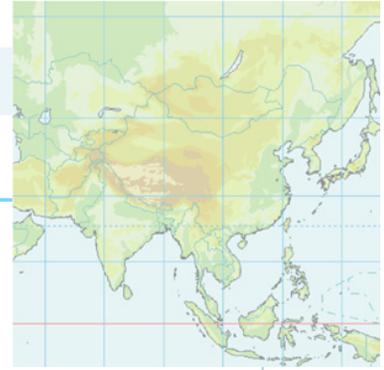


India's Copenhagen Commitments

Risks, Co-benefits and Strategies

P.R. Shukla
Indian Institute of Management
Ahmedabad, India

Presented at
EMF24, Workshop on Climate Change Impacts and Integrated Assessment
Session: Post Copenhagen: Integrated Assessment Analysis in a Mosaic World
August 2, 2010 Snowmass, Colorado, USA



Development Path: Risks and Co-benefits



US Secretary of State Hillary Clinton: As told to CNN's Fareed Zakaria in an interview

<http://business.rediff.com/report/2009/aug/11/do-not-follow-us-growth-model-clinton-tells-india.htm>

<http://edition.cnn.com/CNN/Programs/fareed.zakaria.gps/>

"Although India and China have every right to choose their own path of development, they should not follow the American model in their Endeavour to improve the condition of their citizens,"

"Our argument to China and India is: Yes, you have a right to develop and we want you to develop, and in fact, we admire your commitment to eradicating poverty and we want to help you do that. But you can't do it the way we did it, because you will suffer consequences that will undermine your development" ...

Prof. Joseph Stiglitz

"For developing countries, the 'good news' is that their environment and natural resources policies are often so bad that there are reforms which would be both good for the economy and good for the environment."

Copenhagen Commitments and Strategy



Copenhagen Commitments

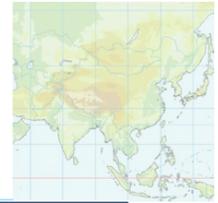
- 20 to 25% Emissions Intensity Reduction from 2005 to 2020 (1.5 to 1.9% decoupling)
 - Per Capita Emissions Below OECD Average (for ever)

National Climate Change Action Plan

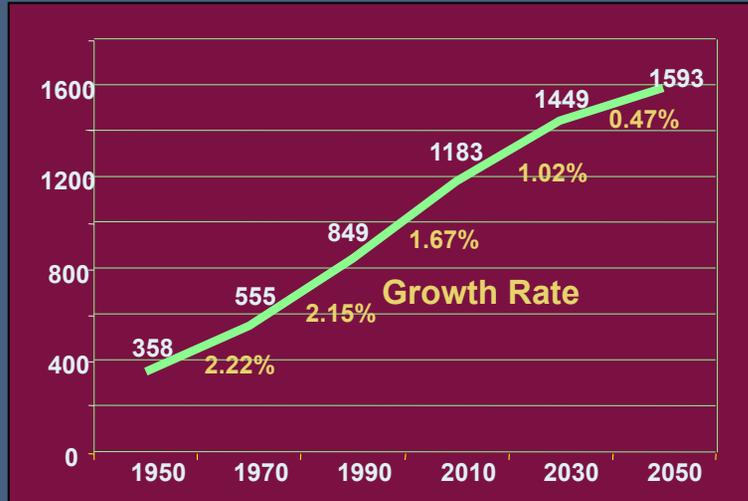
Implementation Strategy: 8 National Missions

1. Solar Energy (22000 MW PV + Thermal by 2022)
2. Enhanced energy efficiency (10000 MW saving by 2012)
3. Sustainable habitat
4. Water Sector (20% water use efficiency improvement)
5. Sustaining the Himalayan eco-system
6. A “Green India” (6 Mil. Hectare Forestation; Forest cover from 23 to 33%)
7. Sustainable agriculture
8. Strategic knowledge for climate change

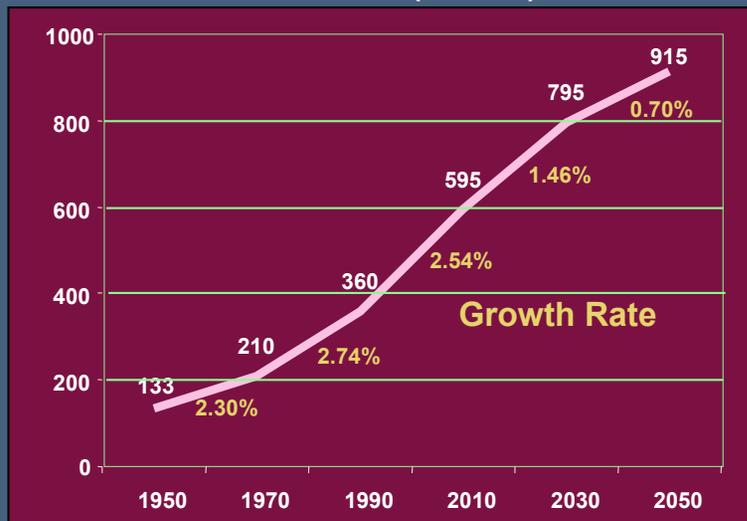
Demographic Drivers



Population (Million)

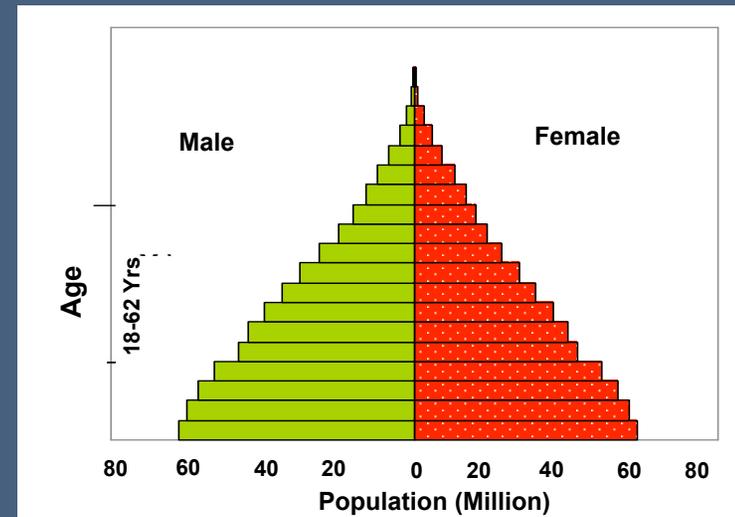


Labor Force (Million)



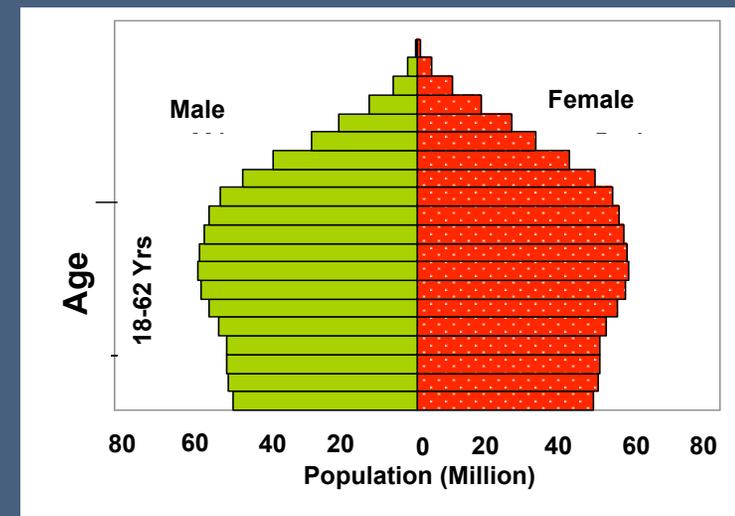
Year: 2000

Pop: 1021 Million

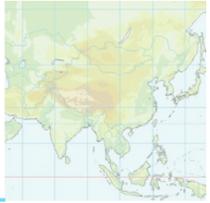


Year: 2050

Pop: 1593 Million



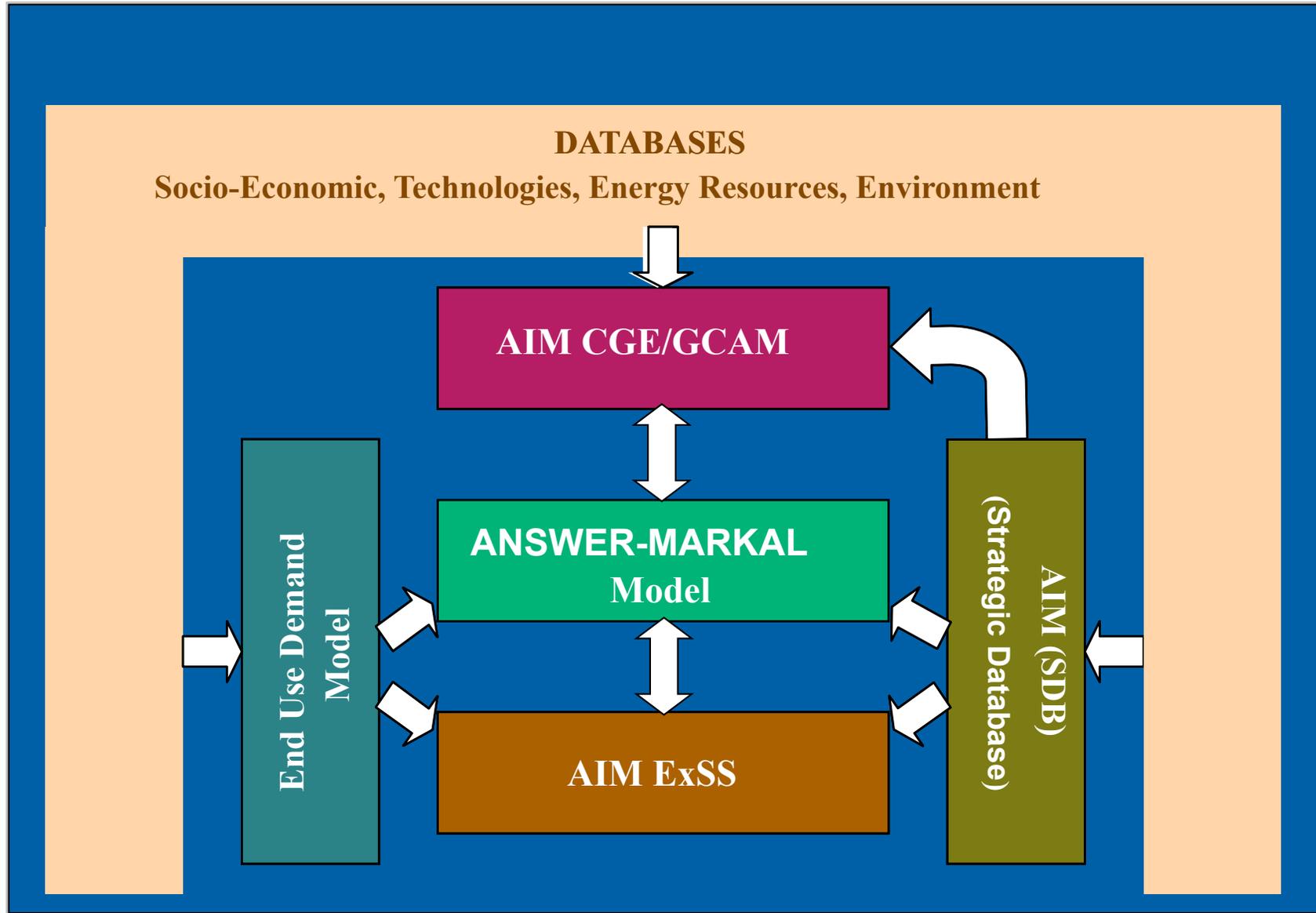
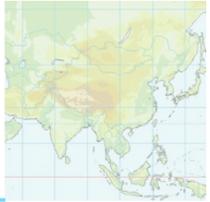
Drivers of Economic Growth



- **Human Capital**
 - High Labor Supply
 - Increasing Education
 - Migration (intra & inter county)
- **R&D**
 - Increasing Government/ Private Expenditure
 - International Knowledge Flows
 - R&D Collaborations
- **Technology**
 - Infrastructures
 - Learning, transfers, deployment
- **Behavioral Changes**
 - High Savings Rate
 - Changing Lifestyles
- **Governance**
 - Institutions
 - Laws
 - Policies



Integrated Multi-Model Structure



BAU Projections



Assumptions

From 2005-2050:

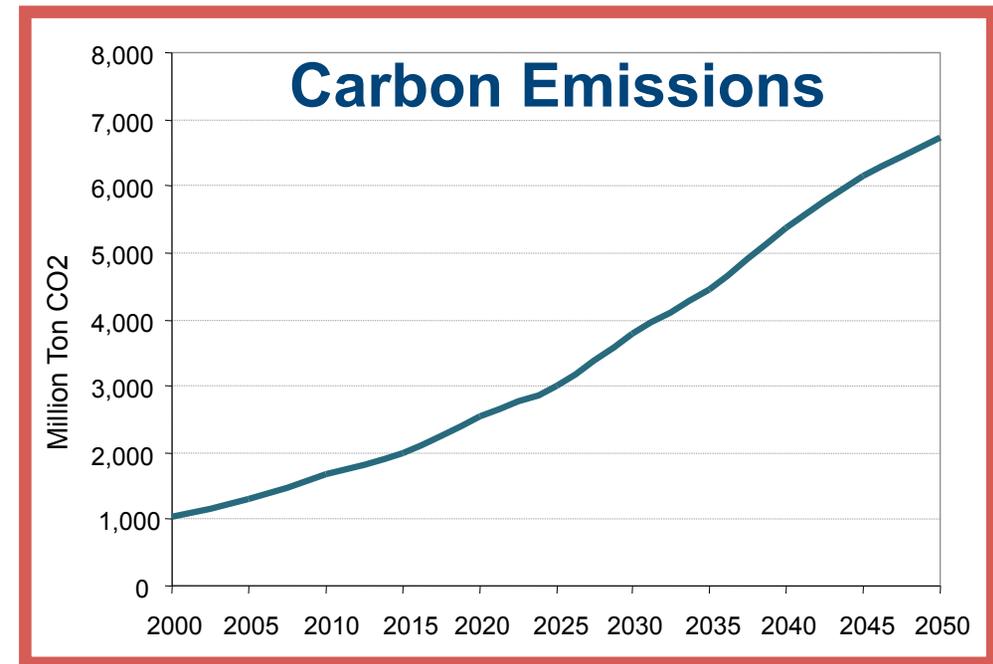
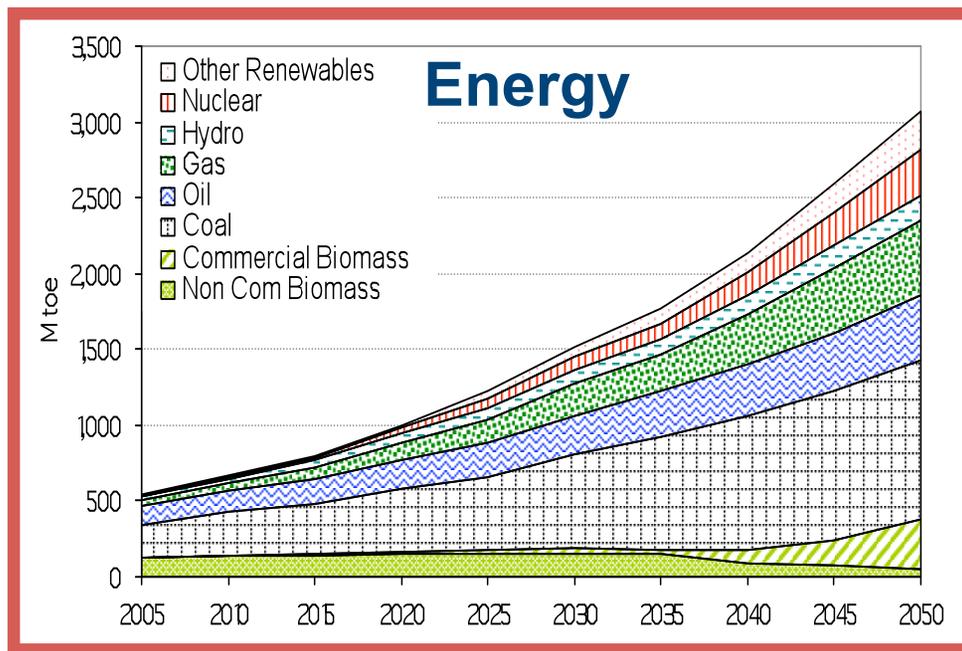
Annual Economic Growth: 7.2%

Annual Population Growth: 0.9%

Absolute Growth in 2050 over 2005

Economy 23 times

Population 1.56 times



Results: Energy and Carbon Intensity

Annual Improvement From 2005-2050:

Energy Intensity: 3.14 (%)

Carbon Intensity: 3.07 (%)

Decarbonization of Energy: -0.07 (%)

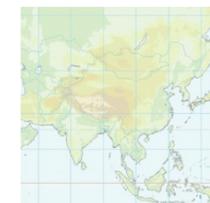
Ratios: 2050 over 2005

Energy Intensity: 0.249

Carbon Intensity: 0.257

Decarbonization of Energy: -3.1 (%)

Copenhagen Commitments: Risks?

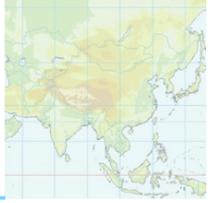


Scenario	GDP (% Annual Growth)			Ratio: GDP / 2005 GDP		
	2005-20	2005-32	2005-50	2020	2032	2050
BAU (Medium Growth)	8.7%	8%	7.2%	3.5	8.0	22.8
High Growth	9.5%	9%	7.5%	3.9	10.2	25.9
Low Growth	7.3%	7%	6.9%	2.9	6.2	20.1
Very Low Growth	7.0%	6%	6.4%	2.8	4.8	16.3

Scenario Analysis: 2005-20

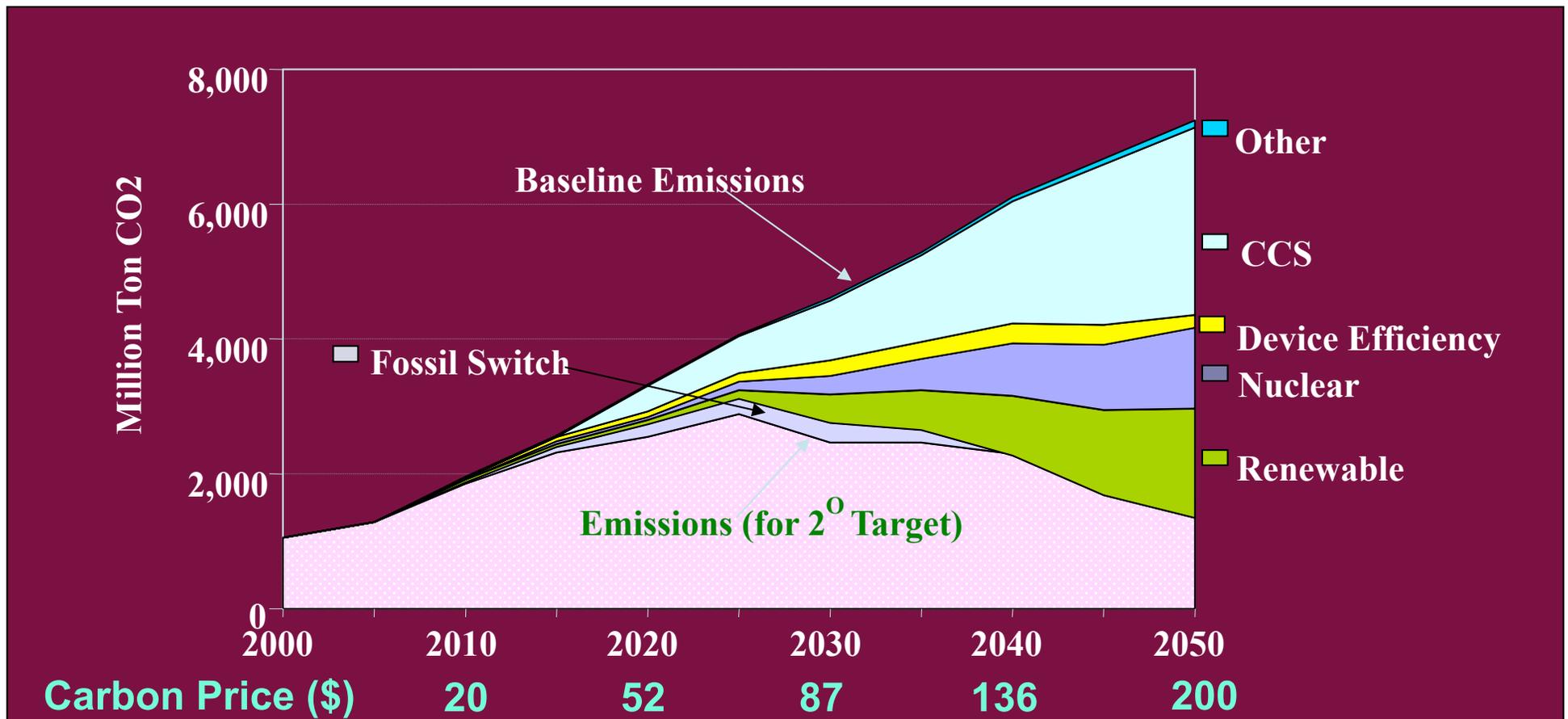
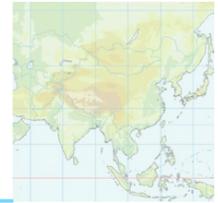
Scenario	GDP Growth	Emissions Growth	CO2 Intensity Decoupling	Ratio 2020 over 2005	
				GDP	Emissions
BAU (Medium Growth)	8.7%	5.1%	3.5%	3.5	2.1
High Growth	9.5%	5.6%	3.9%	3.9	2.3
Low Growth	7.3%	4.7%	2.5%	2.9	2.0
Very Low Growth	7.0%	4.6%	2.4%	2.8	2.0

India's Emissions Intensity Reduction Commitment requires 1.5 to 1.9% annual decoupling (2005-2020)



The 2°C Stabilization Challenge: What is a Reference Case?

Mitigation Options: Conventional



Conventional Development + Carbon price

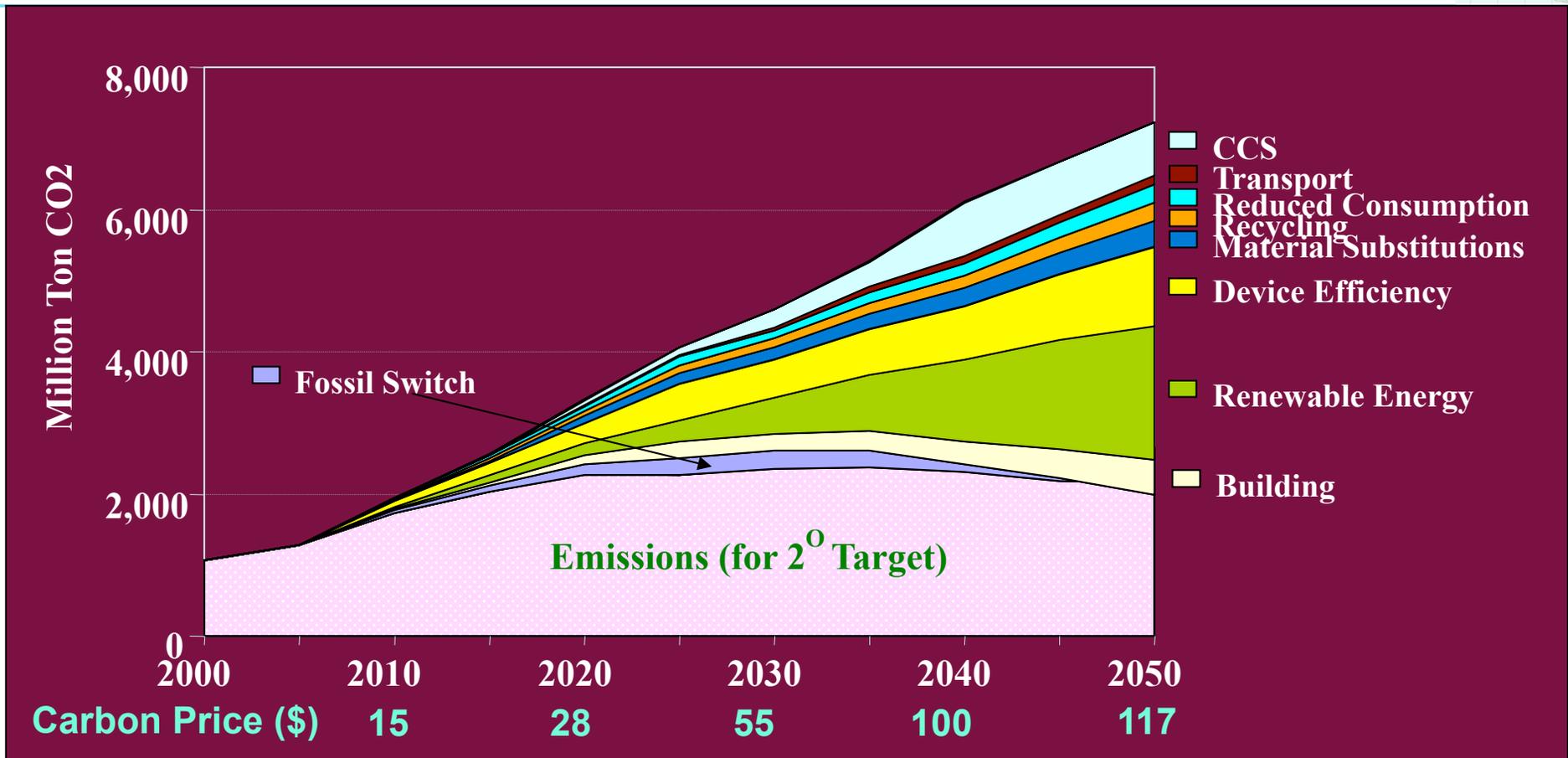
Carbon Price

- Climate Focused Technology Push
- Top-down/Supply-side actions

Technology Co-operation Areas

- Energy Efficiency (Immediate Target)
- Renewable (2020 Targets)
- Nuclear/CCS (Long-term Targets)

Mitigation Options: Sustainability

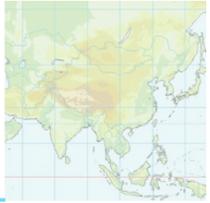


Sustainability Approach: aligning climate and sustainable development actions

- Low Carbon Price
- Bottom-up/Demand-side actions
- Behavioural change
- Diverse Technology portfolio

Technology Co-operation Areas

- Transport Infrastructure Technologies
- 3R, Material Substitutes, Renewable Energy
- Process Technologies
- Urban Planning, Behavioral Changes



Integrated Assessment Modeling

Co-benefits

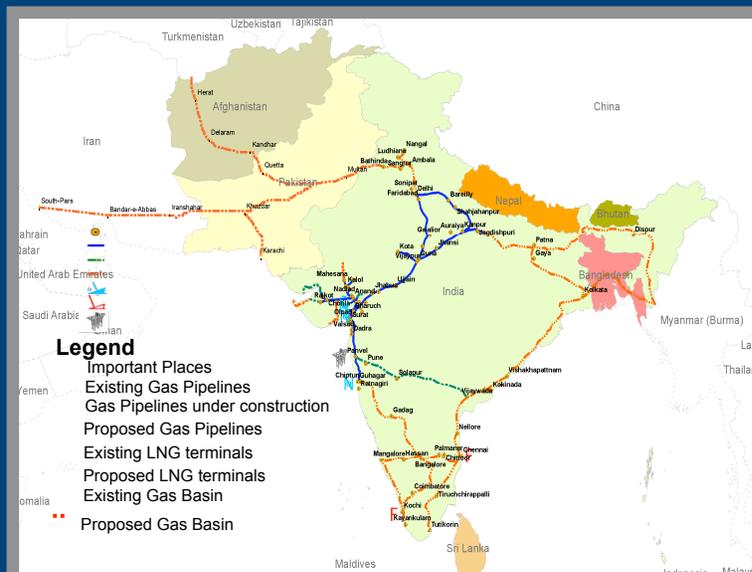
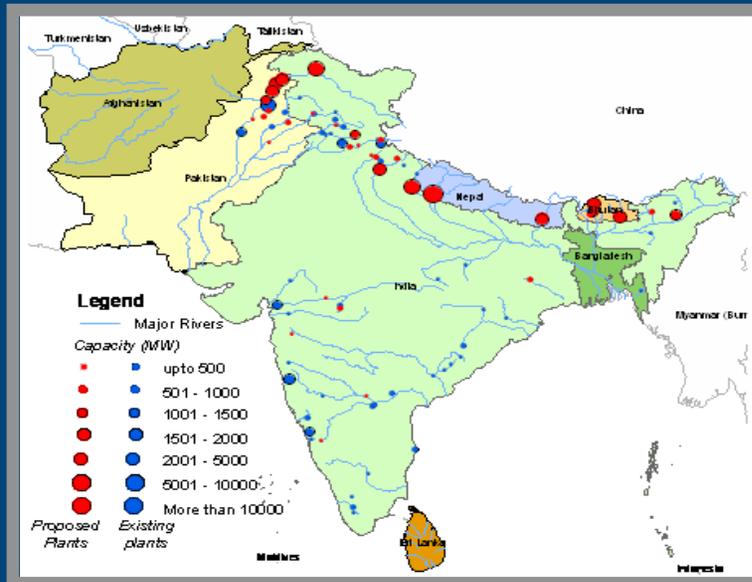
Lock-ins

Social Value of Carbon

Linking National and Global Policies



Integrated Regional Energy Market: Co-benefits



Co-benefits of South-Asia Integrated Energy-Water Market

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

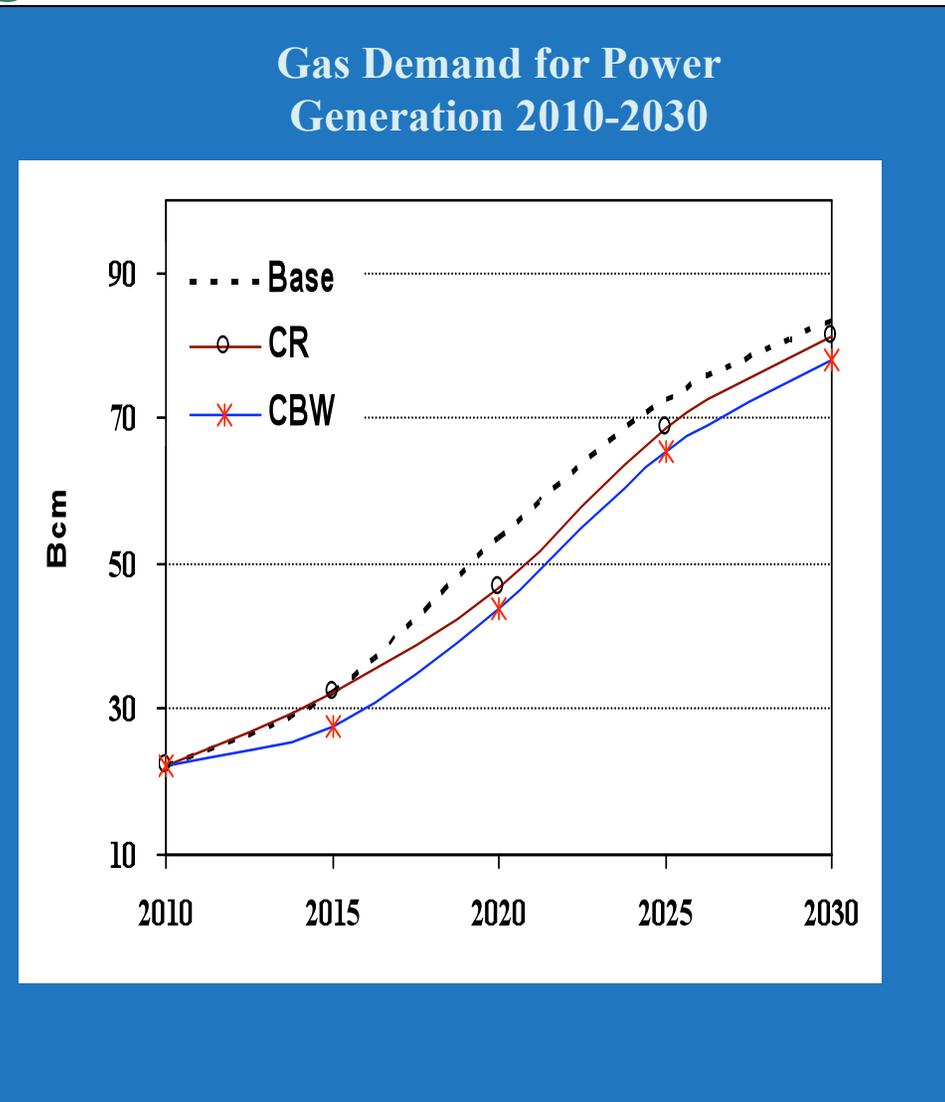
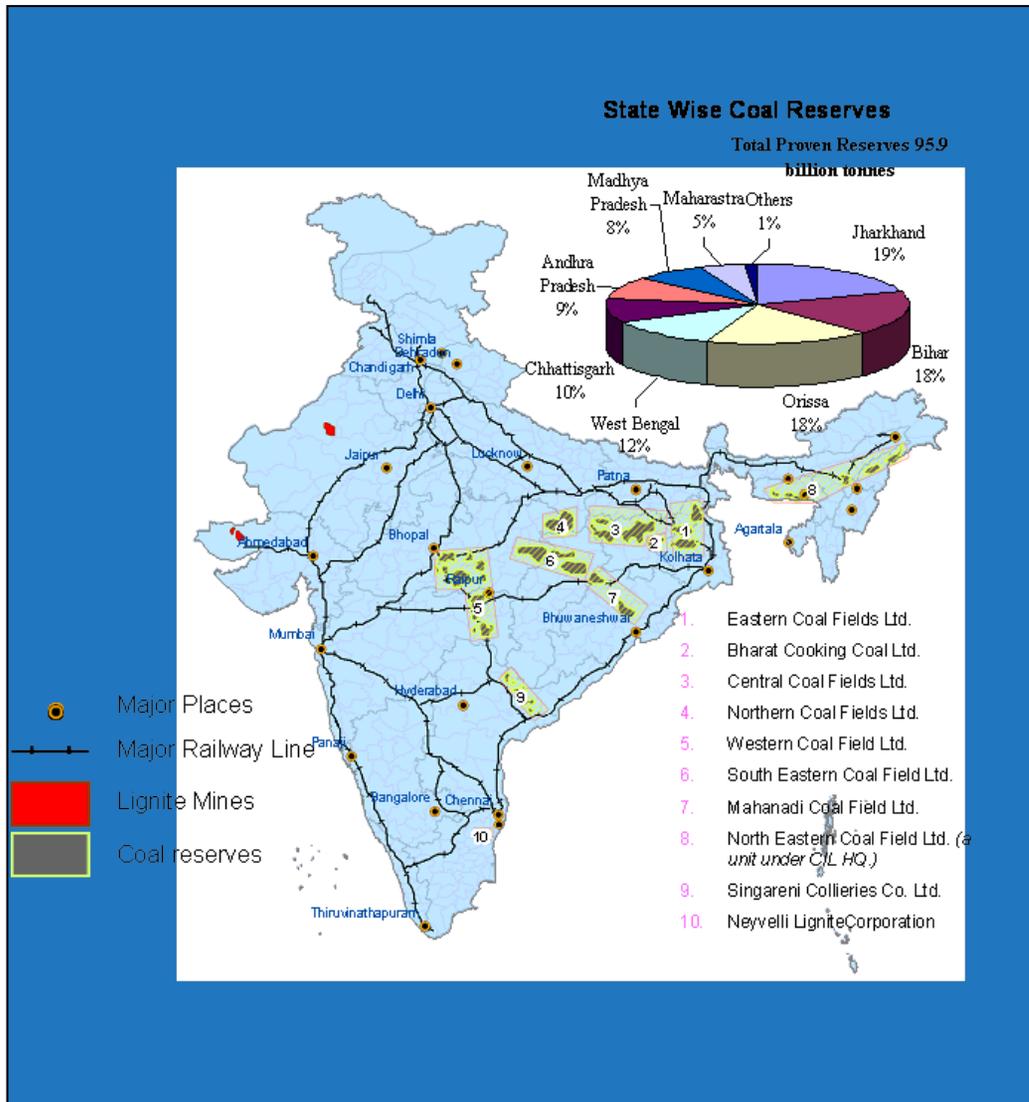
Spill-over Benefits / Co-Benefits

- More Water for Food Production (MDG1)
- 16 GW additional Hydropower (MDG1&7)
- Flood control (MDG1&7)
- Lower energy prices would enhance competitiveness of regional industries (MDG1)

Infrastructures to Overcome Lock-ins - 1



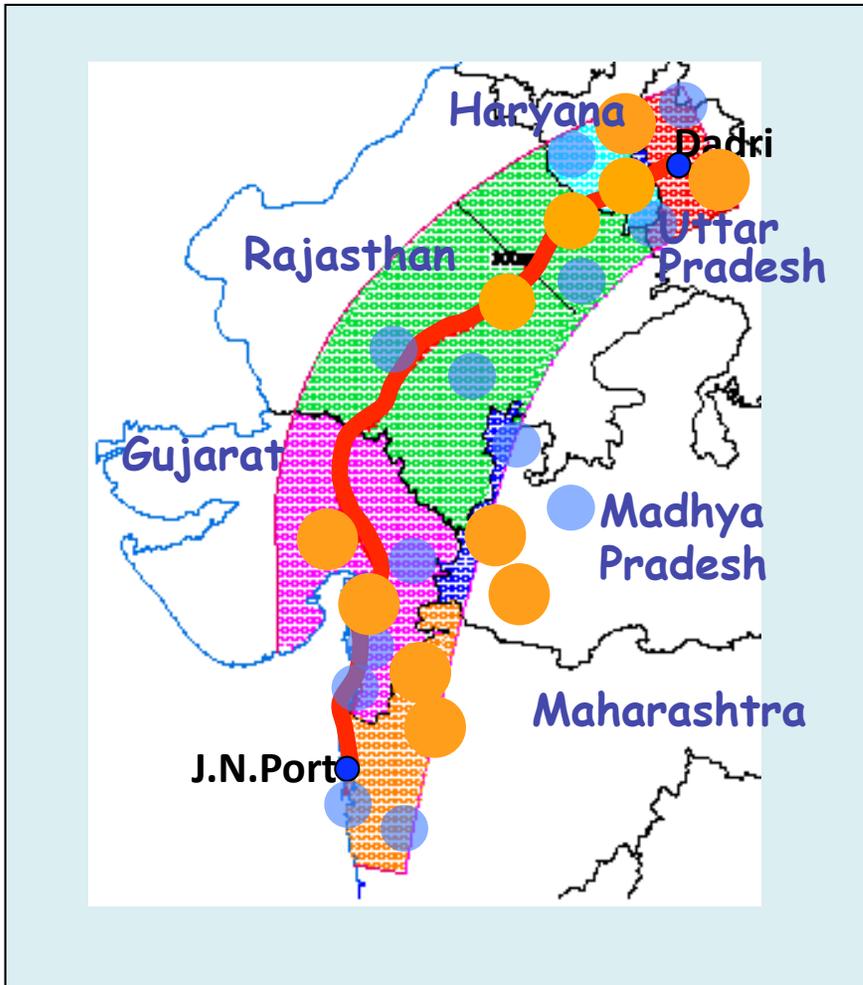
Coal by Wire



Infrastructures to Overcome Lock-ins - 2



Train Corridors



- Sustainable modal shift
- Efficient logistics
- Infrastructures investments
- Associated development

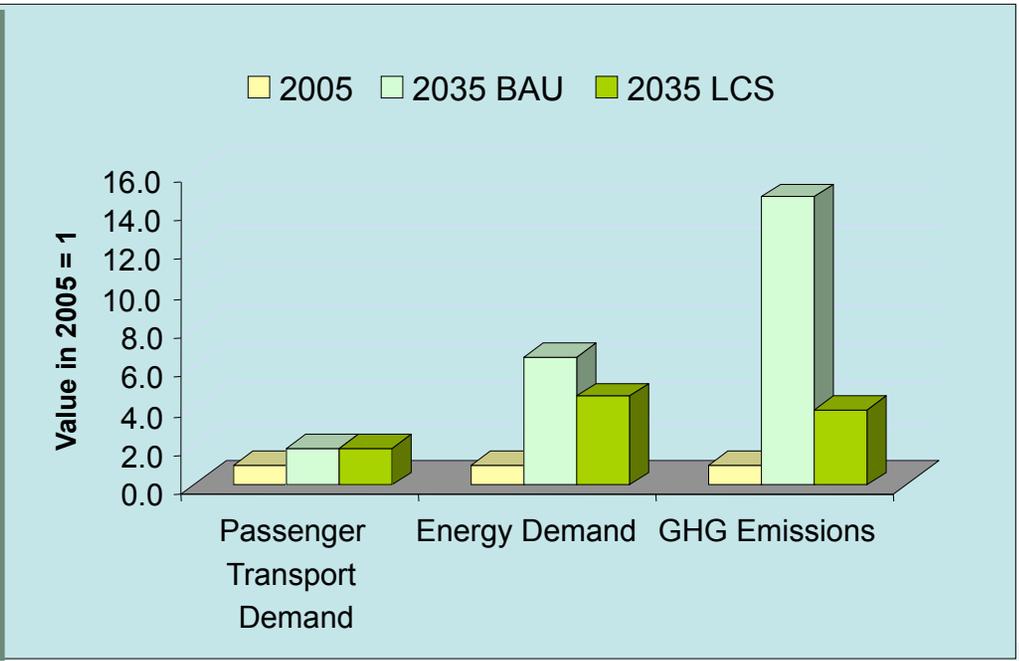
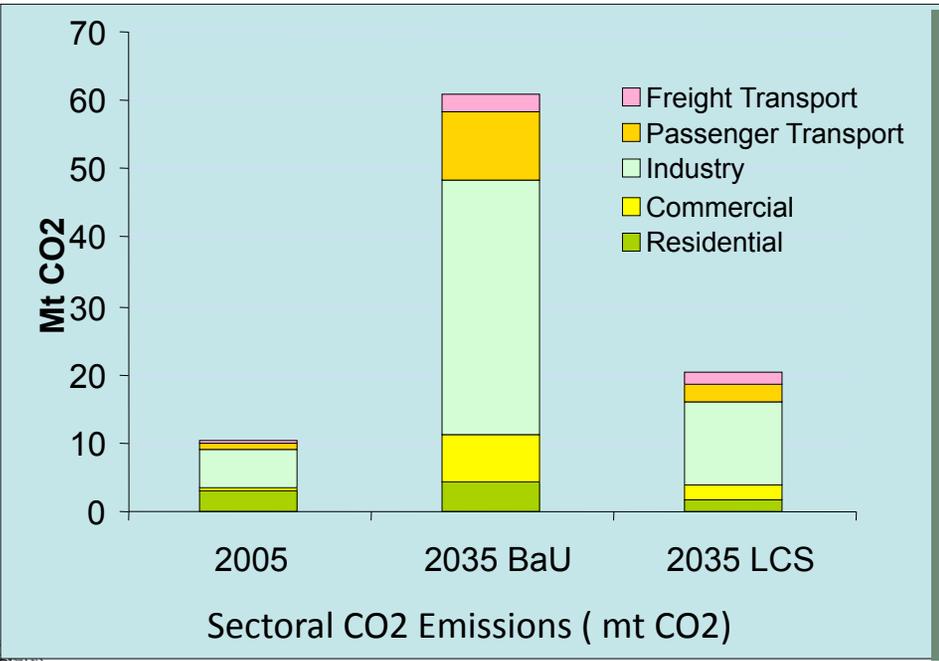
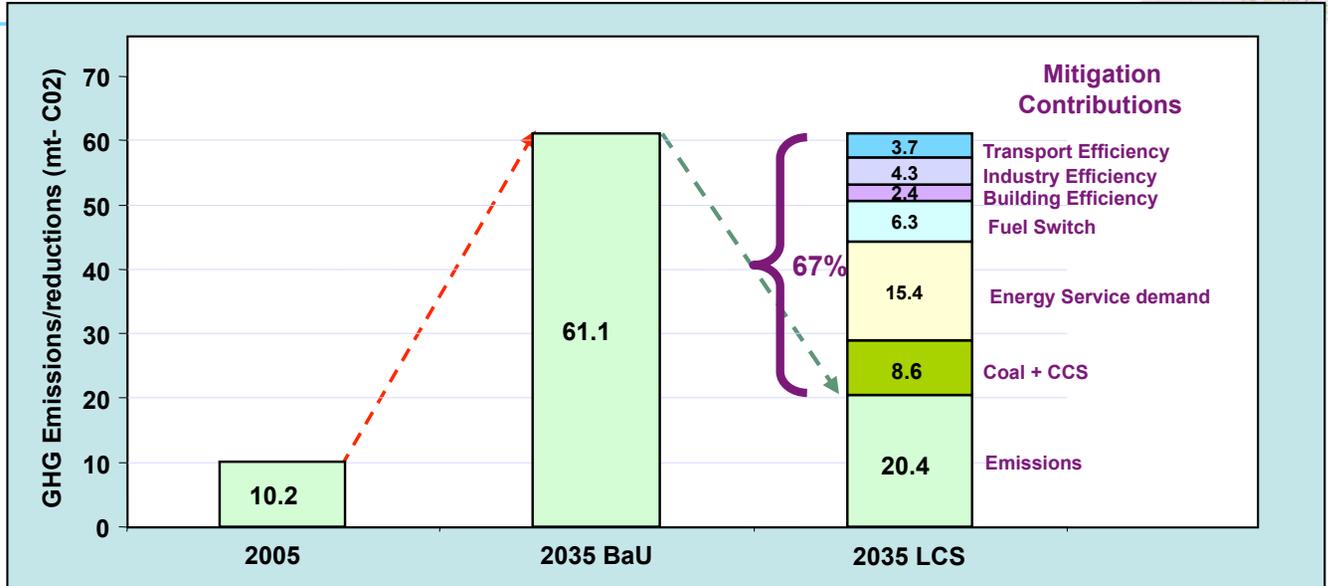
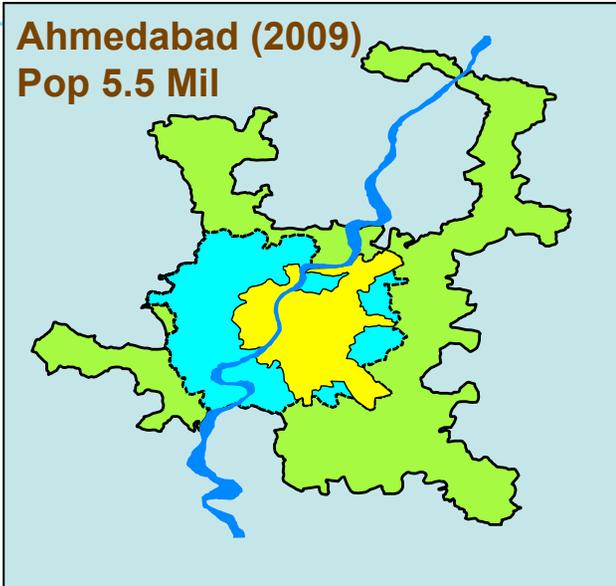
Technologies for Train Corridors

Japan will provide technology and financial support for Delhi-Mumbai Industrial Corridor (DMIC) to be developed similar to Tokyo-Osaka corridor for Rail transport

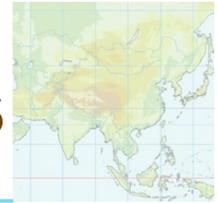
DMIC will result in substantial and sustained reduction in GHG since rail will replace road transport along this corridor



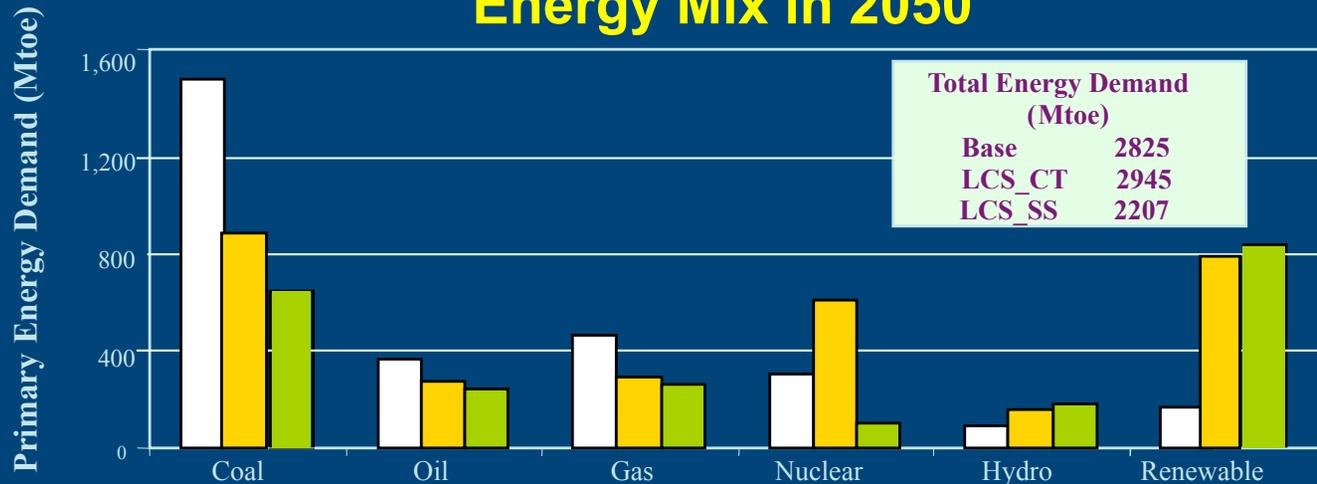
Co-benefits in City Planning: Ahmedabad



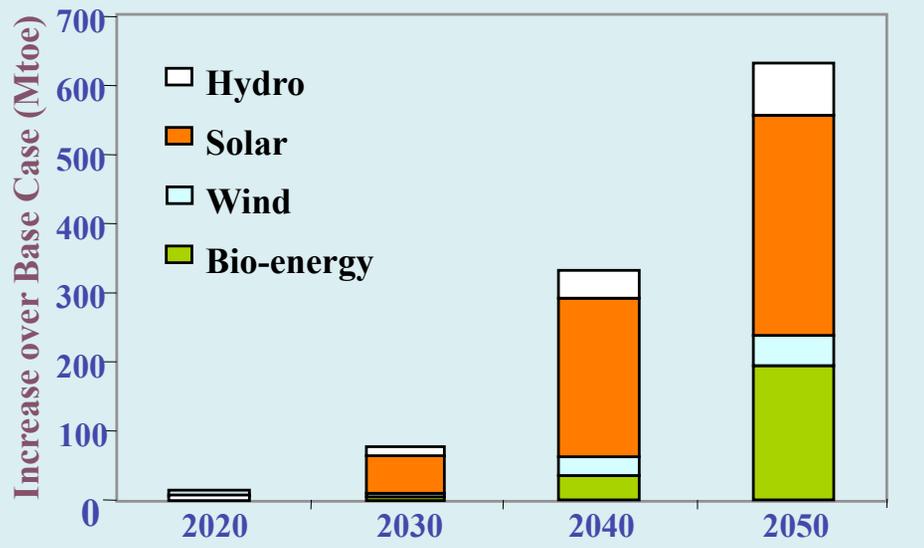
Energy Security & Air Quality Co-benefits



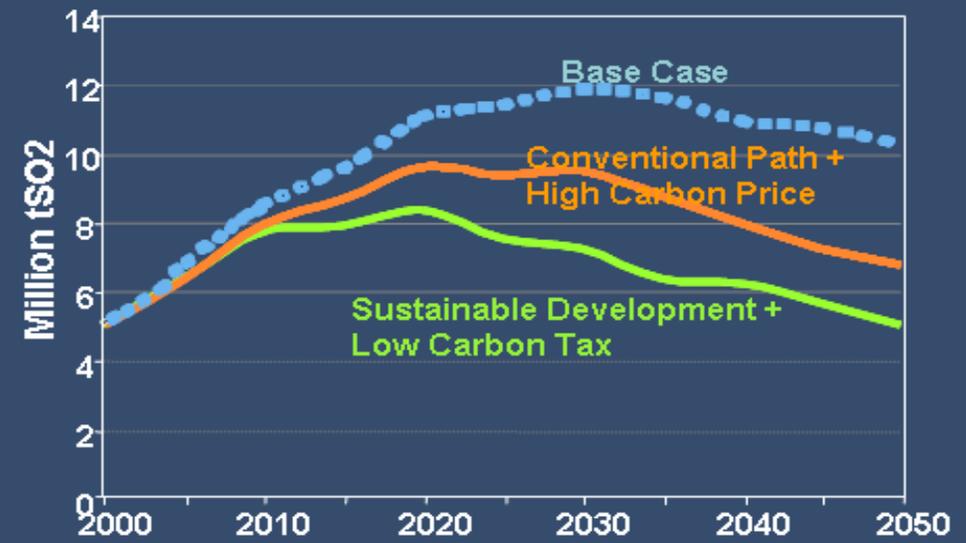
Energy Mix in 2050



Additional Renewable Energy (in LCS_SS)



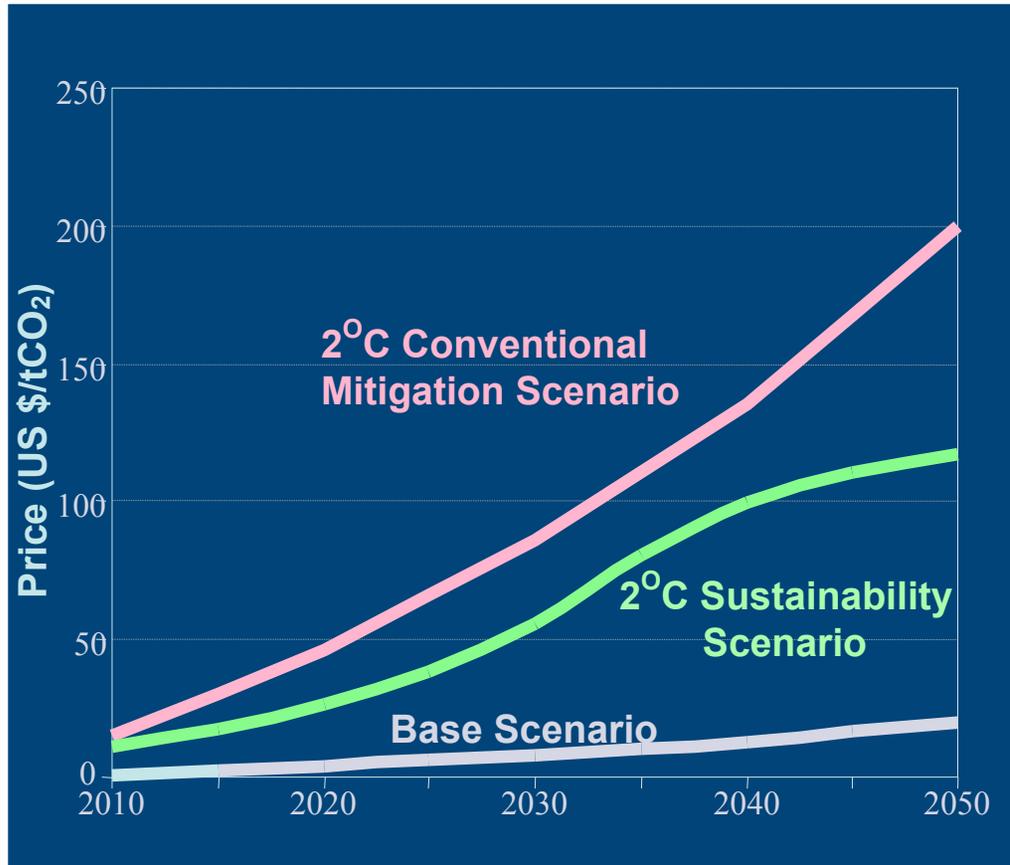
Co-benefits: SO2 Emissions



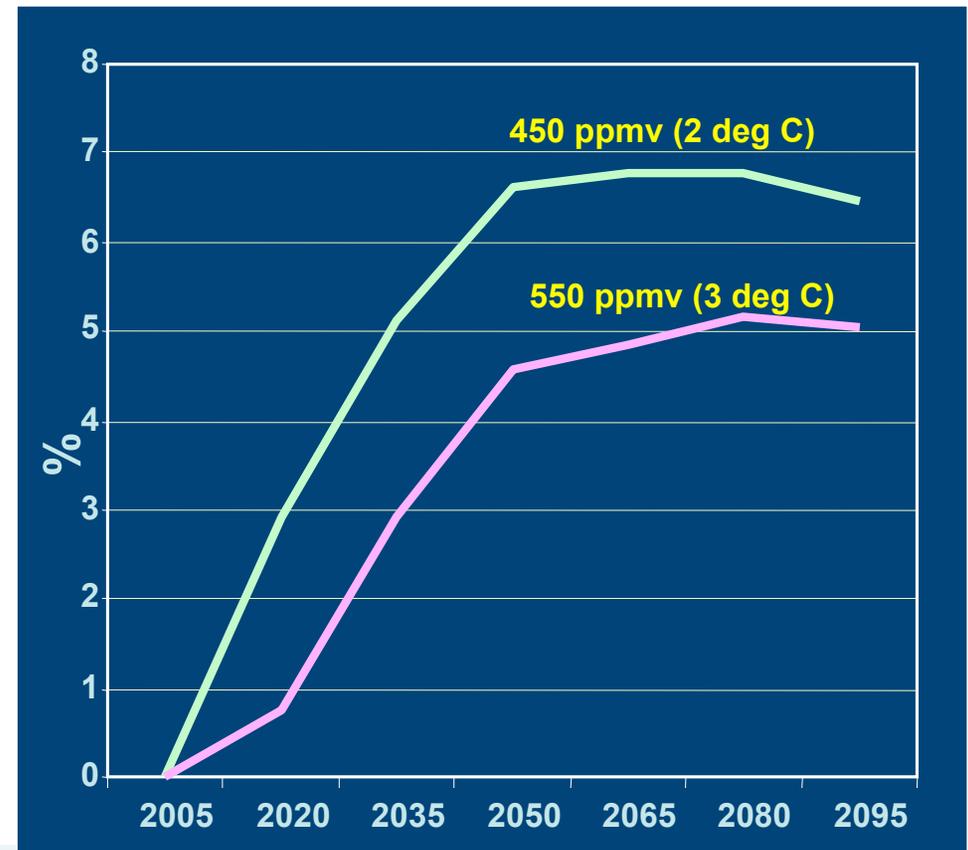
Linking Global & National Analysis



Social Value of Carbon



GDP Loss for India



Integrated Assessment Modeling Challenges



- Taking Policymakers/Decision-makers more seriously
- Look beyond 'conventional' market solutions (lock-ins, co-benefits)
- Modeling protocols that relate to specific Real-World questions
- Pay Attention to 'diversity' of policy-making and implementation
- Revisit past projections and learn



Thank you