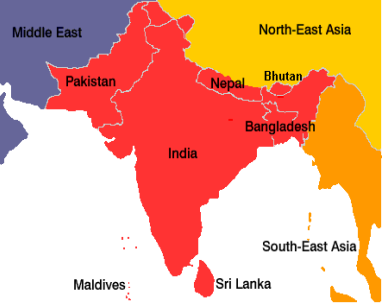

COP11 and COP/MOP1 side event
Global Challenges Toward Low-Carbon Economy
-Focus on Country-Specific Scenario Analysis-
December 3, 2005 Montreal

Low Carbon Scenarios for India to 2050

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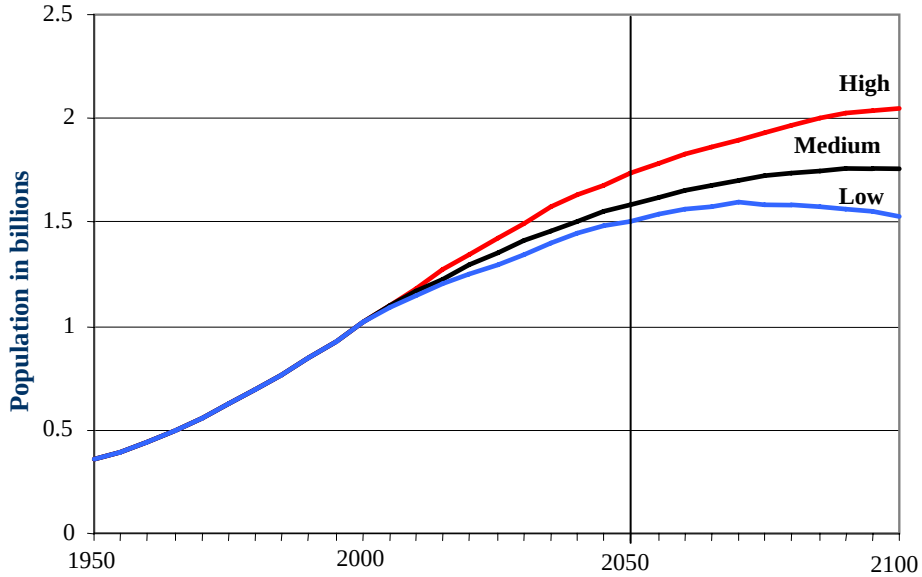
Drivers of Future Emissions

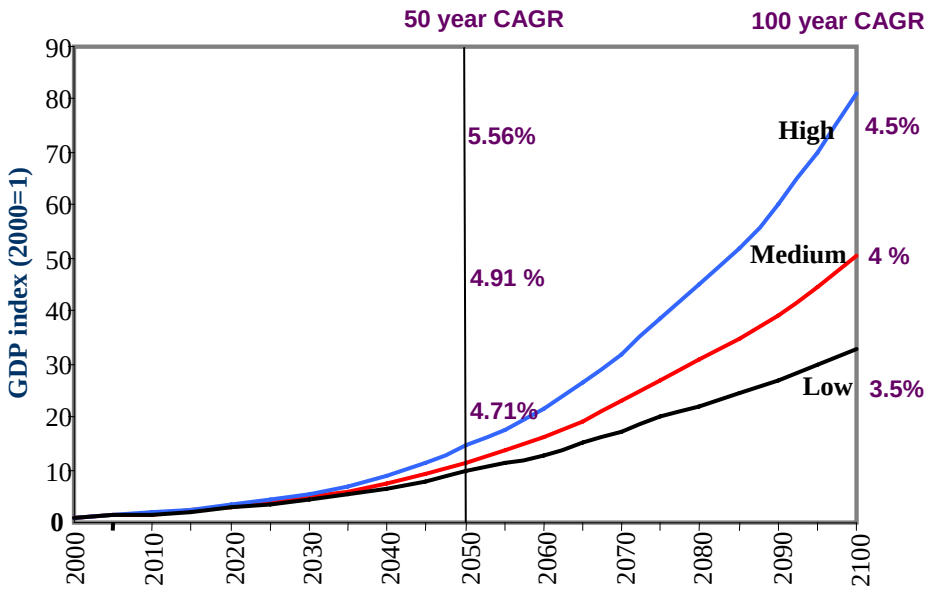
Conventional Drivers

- Population
- Economic Growth
- Energy Resources
- Technologies

Population



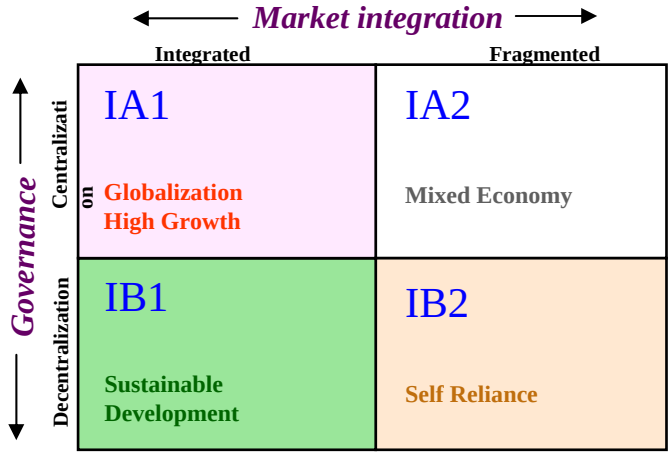
Economic Growth

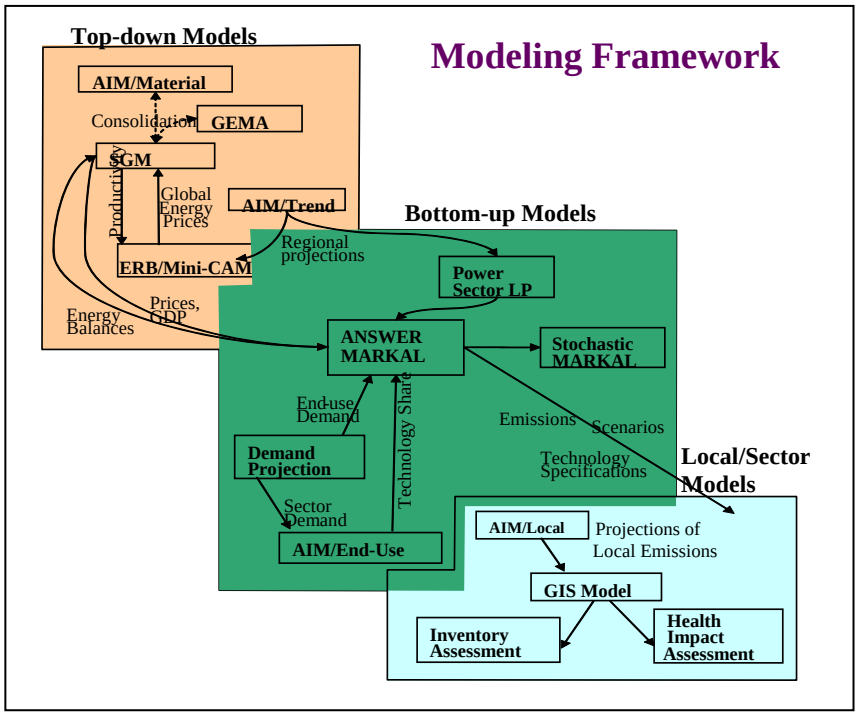


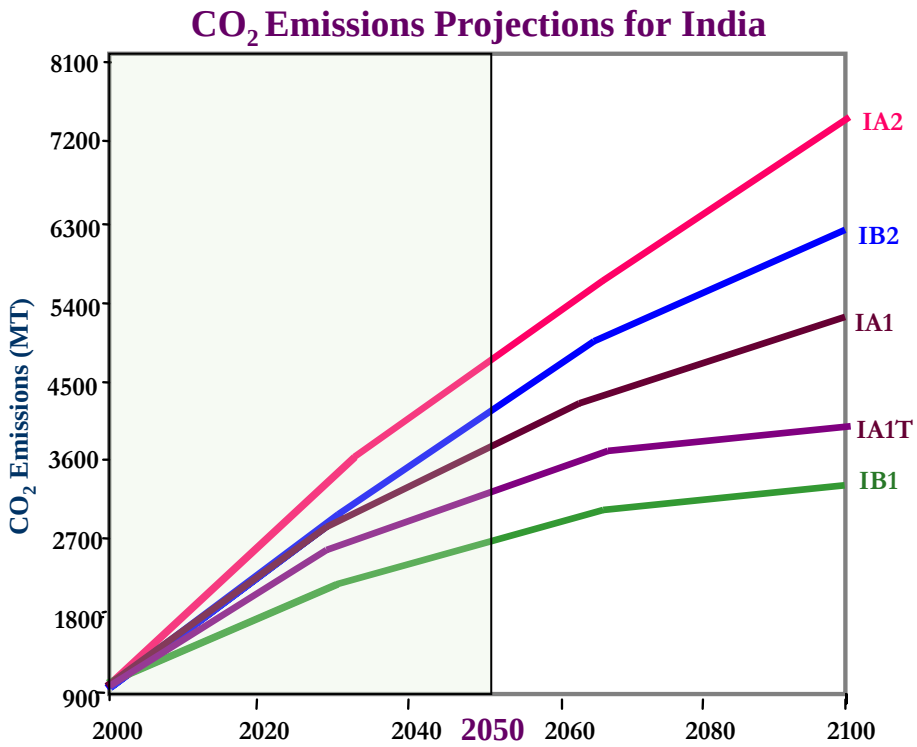
Emerging Drivers for Developing Countries

- Transition Processes (Lock-ins)
- International Labor Markets
- Human Capital
- Knowledge Flows
- Governance (Risks, Investments)

Indian Emissions Scenarios

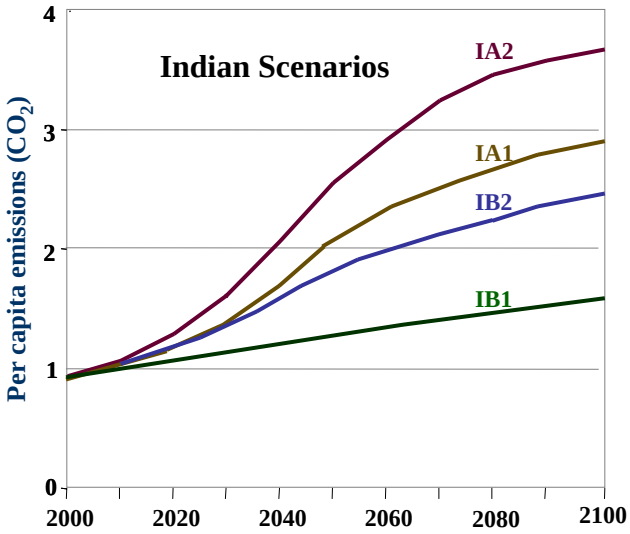


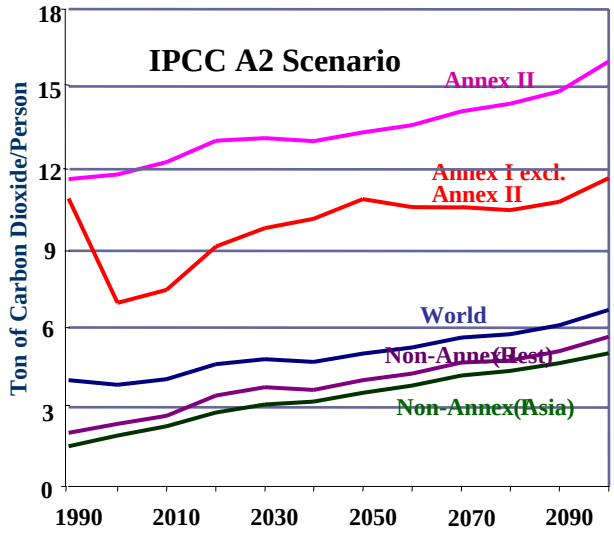




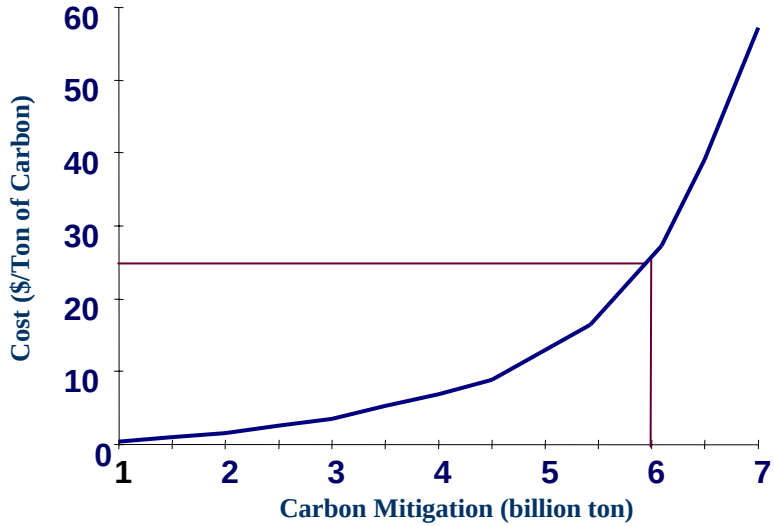
Indian Emissions: Equity and Cost-effectiveness

Per Capita CO_2 Emissions



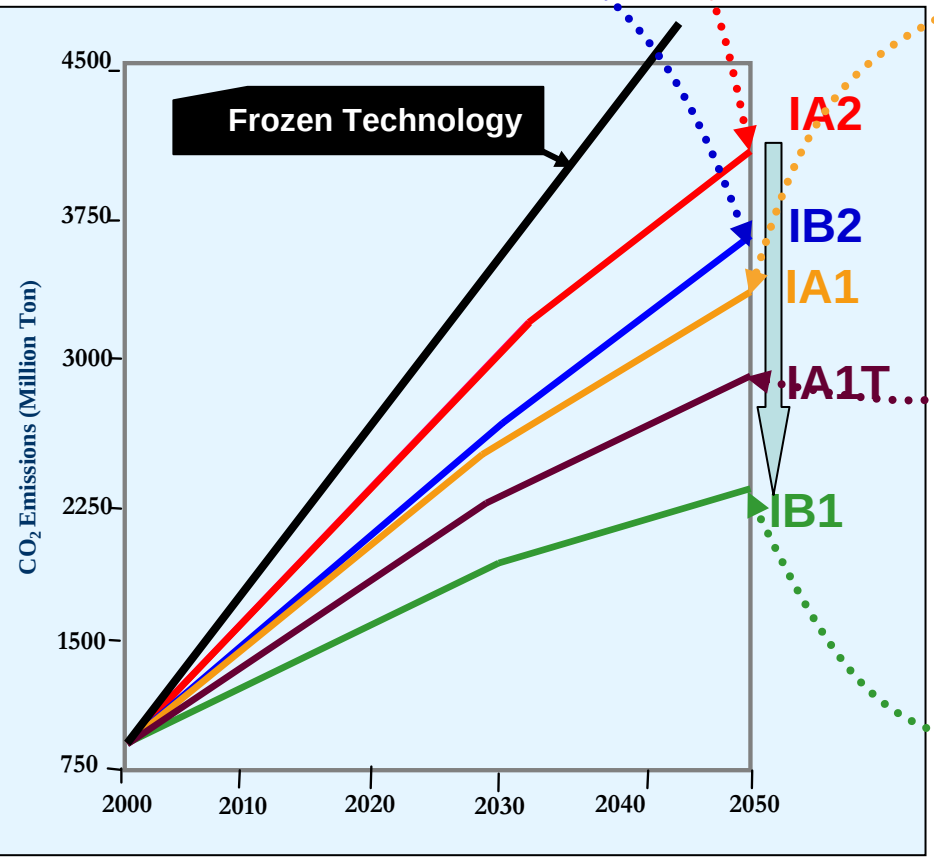


Mitigation Supply-curve from India 2005-2035)



Technologies in Scenarios

Conventional Technology Paths: Include significant endogenous technological change



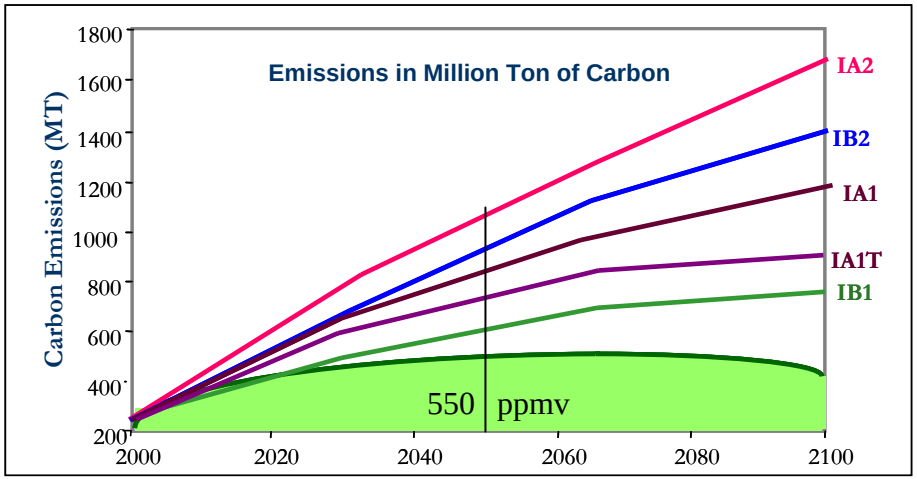
- Synfuels, Next-Gen Nuclear Fission
- Fuel cell vehicles, Pipeline networks
- Energy efficient appliances/ infrastructure
- Coal liquid, IGCC, Hydrogen from gas

- Nuclear (Thorium), Carbon-free hydrogen
- Information highways, High speed trains
- Advanced materials, Nanotechnology

- Push for renewable energy & recycling
- Bikeway, Advanced car sharing system
- Substitution of transport by IT
- Dematerialization, Material substitutions
- Sustainable habitats & land-use practices

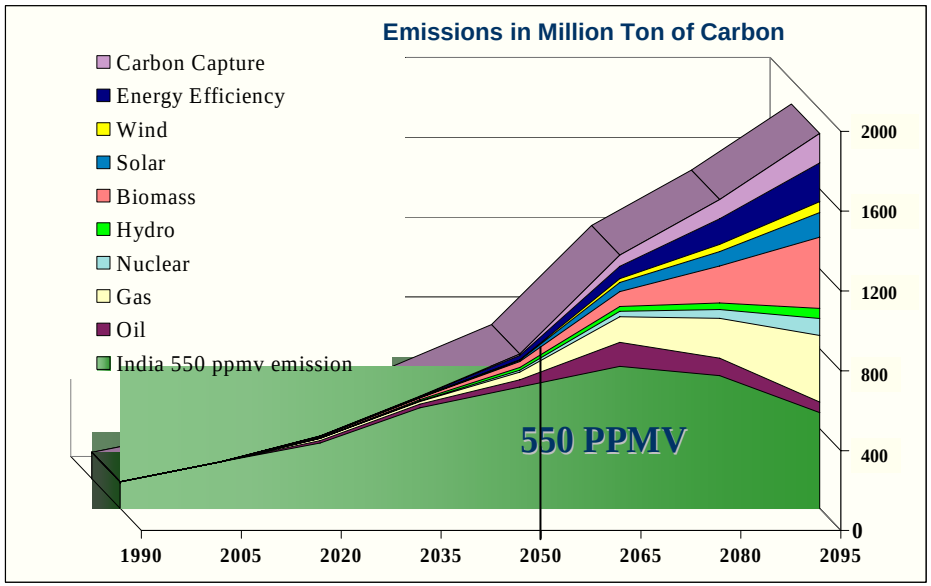
Stabilization Induced Low Carbon Transition

Indian Emission Scenarios & Cost-effective 550ppmv mitigation trajectory



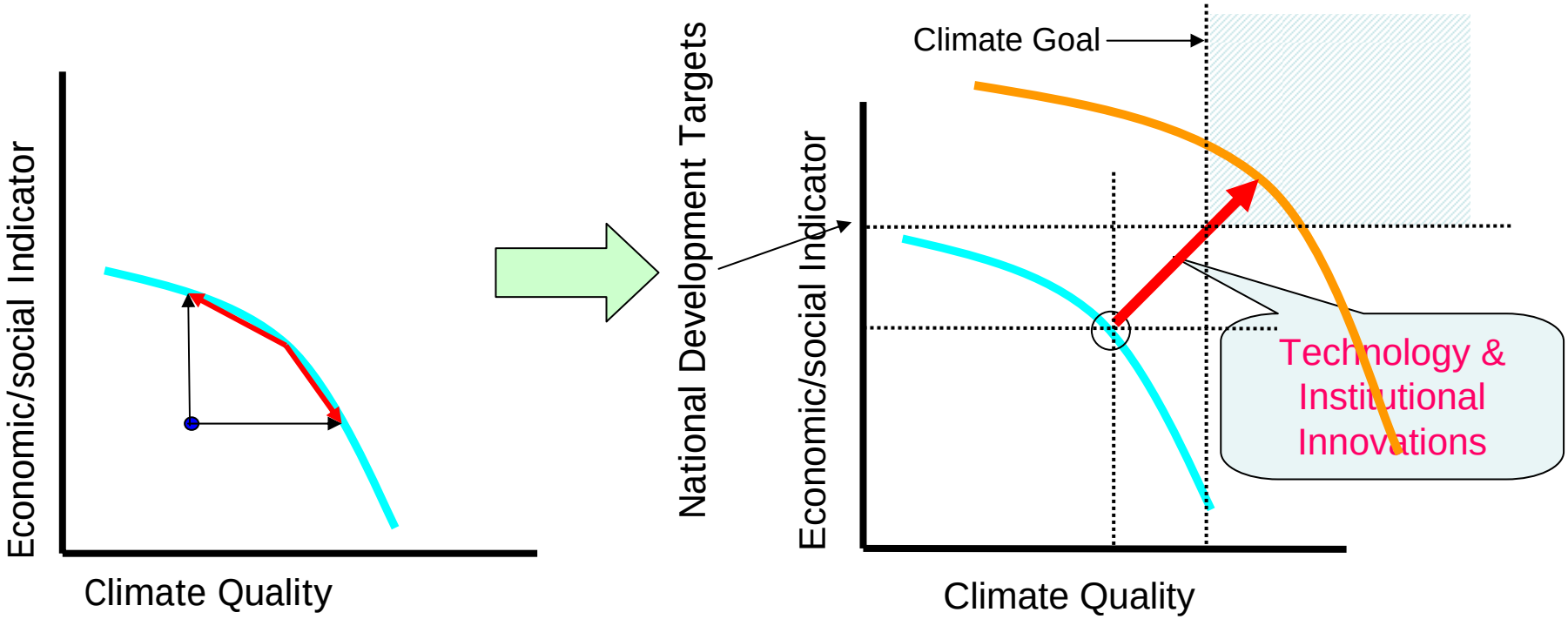
- **Type of endogenous development path matters to quantity and cost of mitigation**
- **Cost-effective Stabilization, e.g. at 550 ppmv level, would require mitigation in India even in case of low endogenous emissions scenarios**
- **Low endogenous emissions trajectory would result from technology innovations and sustainable actions**
- **High economic growth does not mean high emissions**

550 ppmv CO_2 Stabilization Induced Energy/ Technology Transition in India in A2 Scenario



- **There is no silver bullet**
- **Need to develop portfolio of technologies**
- **Significant stabilization induced transitions in the second half of 21st century**
- **Stabilization induced technological change would impose sizable GDP losses**
- **Technology & financial transfers are vital for a cost-effective and fair stabilization regime**

Aligning Development and Climate

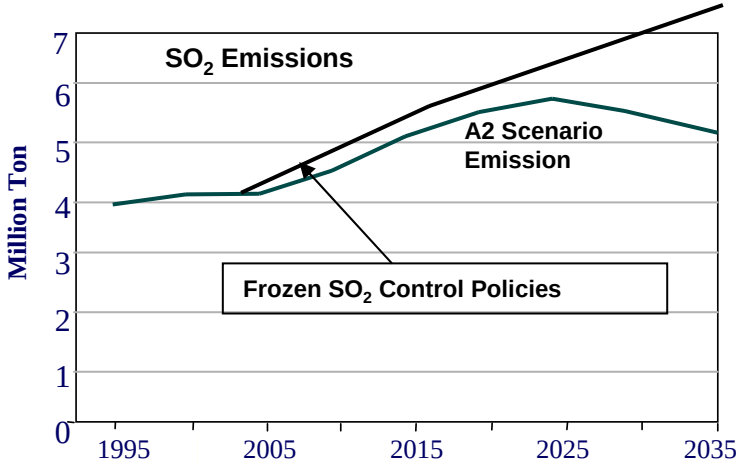


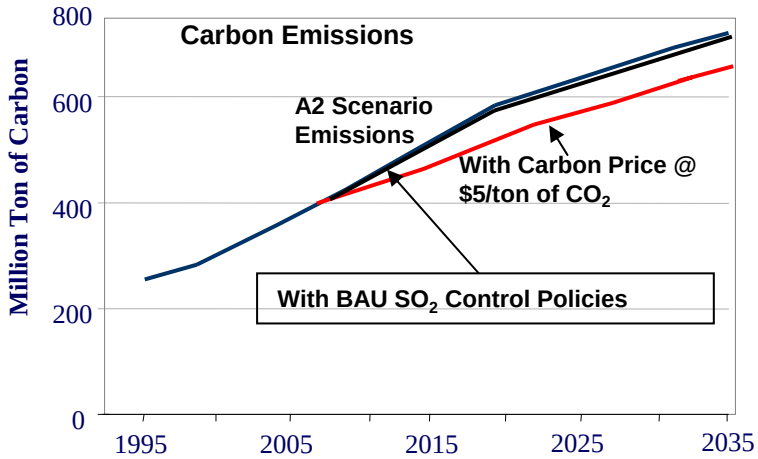
Aligning Development & Climate Actions to Gain Multiple Dividends

Indian Examples

- **Air Quality and GHG Mitigation**
- **Energy Security and GHG Mitigation**
- **South-Asia Regional Energy and Economic Cooperation and Climate**
- **Infrastructure Investment and Climate Risks**

Joint SO2 and CO2 Mitigation

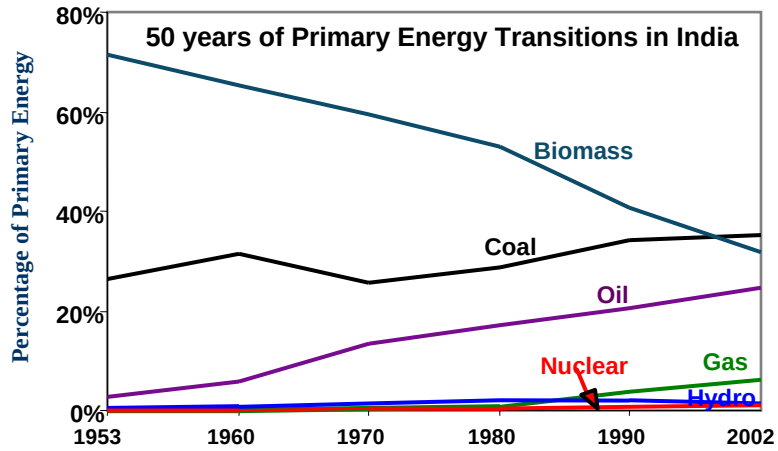




Joint Mitigation (Period 2005-2030)

Mitigation Regime	Co-benefits
SO_2 mitigation alone	Little carbon mitigation
Joint Mitigation: CO_2 mitigation @ $5/ton & same SO_2 target	Joint mitigation costs $400 Million less

Energy Security and GHG Mitigation



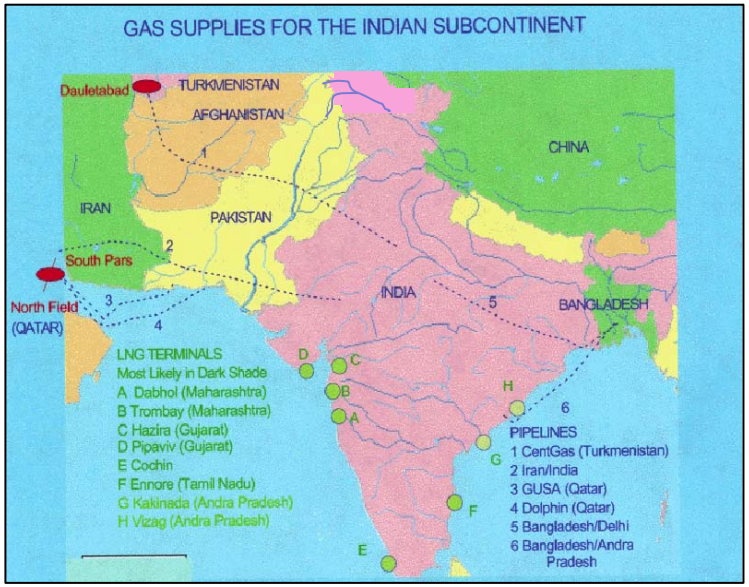
Energy Security: How choices matter to climate?

- **Domestic Coal – High Emissions**
- **Nuclear Fission – Carbon Free, Safety Issues**
- **Wind – Limited Potential, Supply stability**
- **Solar – High upfront cost, Supply stability, Storage**
- **Bio-fuels**
  - *Ethanol – Food Security, Water Stress*
  - *Bio-Diesel – Land Restoration, Employment*

Indian Bio-diesel Mission

- **Phase I (2003-07):Demonstration Projects**
  - *Crop: Jatropha Curcas*
  - *400,000 hectares of land*
  - *Participation by Oil Companies*
- **Phase II (2007-2012)**
  - *Self Sustaining Expansion of Biodiesel*
  - *Production target 1.2 MT of oil/ hectare*

South-Asia Energy Cooperation

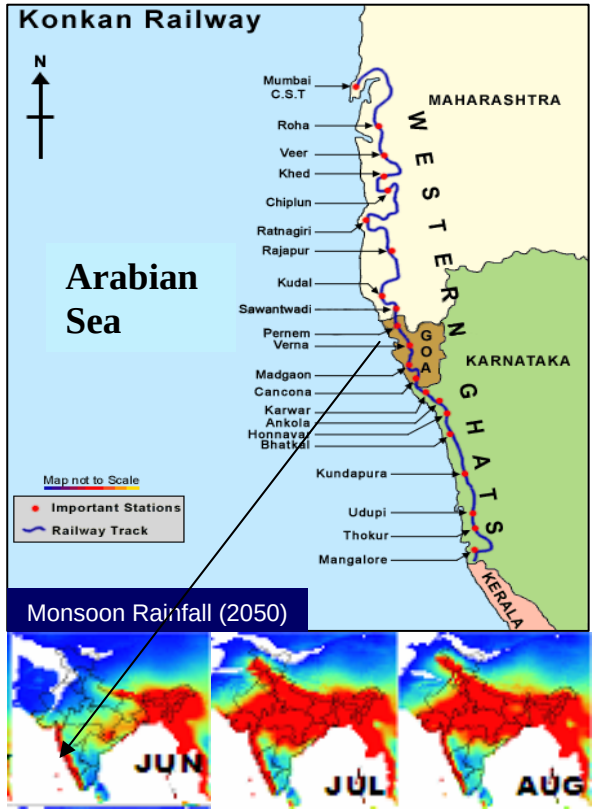


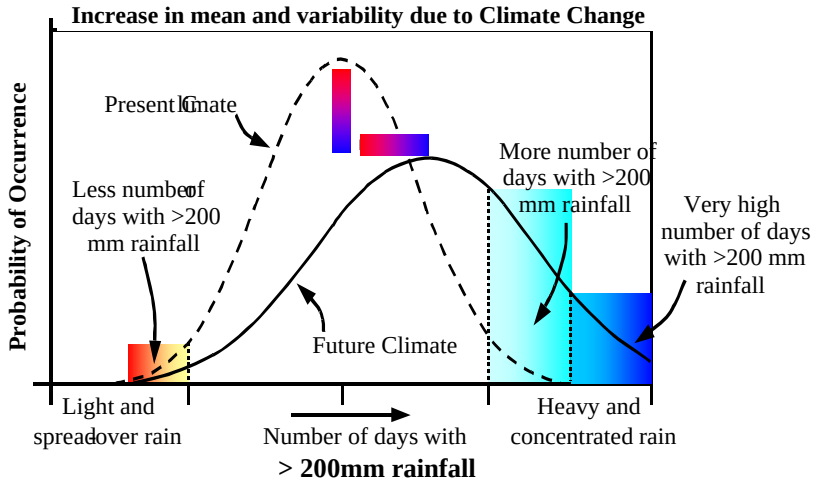
Benefit (Saving) Cumulative from 2010 to 2030		$ Billion	% GDP
Energy	60 Exa Joule	321	0.87
CO_2 Equiv.	5.1 Billion Ton	28	0.08
SO_2	50 Million Ton	10	0.03
	Total	359	0.98

Spillover Benefits:

- 16 MW additional Hydropower
- Flood control
- Lower energy prices would enhance competitiveness of regional industries

Infrastructure and Climate





Conclusions

- Strategies for low carbon future should begin with shaping endogenous development path
- Stabilization would require mitigation even in low endogenous emission scenarios
- Achieving cost-effective global transition to low carbon future would call for substantial mitigation and adaptation actions in Developing Countries
- Stabilization would significantly alter energy system
- Policies and measures for achieving "*National Sustainable Development Goals*" provide climate friendly opportunities
- Aligning development and climate actions would accrue multiple dividends from co-benefits/spillovers and reduce '*climate burden*'