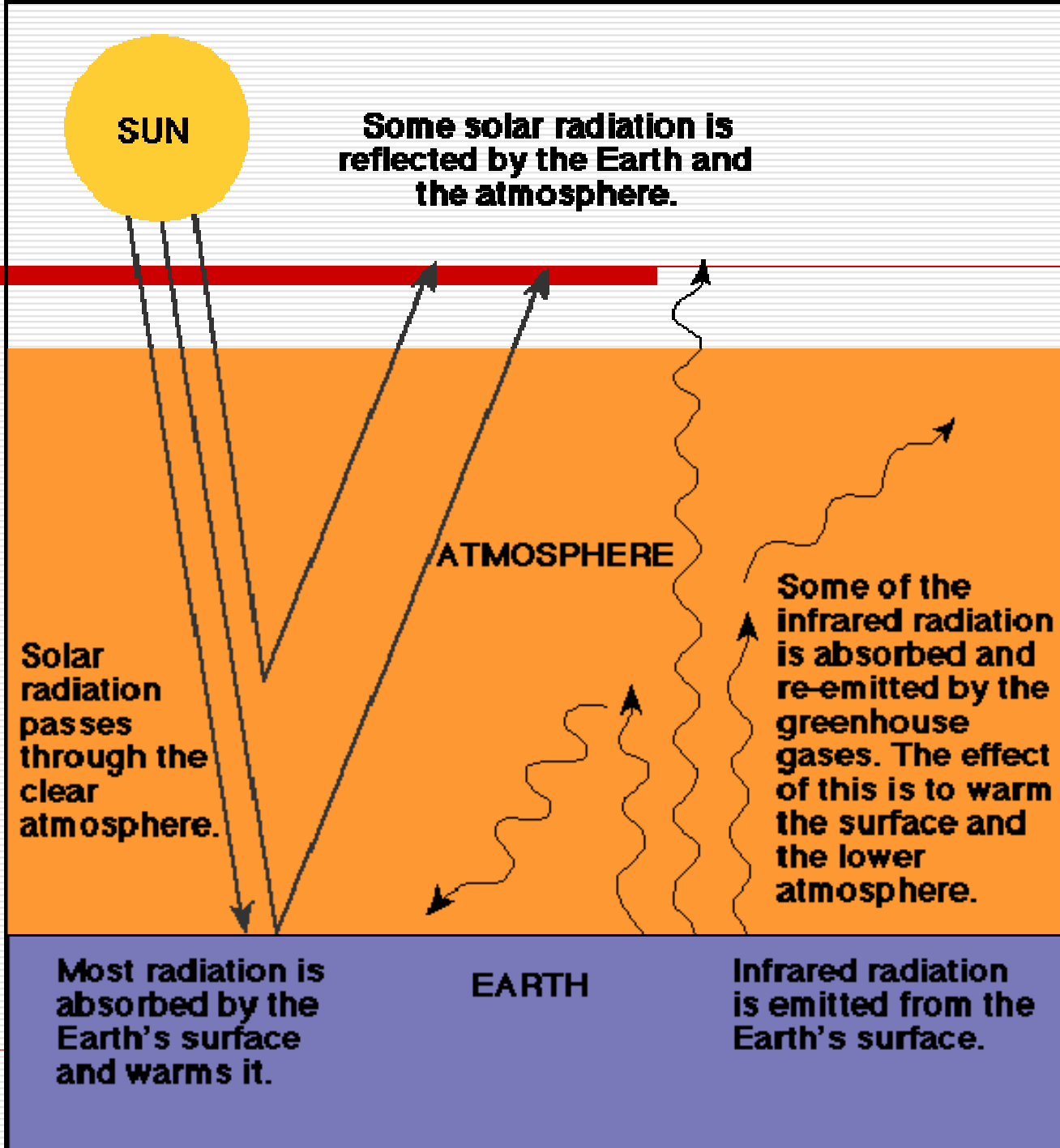


Implications of Climate Change for Indian Industry

Prodipto Ghosh, Ph.D
Distinguished Fellow
The Energy and Resources Institute
12 August 2007

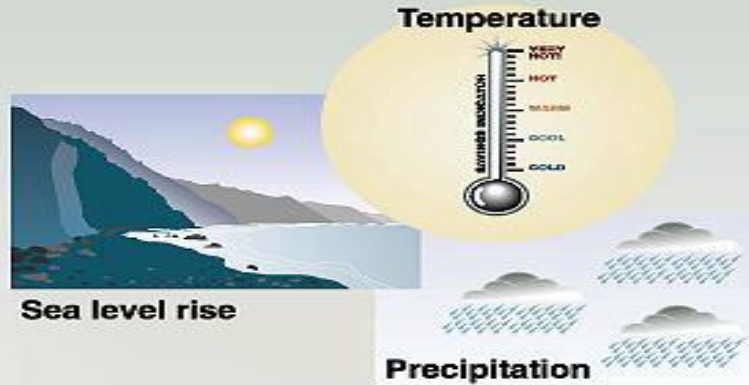
What is anthropogenic climate change?

- Suite of gases (CO₂, CH₄, N₂O, etc,) emitted from various economic activities: Fossil fuel use, wet paddy cultivation, cattle raising, fertilizer use, etc.
- Growing (but not mature) forests absorb (“sequester”) CO₂, the major GHG
- Increasing concentrations of these gases in the atmosphere have same effect as a greenhouse, hence “Greenhouse gases” (GHGs). The resulting increase in temperature may impact many climate parameters



Likely Impacts of Climate Change

Potential climate changes impact



Impacts on...

Health



Weather-related mortality
Infectious diseases
Air-quality respiratory illnesses

Agriculture



Crop yields
Irrigation demands

Forest



Forest composition
Geographic range of forest
Forest health and productivity

Water resources



Water supply
Water quality
Competition for water

coastal areas



Erosion of beaches
Inundation of coastal lands
additional costs to protect coastal communities

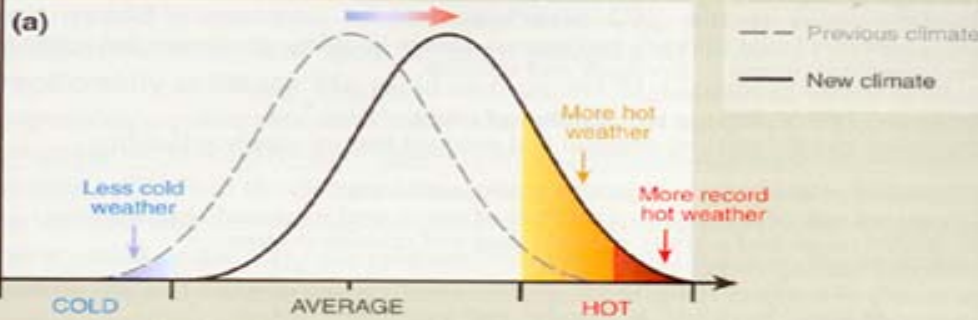
Species and natural areas



Loss of habitat and species
Cryosphere: diminishing glaciers

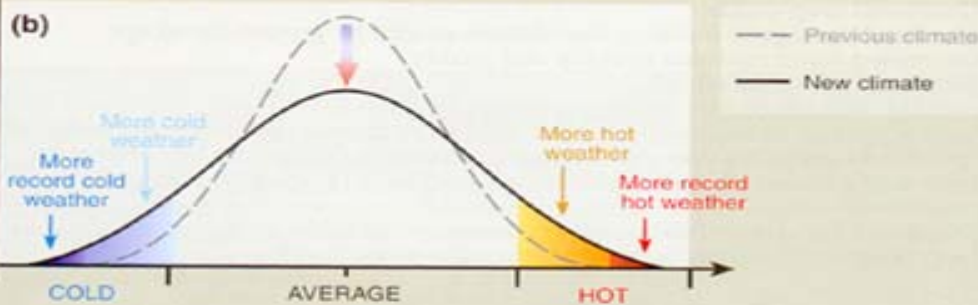
Probability of occurrence

Increase in mean temperature



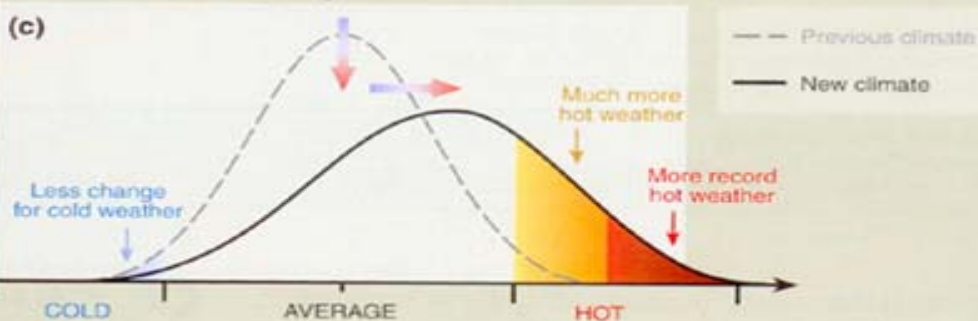
Probability of occurrence

Increase in variance of temperature



Probability of occurrence

Increase in mean and variance of temperature

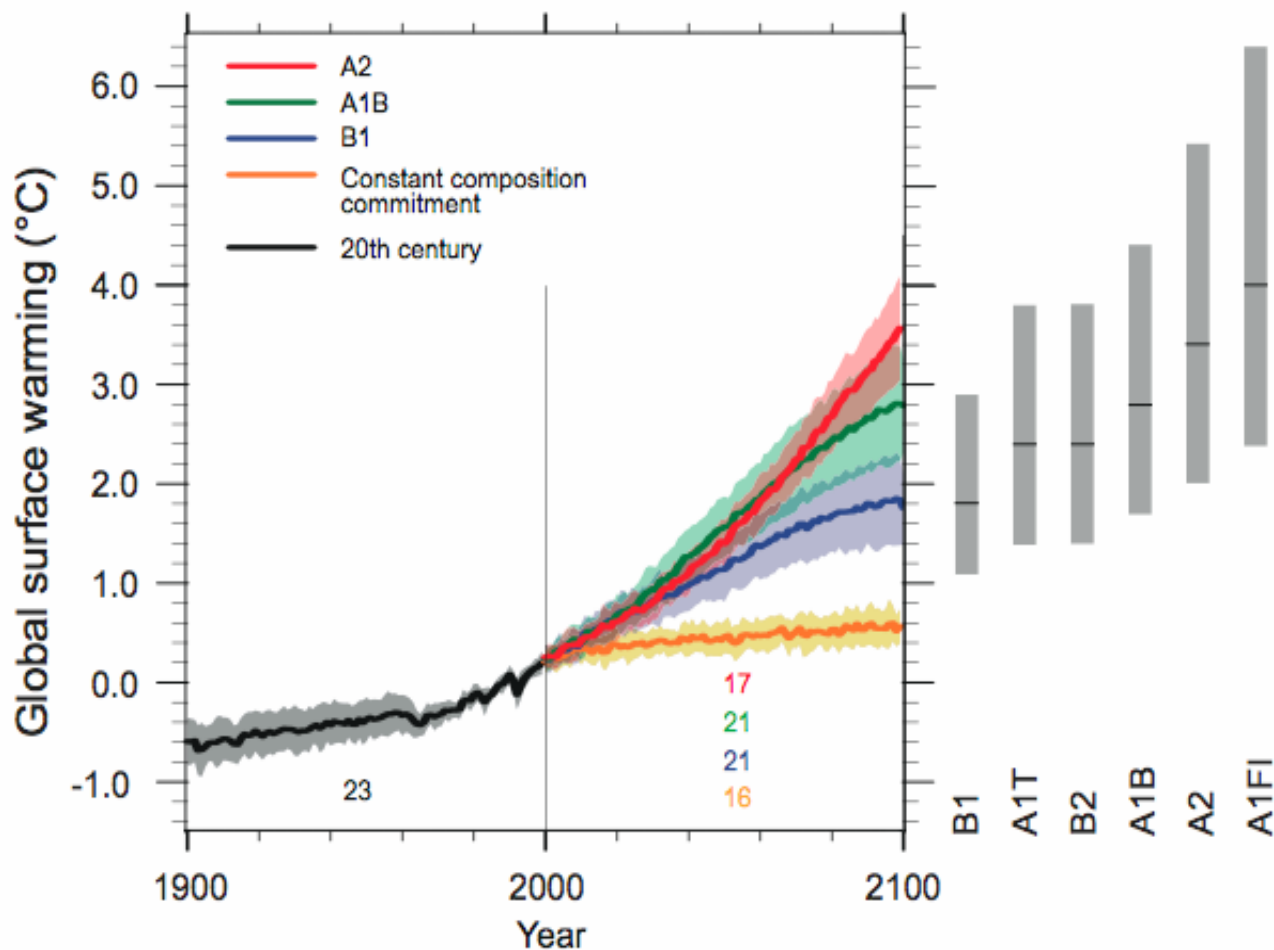


Difference between natural climate variability and anthropogenic climate change

Projections of Future Changes in Climate

Across all scenarios, average warming is 0.2°C per decade

Committed warming averages 0.1°C per decade for next two decades



Structure of Global Climate Change Regime

The UN Framework Convention on Climate Change, 1992

- ❑ The UNFCCC set forth certain principles for addressing climate change by a global effort, in particular, that of “common but differentiated responsibilities” of countries; that development is the foremost concern of developing countries, etc.
- ❑ It also gave a “soft target” for industrialized countries (Annex I Parties) to return to 1990 levels of GHG emissions by 2000
- ❑ All major countries, inc. US, EU, India, China, have ratified the Convention

Kyoto Protocol, 1997:

- ❑ Legally binding Protocol setting out:
- ❑ Targets for GHG reductions by individual industrialized countries during “first commitment period”, 2008-2012, totaling 5.2% below their aggregate 1990 emissions; actual percentages vary by Party
- ❑ US, Australia have not ratified; EU, China, India, Brazil are Parties (Total 161 Parties)
- ❑ Negotiations are to commence in Dec 2007 for post-2012 regime, enormous pressure on China, India, Brazil to take some form of GHG commitments

The Clean Development Mechanism

Kyoto Protocol Provides For

□ Three Mechanisms

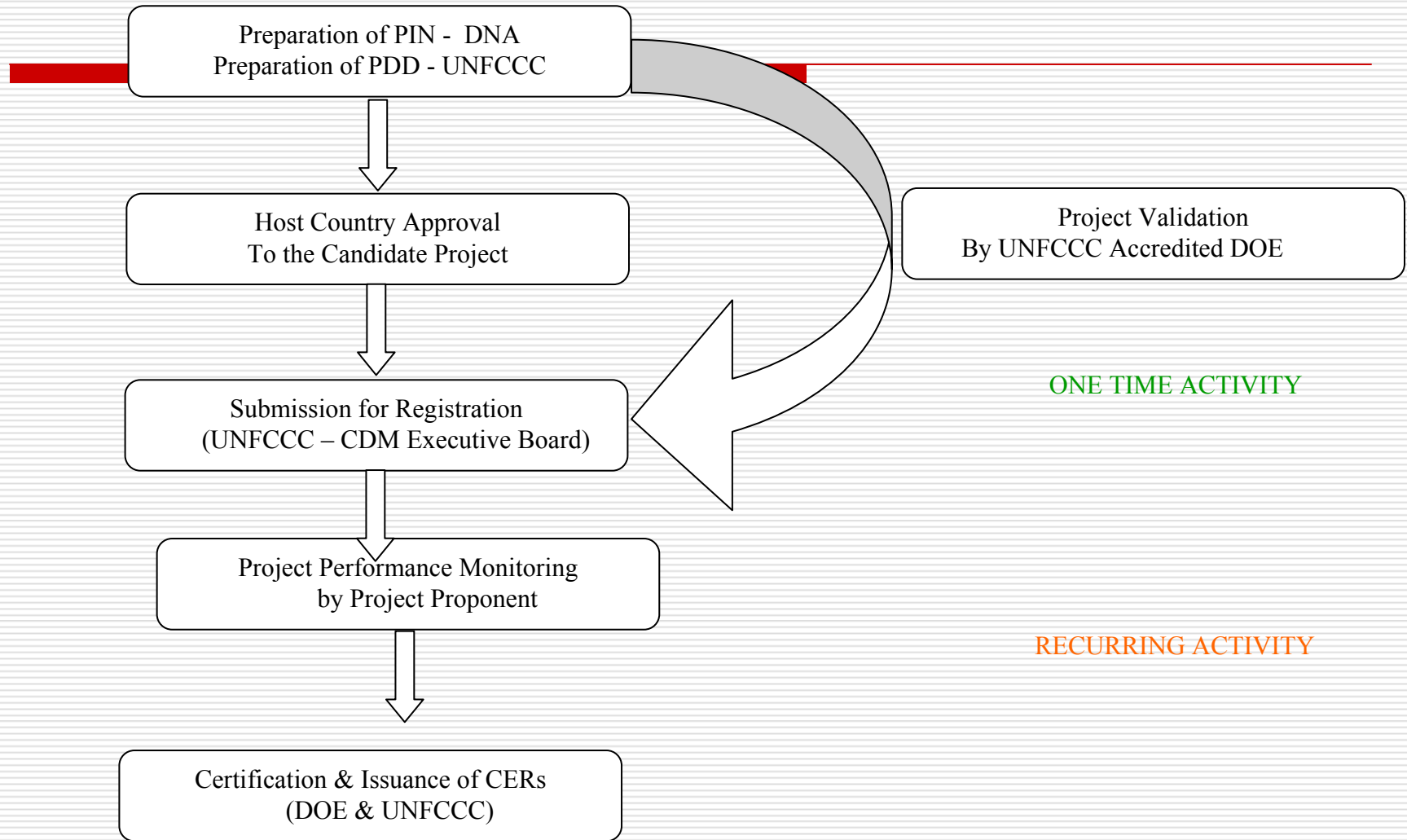
- Clean Development Mechanism
(applicable to developing countries)
- Joint Implementation
- Emissions Trading

➤ In addition, several voluntary mechanisms for carbon trading exist outside the Kyoto Framework

How does the CDM work?

- Any entity (foreign, domestic, joint venture, public, corporate, non-profit) may set up a project to produce any good (e.g. steel) or any service (e.g. transportation), and –C, in a developing country
- Certified Emissions Reductions [CERs] are issued by CDM Executive Board. These can be traded in a global market. Final user is a developed country with GHG abatement commitments

CDM Project Cycle



National CDM Authority

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

Host Country Approval

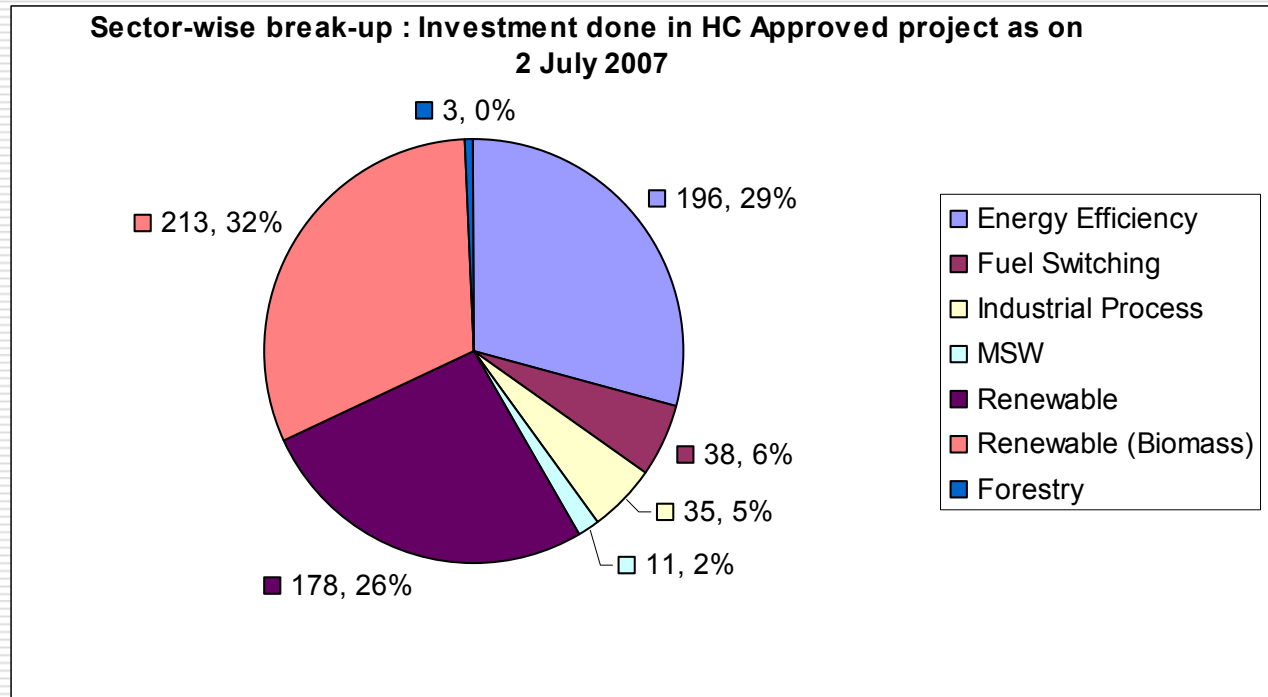
- Emissions Additionality (actual reductions in CO₂e will be enabled by project design)
- Sustainable Development: criteria to be determined by host country (economic, social, environmental)

Type of projects

- Renewable energy (Wind, Biomass, Solar, Hydro)
- Switching to Alternate Fuels
- Energy Efficiency
- Waste Management
- Industrial Process
- Agriculture
- Carbon Sequestration in Forests

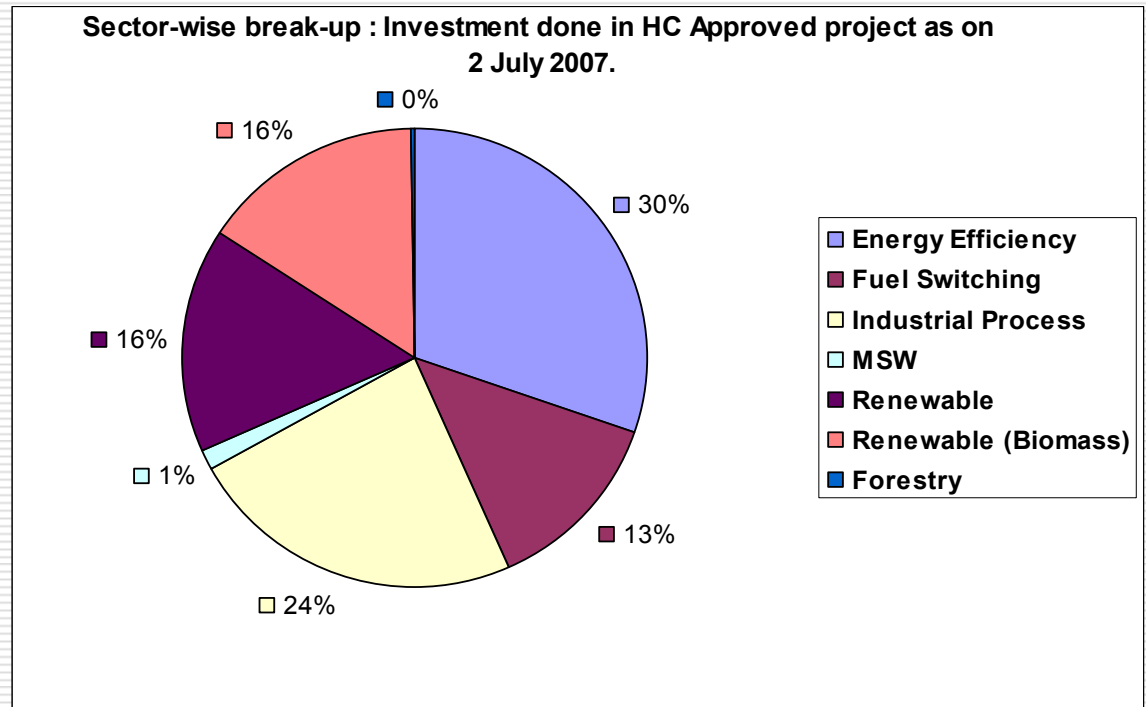
Portfolio of Indian Nationally Approved (DNA) CDM Projects

Sectors	No. of Projects
Energy Efficiency	196
Fuel Switching	38
Industrial Process	35
MSW	11
Renewable	178
Renewable (Biomass)	213
Forestry	3
Total	674

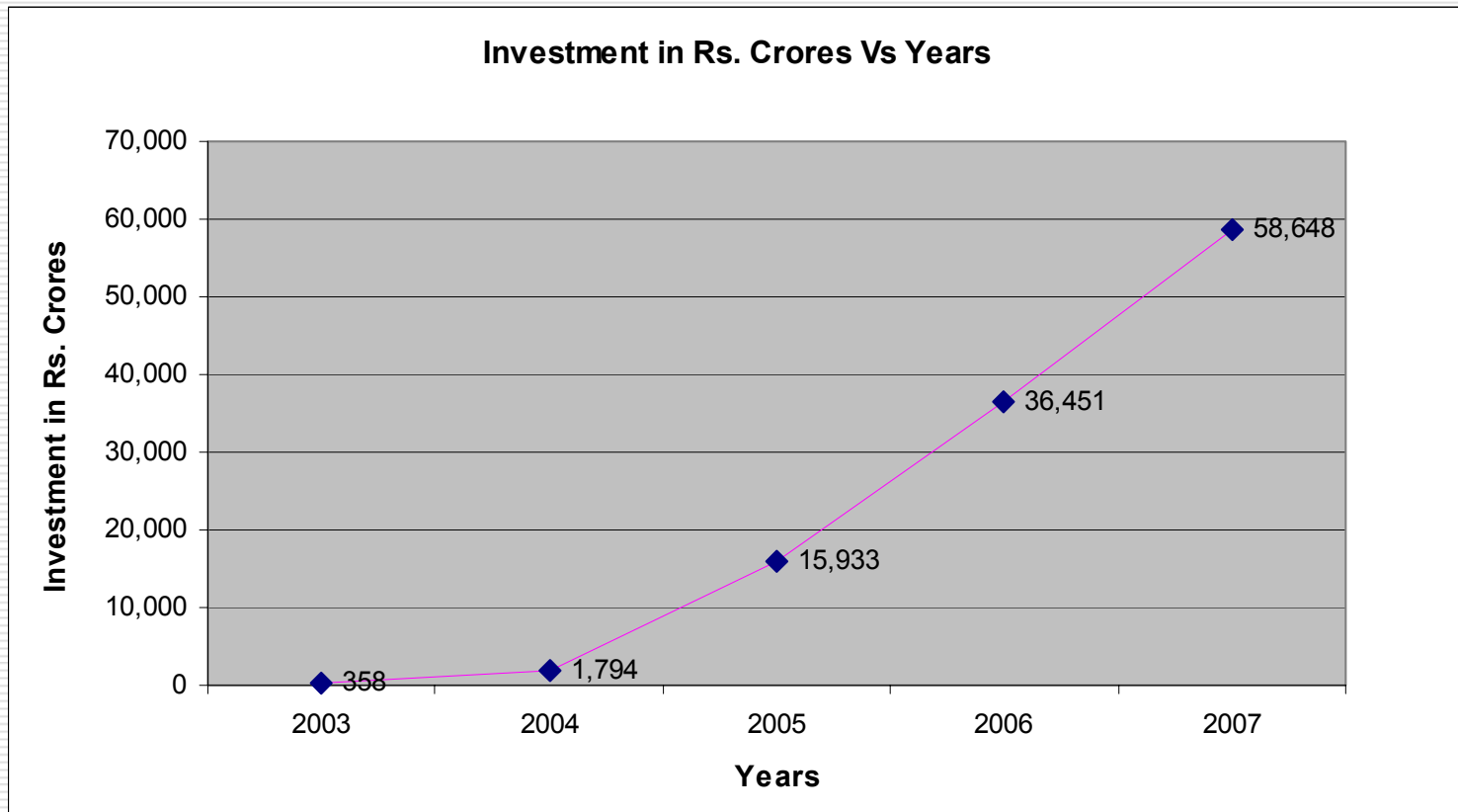


Sector-wise break-up : CERs expected till 2012 from Indian Nationally Approved projects as of 2 July 2007

Sectors	CERs
Energy Efficiency	123,322,201
Fuel Switching	53,569,950
Industrial Process	97,406,038
MSW	4,866,160
Renewable	64,609,075
Renewable (Biomass)	64,198,156
Forestry	960,051
Total	408,931,631

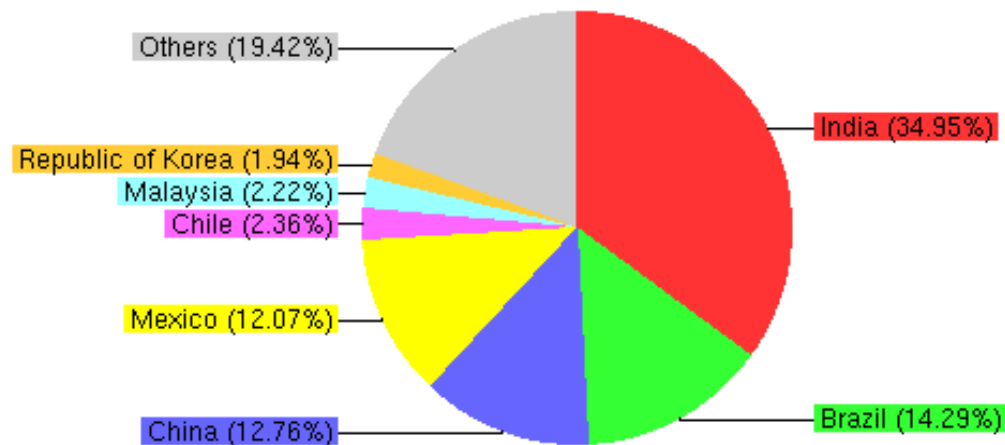


Potential Investment in Indian Nationally Approved CDM Projects



International Comparisons of UNFCCC Approved CDM Projects

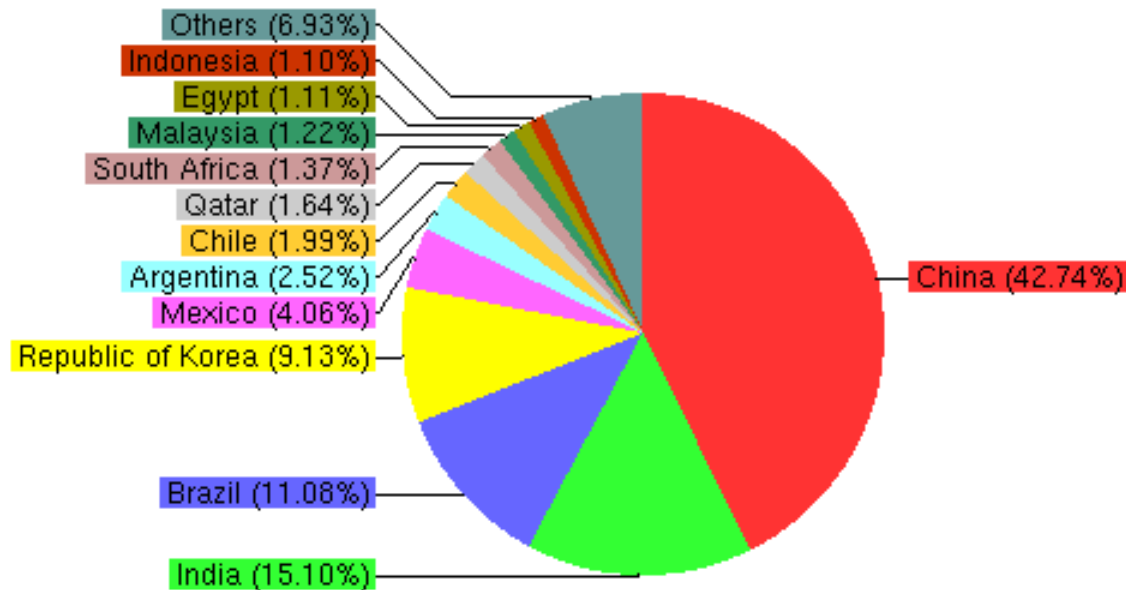
Registered project activities by host party. Total: 721



<http://cdm.unfccc.int> (c) 02.07.2007 16:56

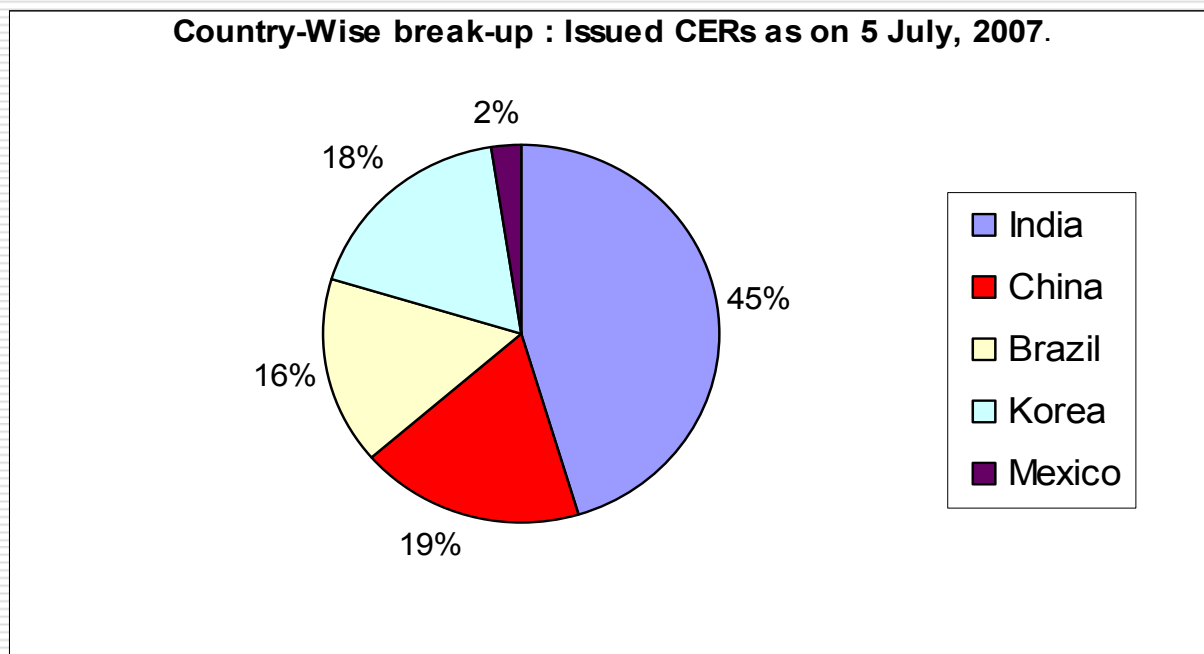
Expected Annual Average CERs

Expected average annual CERs from registered projects by host party. Total: 152,375,647



Actual Issued CERs

Country	Issued CERs
India	26,413,301
China	10,860,618
Brazil	9,265,117
Korea	10,476,712
Mexico	1,454,710



Challenges

- ❑ CMM, CBM, MSW, SME and PSUs/Govt Depts potential largely untapped so far
- ❑ Afforestation and Bio-diesel offer opportunities for Community CDM Projects
- ❑ Active Financial institutions participation in CDM market with innovative financing models (SBI has been the most pro-active)
- ❑ Most projects so far have been relatively small scale
- ❑ Bundled SME projects
- ❑ Programmatic CDM projects (e.g. CFLs)

The Global Carbon Market

Global Carbon Market

- Two types:
- **Allowance based transactions:**
under various “cap & trade” schemes:
AAU (KP) and EU-ETS
- **Project based transactions:** CDM
(CERs), JI (ERUs), and suppliers
under various voluntary schemes

Compliance buyers

- ❑ European private traders under EU-ETS
- ❑ Govt buyers for Kyoto compliance
- ❑ Japanese cos. For voluntary compliance under the Keidanren Voluntary Action Plan
- ❑ US MNCs in Japan/Europe or preparing in advance for the Regional GHGs Initiative in US NE States or California Assembly Bill 32

Compliance buyers...

- ❑ Power retailers/large consumers under NSW market in Australia
- ❑ North American Cos. with voluntary but legally binding compliance in Chicago Climate Exchange (CCX)
- ❑ *Retail segment* selling emissions redns to individuals/cos. seeking to offset their carbon footprints (non-compliance)

Volumes and Values: Allowance Based Transactions

Market	2005 Volume (MTCO₂e)	2005 Value (US\$ mill)	2006 Volume (MTCO₂e)	2006 Value (US\$ mill)
EU-ETS	321	7,908	1.101	24,357
NSW	6	59	20	225
Chicago Climate	1	3	10	38
UK-ETS	0	1	na	na
Total	328	7,971	1.131	24,620

Volumes and Values: Project Based Transactions

Source	2005 Volume (MTCO₂e)	2005 Value (US\$ mill)	2006 Volume (MTCO₂e)	2006 Value (US\$ mill)
Primary CDM	341	2,417	450	4,813
Secondary CDM	10	221	25	444
JI	11	68	16	141
Other compliance	20	187	17	79
Total	382	2,894	5078	5,477

Important information/data sources

- ❑ www.unfccc.int : website of UN Framework Convention on Climate Change providing detailed information on CDM projects approved and under consideration
- ❑ Other websites for carbon market information:
 - www.newenergyfinance.com
 - www.carbon-financeonline.com www.pointcarbon.com
 - www.iisd.ca
 - www.ecosystemmarketplace.com
 - <http://cd4cdm.org>
 - www.iied.org/CC/projects
 - www.rggi.org/documents.htm
 - www.energy.ca.gov/2005publications/CEC-600-2005-025-025.PDF
 - www.IETA.org



Thank You

Implications of domestic regulatory instruments for GHG abatement

Domestic Instrument: Carbon Tax

- ❑ Indirect tax on carbon content of fossil fuels imposed (coal, oil, natural gas)
- ❑ Two possible forms:
 - Revenue Neutral: Rescaled (or eliminated) Central level indirect taxes and carbon tax rates together would not exceed revenues from current yields
 - Revenue Positive: Add on to current Central level indirect taxes and increase revenue yields

Carbon tax...

- Economy-wide implications of a carbon tax are extremely difficult to predict without a properly validated and calibrated computable general equilibrium (CGE) model
- Such a model is not available (but soon will be under a project of NCAER and Min of Environment & Forests)

Carbon tax...

- ❑ In the long-run:
- ❑ In general, energy intensive sectors may become less competitive globally
- ❑ Among these, gas based, oil based, and coal based will be adversely impacted in ascending order
- ❑ There may be adverse impacts on GDP growth and rise in interest rates (as energy is substituted by capital); effects on wage rates are difficult to guess at

Carbon tax...

- ❑ In the short-medium run:
- ❑ There may be stranded assets as the cost assumptions on which projects were implemented are altered
- ❑ In respect of sectors with regulated tariffs (e.g. power), settled issues would be re-opened

Domestic GHG regulation...

- ❑ The CDM already provides an *incentive based* instrument for GHGs reduction, without national fiscal expenditures
- ❑ The proper course would be to further deepen CDM implementation, both through international and national initiatives
- ❑ There is currently no multilateral requirement for India to undertake GHG regulation – our attempt must be to ensure that this situation continues to prevail after 2012