Climate Change Mitigation in Developing Countries

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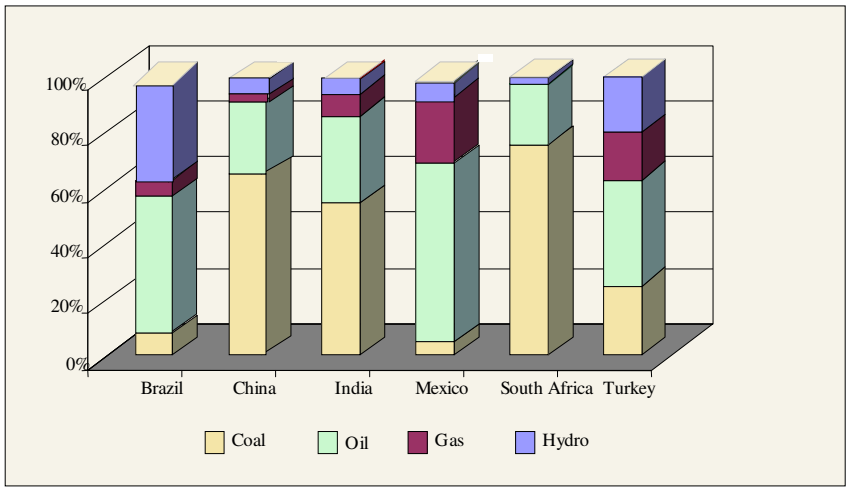
Presentation Agenda

- How (and how much) developing countries have contributed to GHG mitigation?
- What should be key elements of post-Kyoto architecture? Or, How "Development" and "Climate" policies be reconciled in the post-Kyoto architecture?

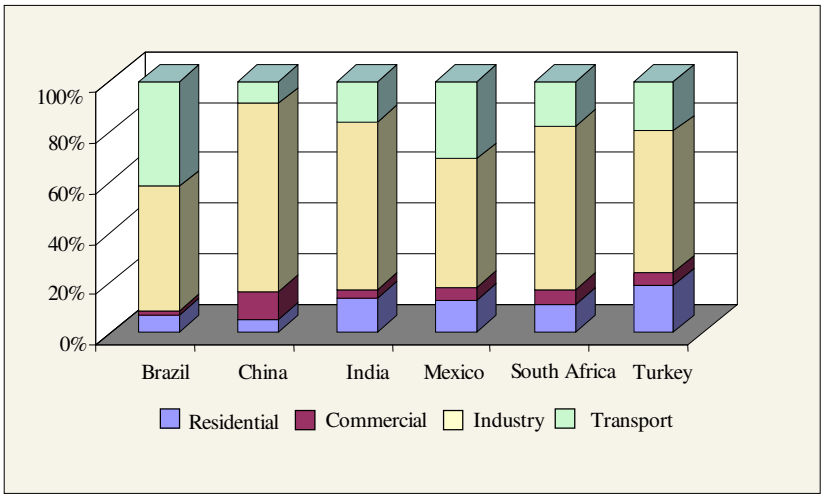
Six Developing Countries Comparison

Country	Population (Million)	Primary Energy per Capita, 2000 (GJ /year)	CO2 per Capita, 1998 (Tc/year)	CO2/GDP Tc/1995$ Mil (PPP)
Brazil	170	44	0.5	73
China	1262	27	0.7	175
India	1016	13	0.3	121
Mexico	98	56	1.1	210
South Africa	43	106	2.3	233
Turkey	65	47	0.9	137
World	6057	63	1.1	155
OECD	1116	200	3	128
USA	282	341	5.4	186

Primary Energy Use (2000)



Energy Related CO2 Emissions (2000)



Mitigation Measures

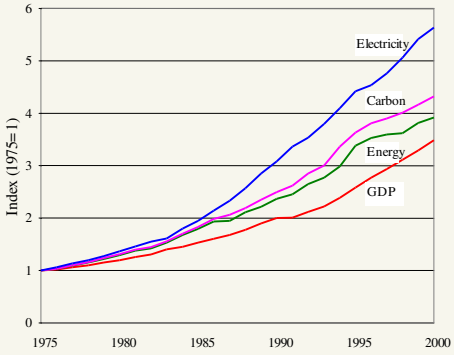
		Brazil	China	India	Mexico	South Africa	Turkey
En. Efficiency	Demand-side	✓	✓✓	✓	✓	✓	✓
	T&D						✓
Clean Fuel	Gas	✓	✓	✓	✓		✓✓
	Renewable	✓✓		✓			
Transport	Ethanol	✓✓		✓			
	Incentives for small car	✓					
	CNG			✓			
Structural Change in Energy Use		✓✓	✓				
Forest (controlling deforestation)			✓	✓		✓	
Energy Reforms	Tariff Reform	✓✓	✓	✓	✓✓	✓	✓✓
	Privatization/ Competition	✓ ✓	✓	✓	✓✓	✓✓	✓✓
Social Reforms	Population Policy		✓				

How much mitigation?

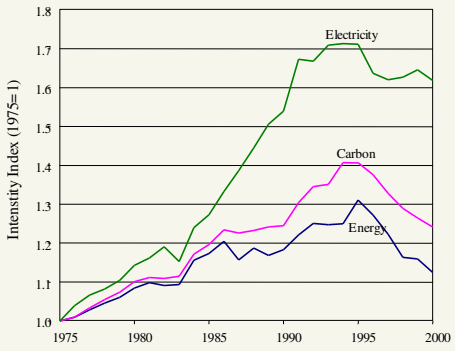
- The six countries have mitigated 300 Million ton of carbon per year by such measures, for reasons other than climate change, though several measures could be "additional" to the economic baseline
- For context, the total mitigation commitment of developed countries under Kyoto Protocol (including USA) would be 392 Million ton of Carbon in 2010
- Present emissions baseline of these six countries is 18% below what would been without such measures

Mitigation: The Case of India

GDP, Energy, Electricity, Carbon



Intensity (per Rs. GDP)



Decoupling Carbon and Energy:

Policy Measures

- Energy Efficiency and Conservation
- Renewable Energy
- Clean Transport Fuel
- Energy and Electricity Sector Reforms
- Forestry and Land Restoration

Technology Push in Energy Intensive Industry

Sector	Units	Average Consumption		Best Technology
		1991	1995	2000
Cement	Kwh/ ton	132	120.5	69
Paper	Mwh/ ton	1.255	1.003	0.985
Caustic Soda	Kwh/ ton	3351	3130	2196
Aluminum	Kwh/ ton	16763	16606	15217
Urea	Kwh/ ton	425.6	390	-
Steel	G. Cal/ ton	11.27	8.93	7.48

Renewable Energy

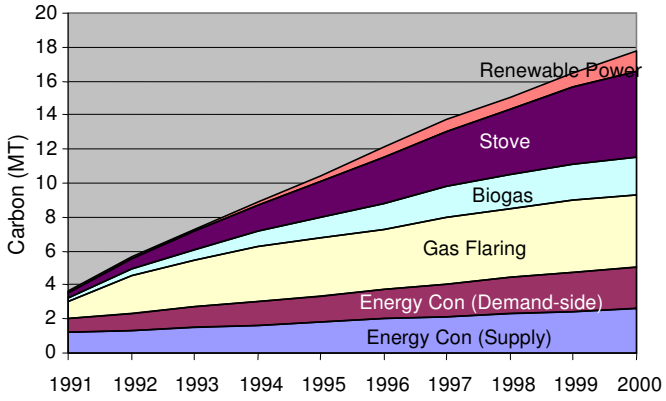
(capacity on March 2002)

	Source/System	Achievement
Rural Energy	Family size biogas plants	3.262 million
	Improved cooking stove	34.3 million
Biomass Power	Biomass power	381 MW
	Biomass gasifier	50 MW
Solar Energy	Solar street lighting systems	41.4 thousand
	Home lighting systems	177 thousand
	Solar lanterns	383 thousand
	SPV power plants	1172 kWp
	Solar water heating systems	590 thousand m^2 collector area
	Box-type solar cookers	515 thousand
	Solar PV pumps	4204
Wind	Wind power	1526 MW
	Wind pumps	793
Hydro	Small hydro power (< 25 MW)	1433 MW
Waste	Energy recovery from waste	17 MW
Transport	Battery operated vehicles	247
Awareness	Energy parks	259

Carbon Mitigated - 2000

Technology Initiative		Carbon Saved (Million Ton)
Energy Conservation (Supply-side)		2.60
Energy Conservation (Demand-side)	Steel	0.86
	Cement	0.34
	Other industry	0.78
	Agriculture	0.15
	Transport	0.10
	Residential + Commercial	0.27
Renewable Power	Wind	0.94
	Small Hydro	0.15
	Biomass	0.19
Improved Stove		4.96
Gas Flaring		4.16
Biogas		2.30
	Total	17.80

Carbon Mitigation
(1900-200)



111 Million ton Carbon Mitigation from 1990 - 2000

Beyond Kyoto:
Development and Climate

Development and Climate: Premises

- Climate most viably approached through development strategies whose climate benefits are ancillary to sustained economic growth
- Rise in developing county emissions driven by development imperatives and supported by current resource and technology flows
- Both climate and development concern fundamental issues of energy, transport, land use and food security

Current Climate Regime

- Regime architecture is climate-centric and flows from output to input
- CDM holds only limited prospect of increased or redirected flows
- No assurance of stable assistance from developed to developing countries

Shifting Context – Transitions

- Transition from state to market economies is a semi-permanent
- Market reforms driven largely by need for new development capital
- Patchwork of residual and "reformed" institutions and alliances
- Private flows grew five-fold while ODA declined during 1990-2000
- Shift in flows from bank lending to foreign direct investment
- 10 countries receive 70 percent of FDI
- Largest investments are in electricity, natural gas and telecom

Shifting Context - Partnerships

- "Hybrid" states present new risk profiles
- New Investment Strategies
- Conservative investors hedge by acquiring local partners – i.e. Brownfield investment
- Aggressive investors seek "market-making" alliances
- Changing Trends in Development Assistance
- Characterized by pledges at Monterrey and Johannesburg:
  - Softer and more selective
  - Conditioned on "governance" reforms
  - Channeled through public-private partnerships

Principles Going Forward

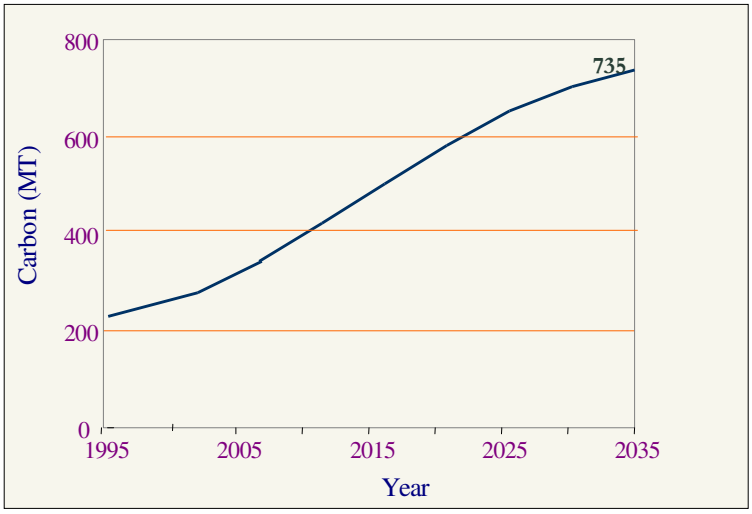
- From Input to Output
  - Policy must tilt development choices toward climate-friendly options
  - Operate at a scale large enough to alter emission trajectories
  - Rather than discrete projects, measured against business as usual, aim to fundamentally shift baselines
- Aligning Interests
  - Seek alliances of domestic firms/ agencies, foreign investors, ODA providers
- Targeting Assistance
  - Adaptation
  - Capacity for climate-favoring development
- Creating Regional Models
  - Accelerate technology diffusion by targeting regional leaders

Options for a Future Architecture

- Input-based goals
  - Sectoral goals
  - Intensity goals
  - Policies and measures
- Programmatic climate cooperation
  - GHG credits for broad policy shifts
  - A climate bank?
- Early Signals
- Integrated Solutions

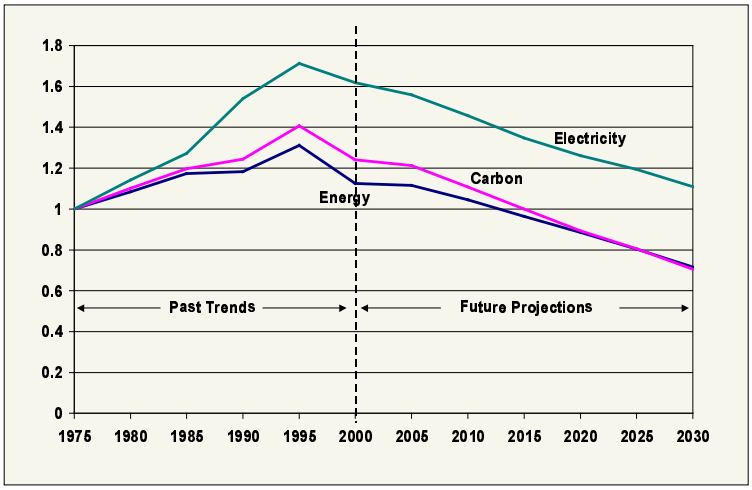
Development and Climate: The Case of India

Future Carbon Emissions



Energy, Electricity and Carbon Intensities

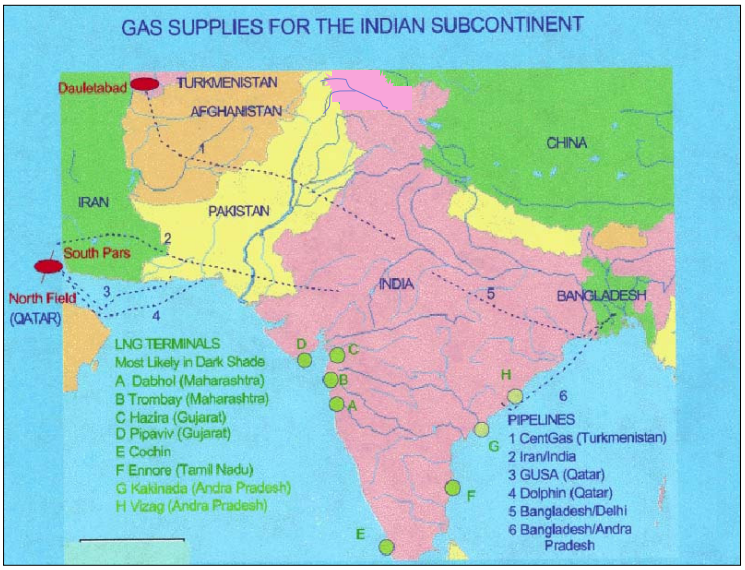
(Reference Scenario)



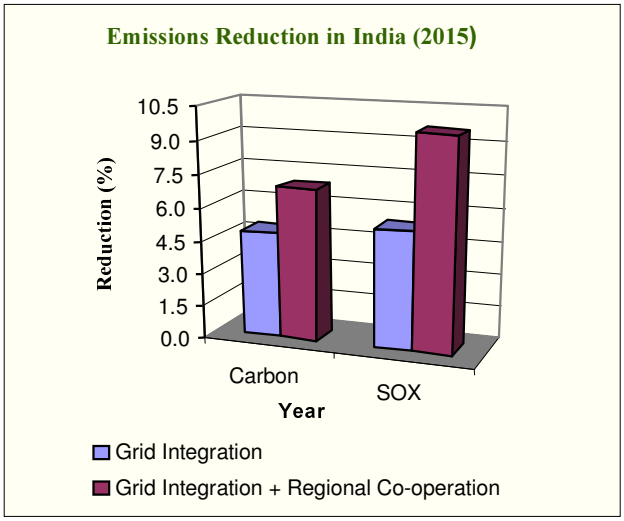
Carbon Mitigation via CDM
(under different Post-Kyoto Signals)

Scenarios	Global Carbon Price	Carbon Mitigation (Million Ton)	Cumulative Mitigation %
750 ppmv	$5-8/ ton	138	3%
650 ppmv	$5-10/ ton	301	7%
550 ppmv	$5-14/ ton	449	10%

South-Asian Energy Market Development



Environment Gains: South Asian Energy Market



Benefits of South-Asia Energy and Electricity Market Integration

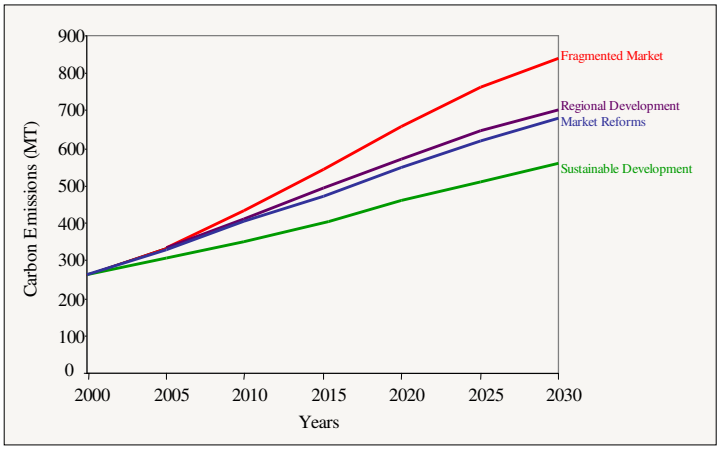
(Cumulative for period 2010-30)

Benefit (Saving)		$ Billion	% of Region's GDP
Energy (Direct Benefits)			
Energy	59 Exa Joule	180	0.48
Investment in Energy Supply Technologies		72	0.19
Investment in Energy Demand Technologies		69	0.18
Environment (Indirect Benefits)			
Carbon Saved	1.4 Billion Ton	28	0.08
SO_2 Saved	50 Million Ton	10	0.03
Total Direct and Indirect Benefits		359	0.98
Spillover Benefits			
Water	16 GW additional hydro capacity		
Flood Control	From additional dams		
Competitiveness	Reduced unit energy/electricity cost		

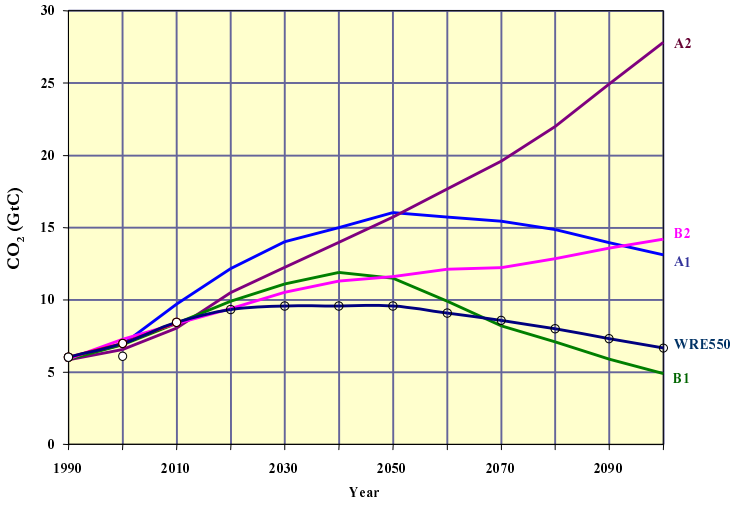
From CDM to "Development and Climate"

	Project/ Program	Strategy
CDM	***Retrofit Projects*** *(e.g.)* . Boiler retrofit . Process improvements	. Promote technology transition in small/ medium industry . Link with resource conservation programs
CDM	***Green-field Projects*** *(e.g.)* . New Wind Farm . Gas Power Plant	. Positive list . Promote technical/ financial collaborations . Jump start technology transition/ hedging
Development	***Infrastructure Projects*** *(e.g.)* . Gas Pipeline . Electricity T&D . Road/ Rail infrastructure	. Link with development . Regional energy cooperation . High mitigation potential but difficult to operate under CDM regime
Development	***Reform Programs*** *(e.g.)* . Technology R&D/ Dissemination . Electricity Distribution Reforms . Consumer Awareness	. Strong link with economic reforms and sustainable development . High transaction costs but high co-benefits . No way to operate under Kyoto regime

Indian Emission Scenarios



Global Emission Scenarios (SRES)



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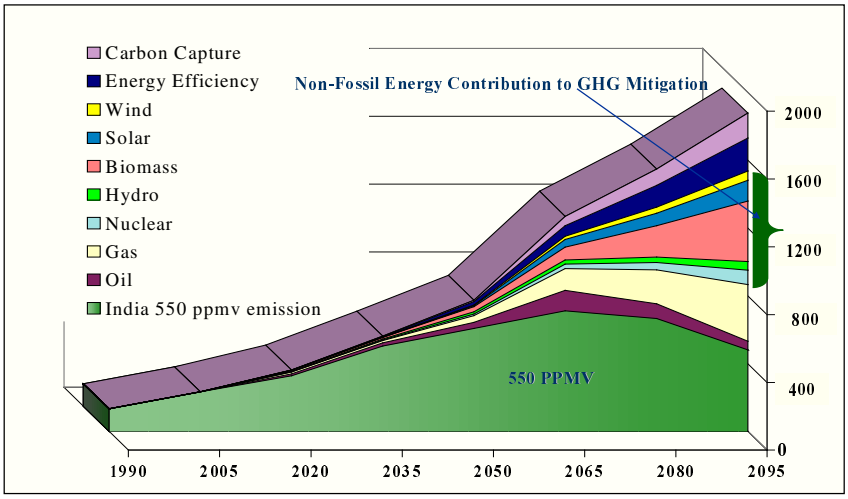
Technological Change in India to Stabilize CO_2 at 550 ppmv



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Conclusions

- Non-climate policies and measures in developing countries have contributed significant mitigation
- Climate cause would be better served if the regime is driven by inputs than output measures
- Rising investment and technology flows provide significant opportunities for transition to low emissions pathways
- Climate embedded within development policies would have lower climate costs and risks
- Development pathway is key determinant of effective climate regime