HANDBOOK OF STATISTICS 1998

Impact of Climate Change

- **FCCC** - ensure that food production is not threatened
- **Rosenzweig & Parry** - signi. Adverse impact on developing countries
- **Parikh J & Kavikumar** - A more detailed study of Indian Agriculture

Rice Yield

ΔT 2.5°C to 4.9 °C

-15% to -42%

Wheat Yield

(Without carbon fertilization effect)

-25% to -55%

- **With fertilization** smaller but similar impact
- With adaptation**

$\Delta T + 2^\circ\text{C} + 7\%$ Precipitation $\text{GDP}_{\text{Agri}} \downarrow 7\%$

$\Delta T + 3.5^\circ\text{C} + 15\%$ Precipitation $\text{GDP}_{\text{ag}} \downarrow 25\%$

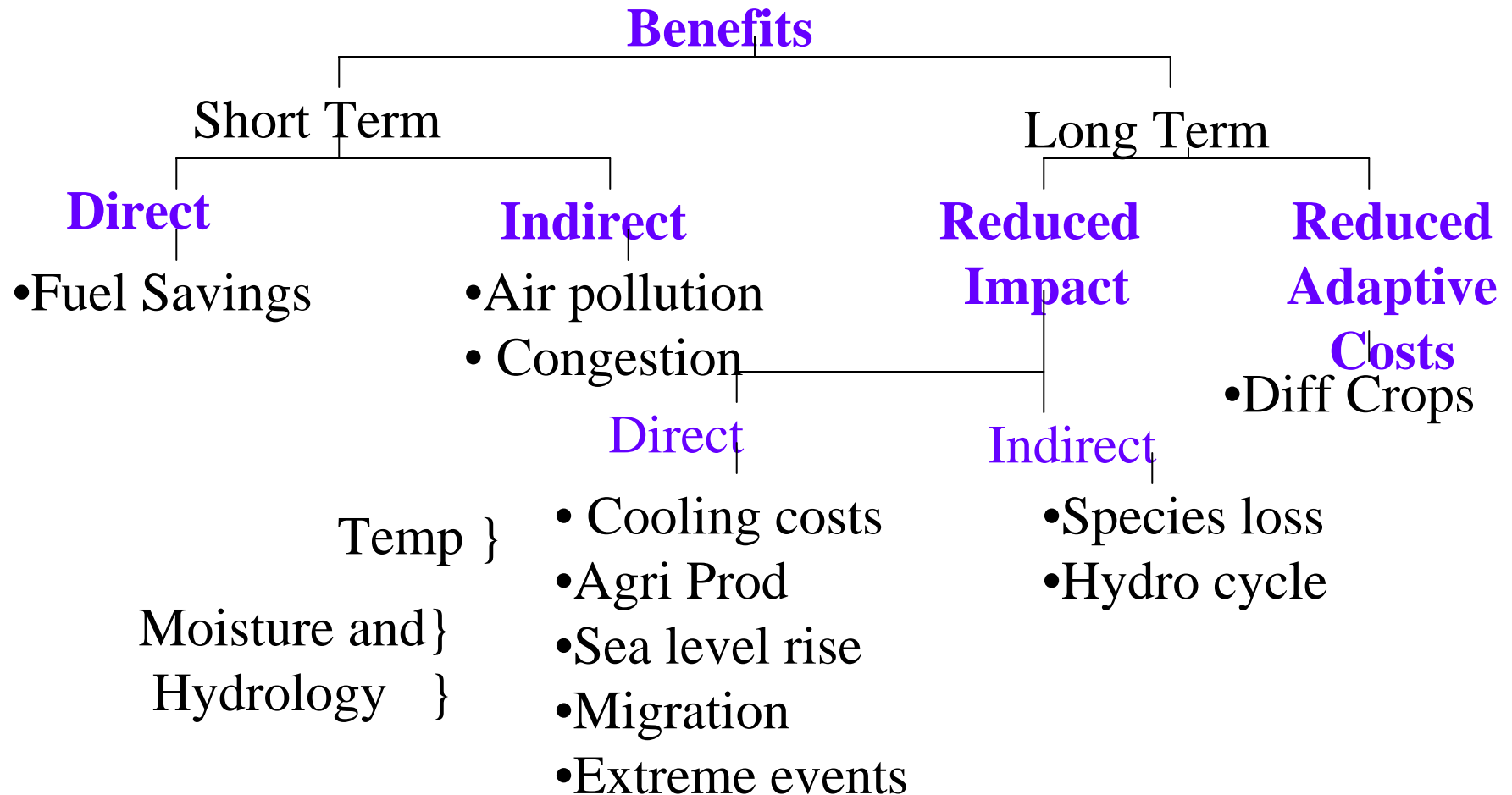
\Rightarrow Poverty $\uparrow \Rightarrow$ Hunger \uparrow

Adaptive Strategies

-- Socioeconomic

- **Training and general education**
- **Identification of vulnerabilities**
- **Examining “robustness” of farming strategies**
- **Interaction between farmers and researchers**
- **Food programs and social security programs**
- **Improvement of transportation and distribution infrastructure**
- **Changes in policies that generate market inefficiencies**

BENEFITS OF GHG MITIGATION



What India is Doing to Reduce GHG Emission?

Direct and Indirect Efforts:-

- **Emphasis on Energy Conservation**
- **Promotion of Renewable Energy**
- **Abatement of Air Pollution**
- **Afforestation and Waste Land Development**
- **Economic Reforms, Subsidy Removal**
- **Fuel Substitution Policies**

Institutional Set Up

- **Petroleum Conservation Research Centre (PCRA)**
 - To reduce oil import
 - Oil exploration, production, refining
- **Energy Management Centre (EMC)**
 - Training, research, implementation
- **Power Finance Corporation (PFC)**
 - Improve supply side efficiencies
- **Ministry of Non-conventional Energy Sources (MNES)**
 - Energy conservation

Measures taken

- **Motivation for implementation of energy efficient options**
- **Afforestation and Wasteland Development**
 - **Programmes of afforestation supported by government**
 - **Rate of deforestation has decreased in the 1990's**

International mechanism followed in India

India signed the United Nations Framework Convention on Climate change (UNFCCC) on ***June 10, 1992*** and ***ratified it on November 1, 1993.***

It ratified the ***Kyoto Protocol in on August 26, 2002*** and hosted the eighth Conference of the Parties to the UNFCCC in October 2002 in Delhi.

The Kyoto Protocol commits developed countries (Annex 1) to reduce their overall greenhouse gas (GHG) emissions by 5.2% by 2008-2012

Mechanisms under the Kyoto Protocol

Joint implementation (JI)

Annex I Parties to implement projects that reduce emissions, or remove carbon from the atmosphere, in return for emission reduction units (ERUs).

Clean Development Mechanism (CDM)

Annex I Parties to implement project activities that reduce emissions in non-Annex I Parties, in return for certified emission reductions (CERs).

Emission Trading

provides for Annex I Parties to acquire units from other Annex I Parties and use them towards meeting their emissions targets under the Kyoto Protocol.

What is CDM?

- CDM is one of the flexible mechanisms of *Kyoto Protocol*.
- Under CDM, an industrialized country with a GHG reduction target (an Annex B country) can invest in a project in a developing country without a target (Non-Annex B) and *claim credit for the emissions* that the project achieves.
- CDM provide cost effective reduction.
- CDM also assist developing countries in achieving sustainable development.

Possible CDM Projects

- **Energy efficient technologies**
- **Modernize power systems**
 - **Reduce losses**
 - **Efficient power plants**
- **Reduction of methane emissions**
 - **Gas flaring**
 - **Gas leakages**
 - **Coal mines safety**
- **Harvest methane from sewage**
- **Improve ruminant digestion**
- **Reduce biomass burning**
 - **Cooking stoves**
 - **Brick & charcoal kilns**
- **Less C. intensive techs in transport, industrial and agricultural sectors**

National CDM Authority

- Secretary (E&F) Chairman
- Foreign Secretary
- Finance Secretary
- Secretary, DIPP
- Secretary, MNES
- Secretary, MOP
- Secretary, Planning Commission
- Joint Secretary (CC), MoEF
- Director (CC), MoEF Member Secretary

Types of Projects approved

■ Biomass/ Cogeneration	33
■ Industrial Processes/ Energy Efficiency	33
■ Municipal Solid Wastes	1
■ Fuel Switching	6
■ Renewables'	17

Projects State-wise

AP	8	Maharashtra	2
Chattisgarh	3	MP	2
Gujarat	4	Orissa	6
HP	4	Punjab	5
Rajasthan	2	Rajasthan	12
Jharkhand	3	TN	8
Karnataka	16	UP	8
WB	5	Utranchal	2

Potential in Renewables

<i>Technology</i>	<i>Potential</i>	<i>Cum. Installation upto March 31, 2003</i>
Wind Power	45000 MW	1870 MW
Small Hydropower (< 25 MW)	15000 MW	1509 MW
Biomass	19500 MW	484 MW
Energy from Waste	1700 MW	26 MW
Solar photovoltaic		121 MWp

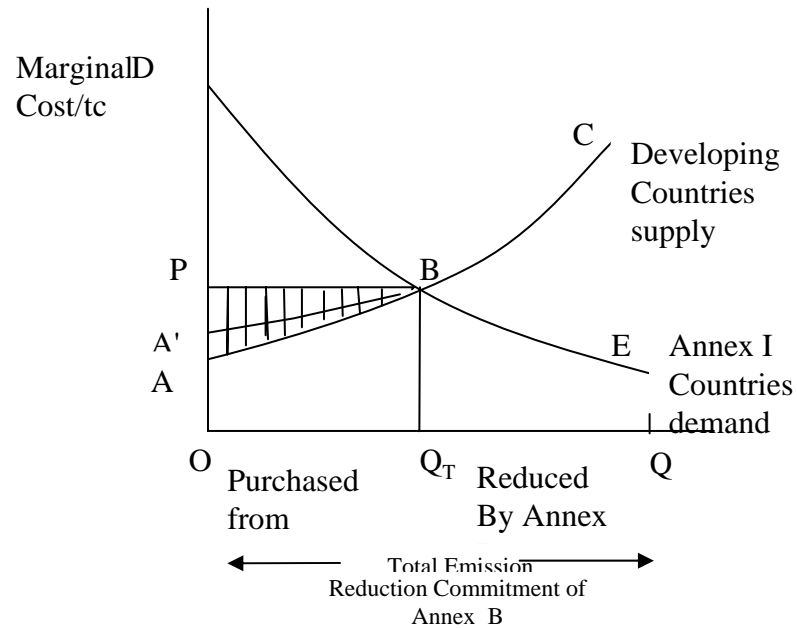
Wider Benefits of the CDM Instrument for All Countries

- *Mobilize capital* for investments to a more productive and less carbon-intensive economy
- Stimulate the combined *participation of the public and private sector* (*PPP models*)
- Provide a tool for *Technology Transfer*
- Help define investment priorities aligned with *Sustainable development* principle

Barriers

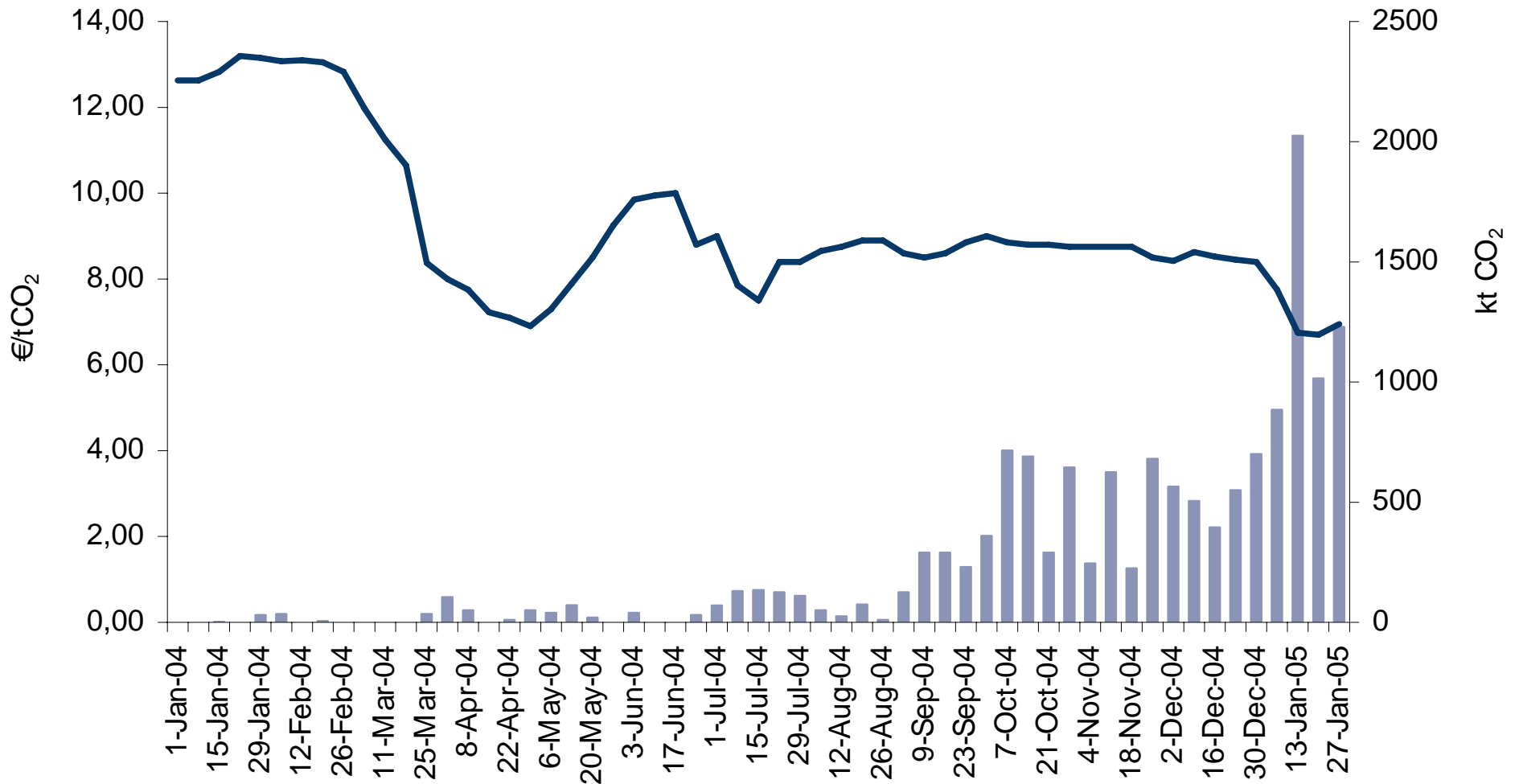
- Investment barrier
- Technological barrier
- Barrier due to prevailing practices
- Lack of awareness
- Risks and transaction costs.

Carbon Trading : Who Gains What?



- Under a competitive market at B, Q_T will be traded at market price P
- Developing Countries would get producer surplus of AB/P
- Annex B countries will get consumer surplus of PDB
- In a bilateral project by project negotiation developing countries are likely to get only AA'B. (see text)

CARBON PRICE MARKET TREND



Source: Point Carbon's Carbon Market Indicator

■ Volume — EUA 2005

Thanks you...!!!