

# Aligning Climate Change and Sustainable Development Objectives: *Perspective, Framework and Illustrations from India*

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“Developing Visions for a Low-Carbon Society through Sustainable Development”  
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# Agenda

## Development and Climate: The Perspective

## Framework for Mainstreaming Climate Change in National Development

## Illustrations from India

- Aligning Future Energy and Technology Transitions with Climate Goals
- Co-Benefits from Joint Market for CO<sub>2</sub> and SO<sub>2</sub> Mitigation
- Aligning Electricity Reforms for Low Carbon Content of Electricity
- Co-benefits of Cooperation for Energy-Water Markets in South-Asia
- Co-benefits of Sustainable Development and Mitigation of Climate Change Risks to Long-life Assets like Infrastructures

## Conclusions



# Development and Climate Perspective and Framework

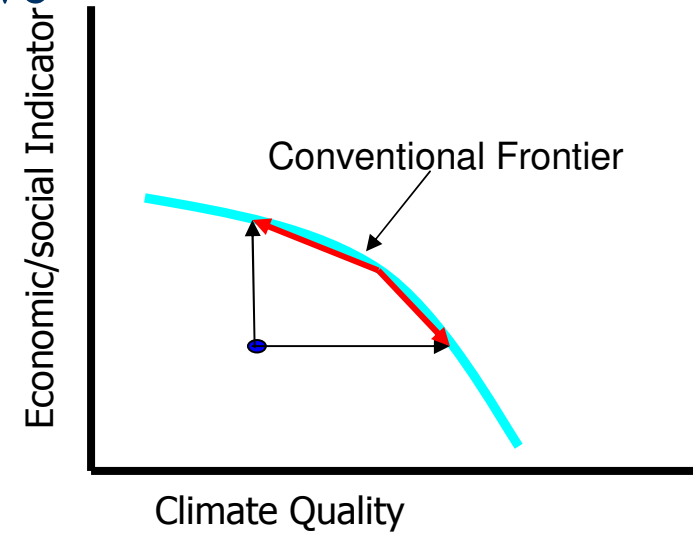
## Why should “Development and Climate” actions be aligned?

- Climate change is a derivative problem of development
- Development is the key to mitigative and adaptive capacities
- Dealing with climate change exclusively is very expensive & expected to cost several trillion dollars over this century
- Strategies for dealing with sustainable development and climate change have many common elements, and aligning these would reduce costs and minimize welfare losses

# Development and Climate: The Perspective

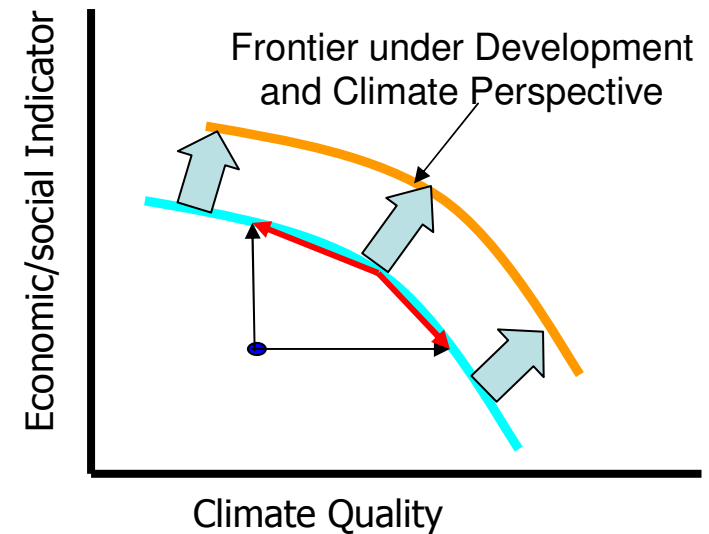
## Conventional perspective

- *Development is a threat to climate*
- *Climate change is a barrier to development*



## Development and Climate perspective

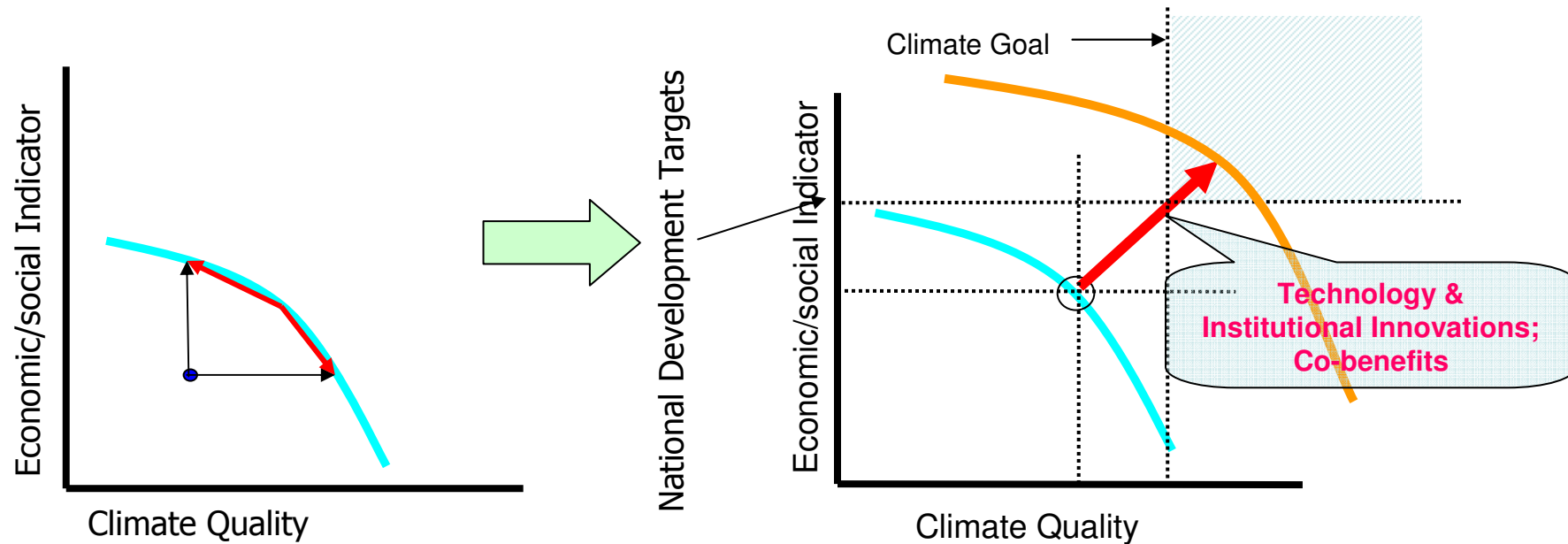
- *Pathways to achieve sustainable development goals are climate-friendly*
- *Sustainable Development is the driving force for addressing climate change challenges*



# Development and Climate: Shifting the Frontier

Shifting development and climate “frontier” though:

- *Innovations (technology, institutions)*
- *International and regional cooperation*
- *Targeted technology and investment flows*
- *Aligning stakeholder interests*
- *Focusing on inputs rather than outputs (conduct vs.results)*



# Development and Climate: Framework

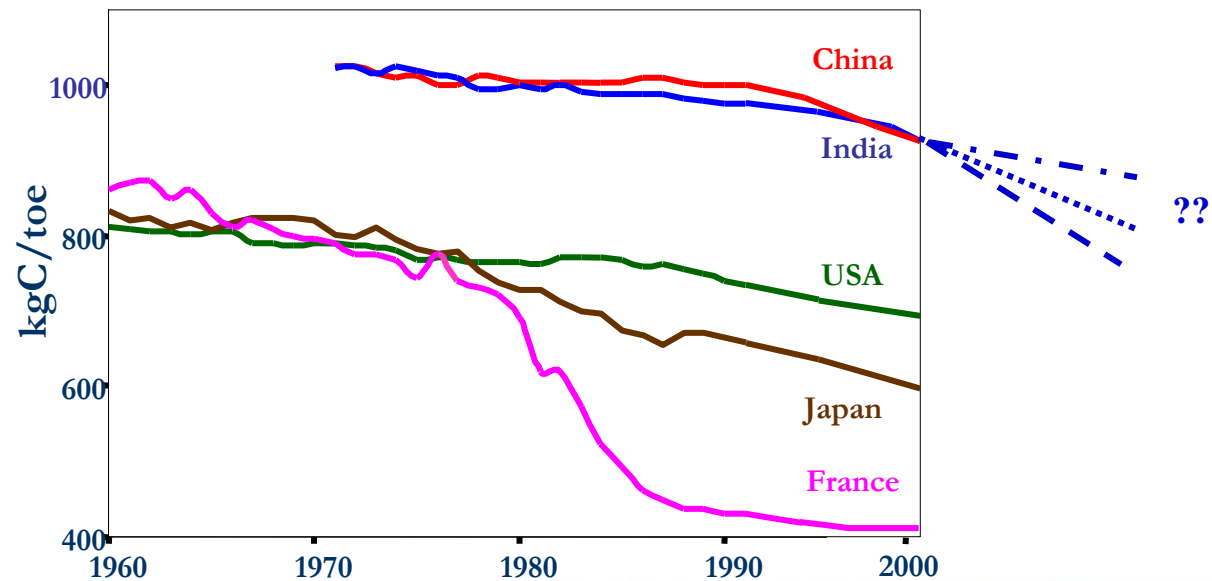
## Approach

- *Shift baseline*
- *Multiple dividends*
- *Link local & global; short & long-term*

## Methodology for assessment

- *Scenarios (key drivers, development policies)*
- *Processes (cooperation, learning)*
- *Institutions (rule of law, governance)*
- *Resources (endowments, human capital, finance)*

## Decarbonization of Primary Energy



# Mainstreaming Climate Change in National Development

## Climate policies and actions to be driven by:

- *National development targets*
- *Agreed goals under extant international agreements*

## MDG, India's National Targets and Climate Change

MDG and global targets	India's National plan targets	Interface with Climate Change
<p><b>Goal 1: Eradicate extreme poverty and hunger</b></p> <p>Targets: Halve, between 1990 and 2015, the proportion of people with income below \$1 a day and those who suffer from hunger</p>	<ul style="list-style-type: none"> <li>• Double the per capita income by 2012</li> <li>• Reduce poverty ratio by 15% by 2012</li> <li>• Contain population growth to 16.2% between 2001-2011</li> </ul>	<ul style="list-style-type: none"> <li>• Income effect would enhance choices for cleaner fuels and adaptive capacity</li> <li>• Reduce GHG Emissions due to lower population</li> </ul>
<p><b>Goal 7: Ensure environmental sustainability</b></p> <p>Targets: Integrate SD principles in country policies/ programs to reverse loss of environmental resources</p> <p>Target: Halve by 2015 the proportion of people without sustainable access to safe drinking water</p>	<ul style="list-style-type: none"> <li>• Increase in forest cover to 25% by 2007 and 33% by 2012 (from 23% in 2001)</li> <li>• Sustained access to potable drinking water to all villages by 2007</li> <li>• Electrify 80,000 additional villages by 2012 via decentralized sources</li> <li>• Cleaning of all major polluted rivers by 2007 and other notified stretches by 2012</li> </ul>	<ul style="list-style-type: none"> <li>• Enhanced sink capacity, reduced GHG and local emissions; lower fossil imports; reduced pressure on land, resources and ecosystems</li> <li>• Higher adaptive capacity to from enhanced supply of water, health &amp; education in rural areas</li> </ul>

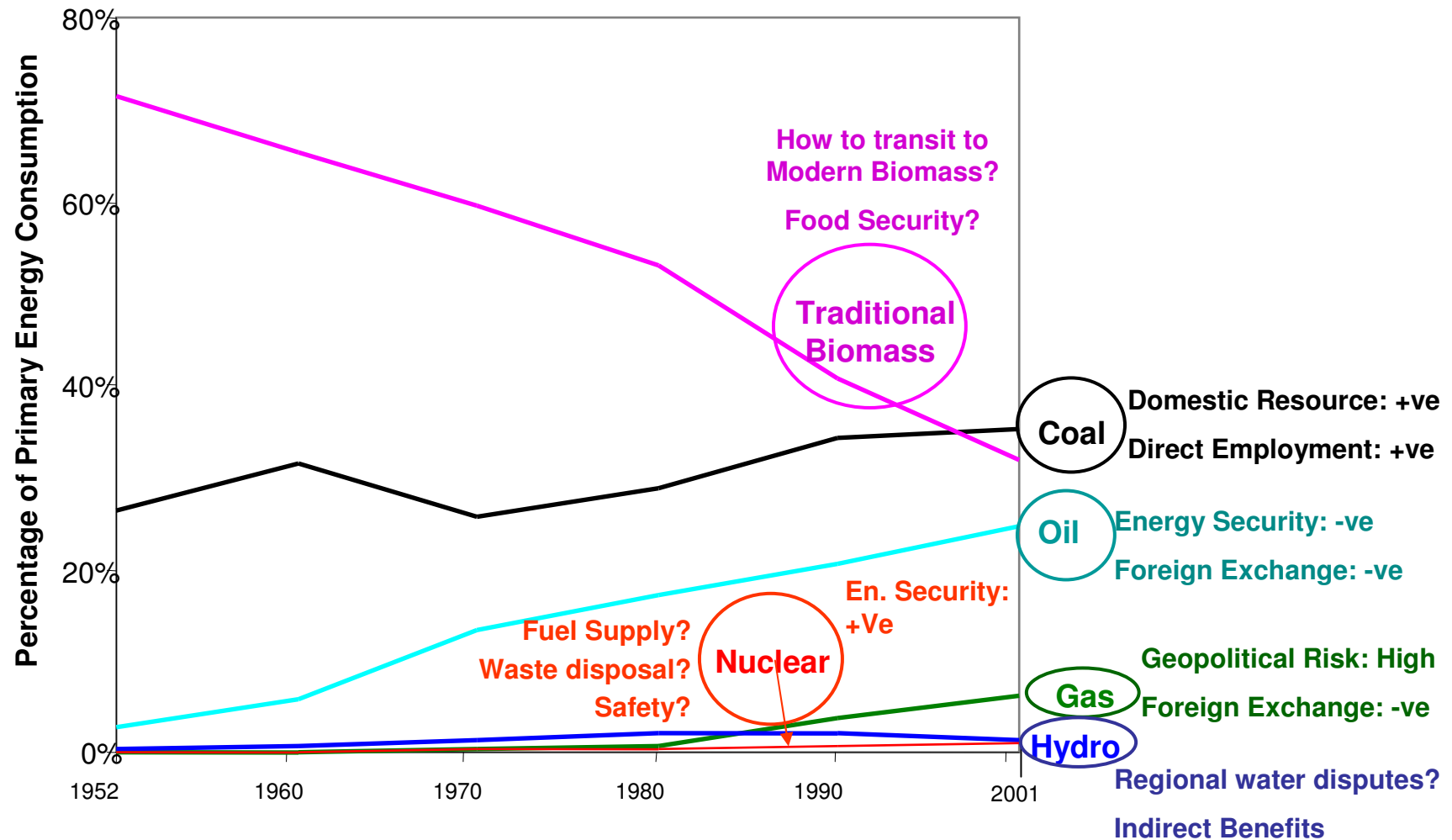


# Illustrations from India

- **Aligning Future Energy and Technology Transitions with Climate Goals**
- Co-Benefits from Joint Market for CO<sub>2</sub> and SO<sub>2</sub> Mitigation
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# Energy Transitions: How they matter to Low Carbon Future?



# Bio-diesel: Multiple Dividends

## Jatropha Plantation in India



- **Rural Employment:**  
Large scale employment potential in Jatropha plantation, seed collection and extraction
- **Farm Income (from waste lands):**  
Net income Rs. 12000/Ha/year
- **Energy Security**  
Imported fossil oil is replaced
- **Environment**  
Neutral carbon emissions, Rehabilitates waste land

## Oil Extraction Plant

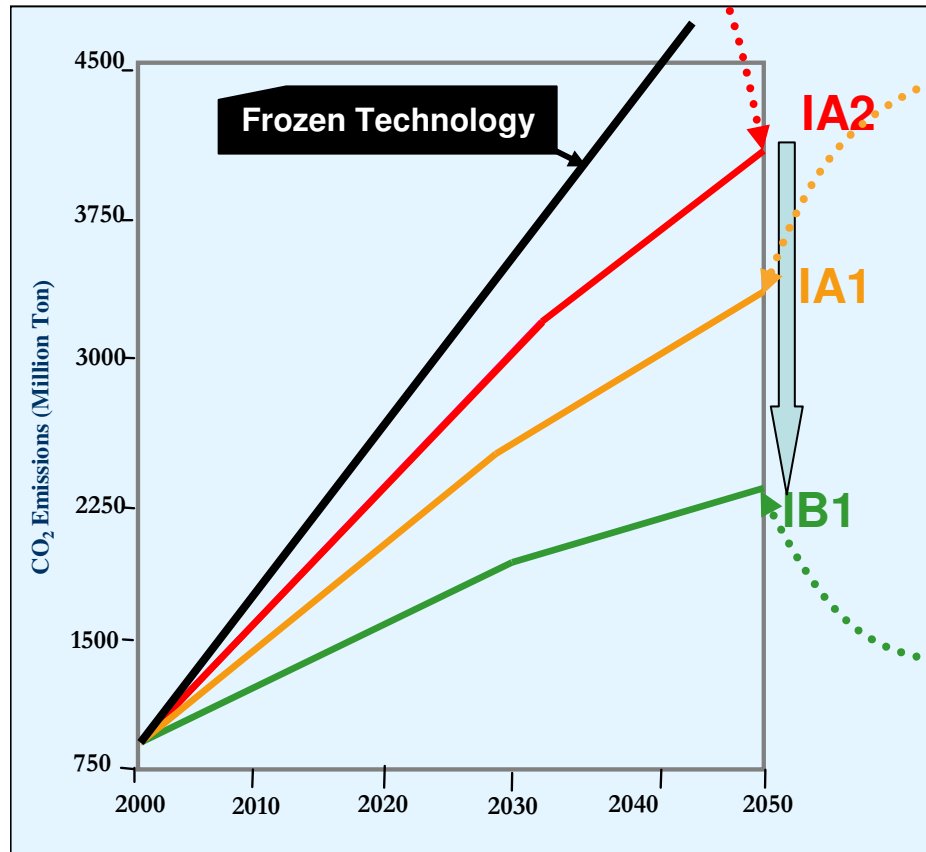


## Rural Employment



# Technologies in Low Carbon Scenarios: Medium-Term (2050)

Conventional Technology Path: Includes significant endogenous technological change



## Globalization/Market Efficiency Scenario

Synfuels, Next-Gen Nuclear (Thorium)

Fuel cell vehicles, Pipeline networks

Energy efficient appliances/ infrastructure

Coal liquid, IGCC, Hydrogen from gas

Advanced materials, Nanotechnology

## Sustainable Development Scenario

Push for renewable energy & recycling

Advanced car pooling, Shared assets

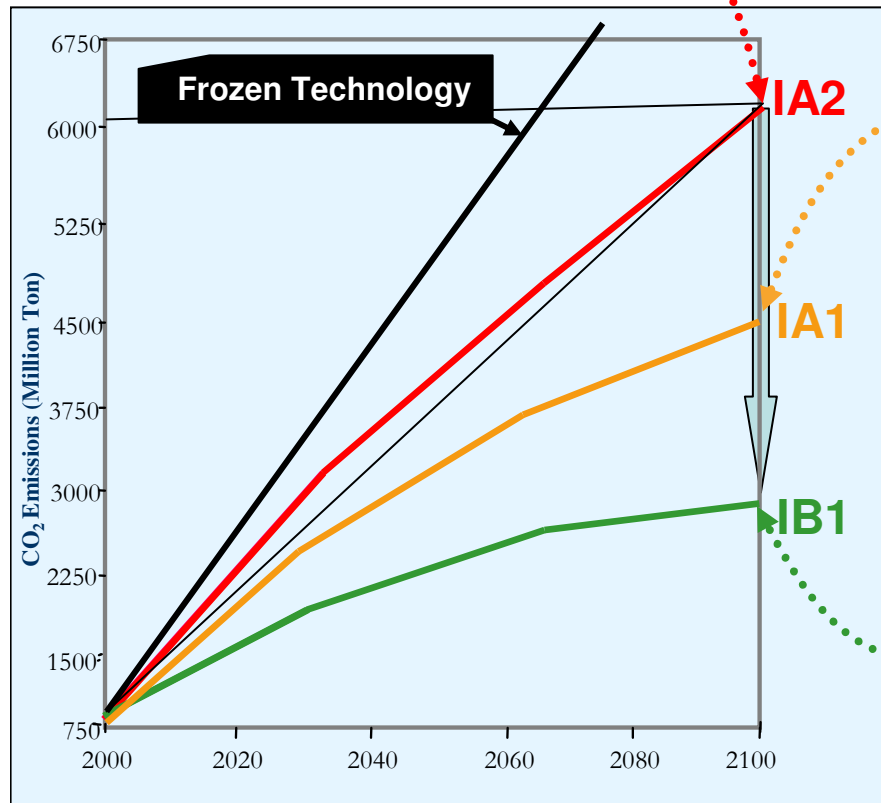
High speed trains, Swap of transport by IT

Dematerialization, Community institutions

Sustainable habitats, Reforestation

# Technologies in Low Carbon Scenarios: Long-term (2100)

Conventional Technology Paths: Includes significant endogenous technological change



## Globalization/Market Efficiency Scenario

Synfuels, Gas hydrates, Nuclear Fusion

Fuel cell vehicles, High air transport share

IT controlled buildings/appliances

Advanced global shipping networks

Global R&D, Intensive agriculture

## Sustainable Development Scenario

Integrated resources/technology planning

Decentralized & renewable technologies

Lifestyle changes, Eco-friendly choices

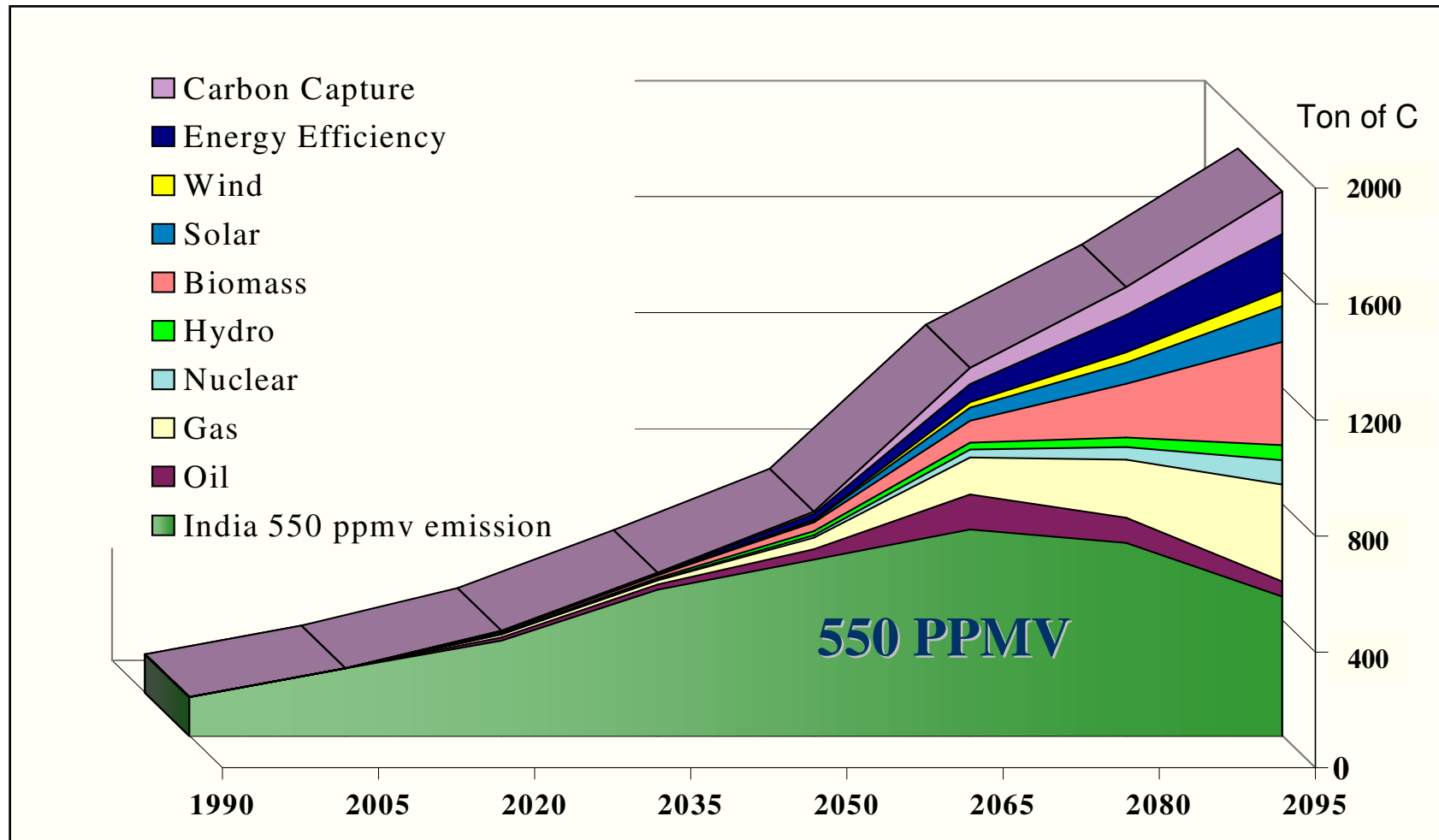
Sustainable agriculture/forestry/land-use

Multi-purpose water systems

Sustainable habitats, Service Pools

# Stabilization Induced Technological Change – IA2 Scenario

550 ppmv CO2 Stabilization in India

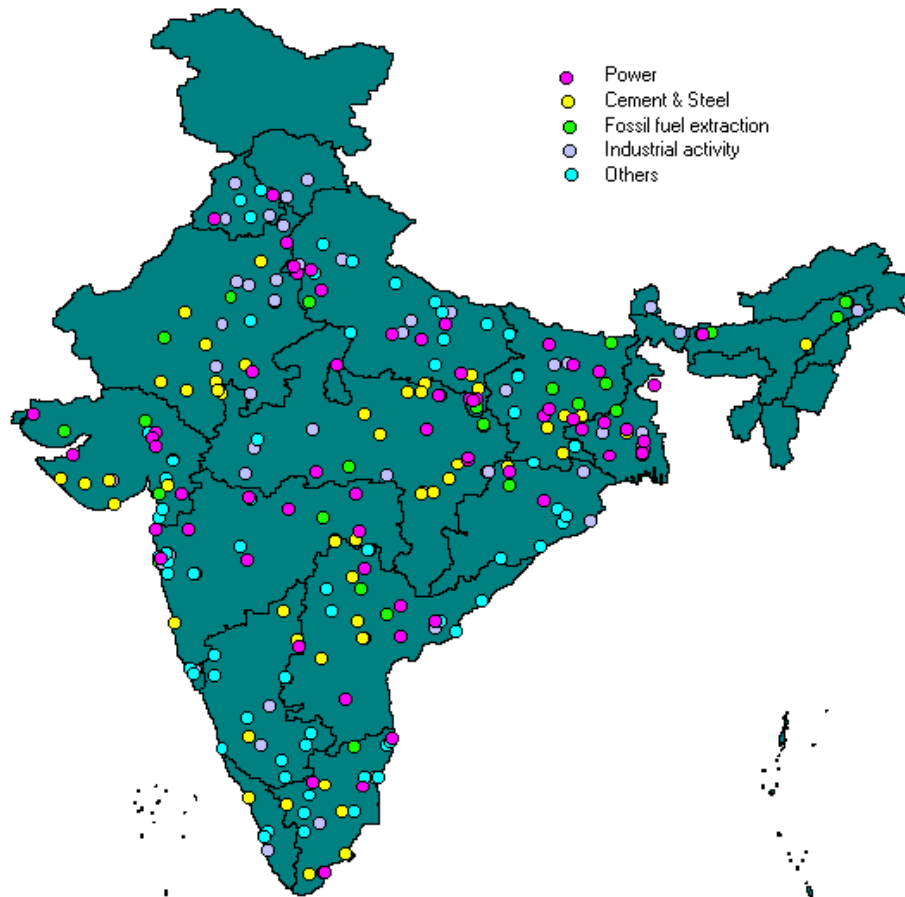


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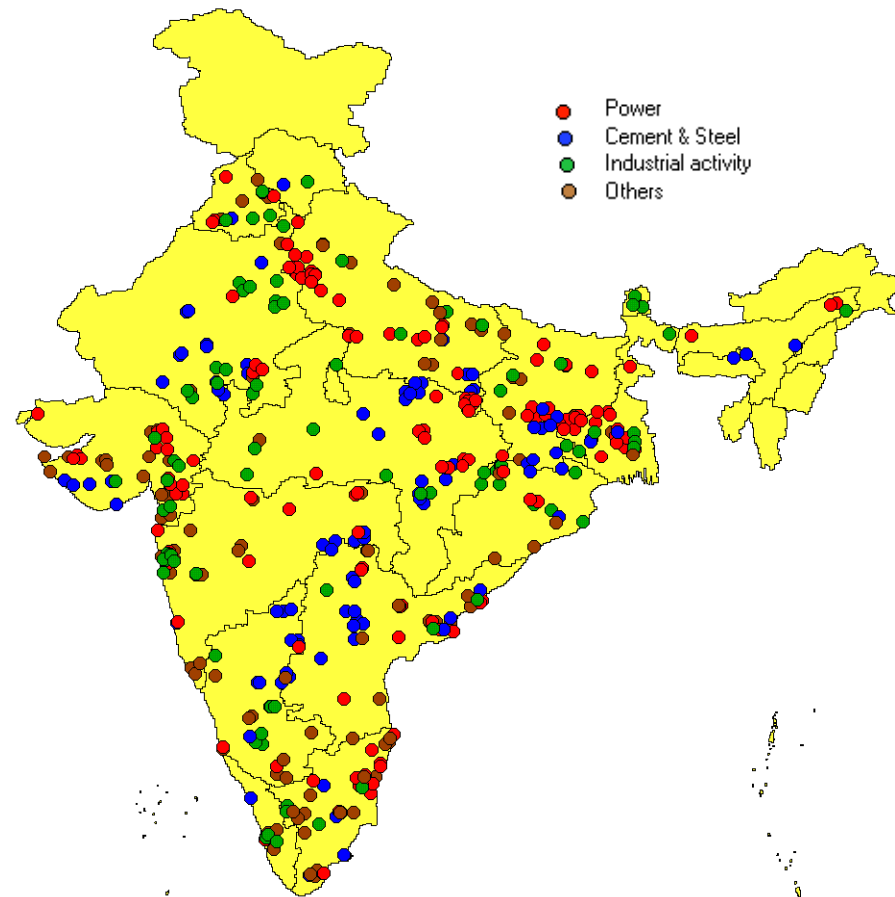
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# LPS Locations

Year: 2000

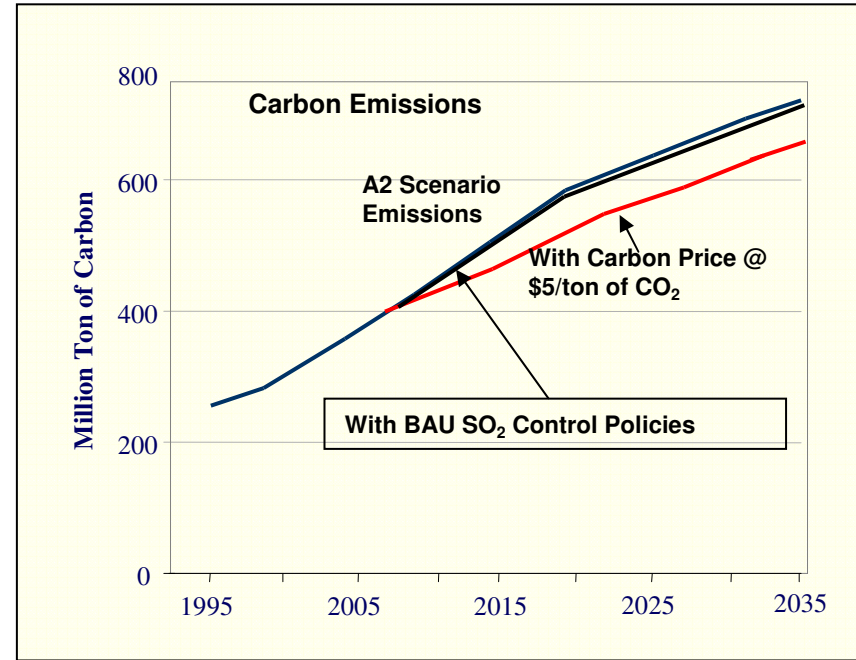
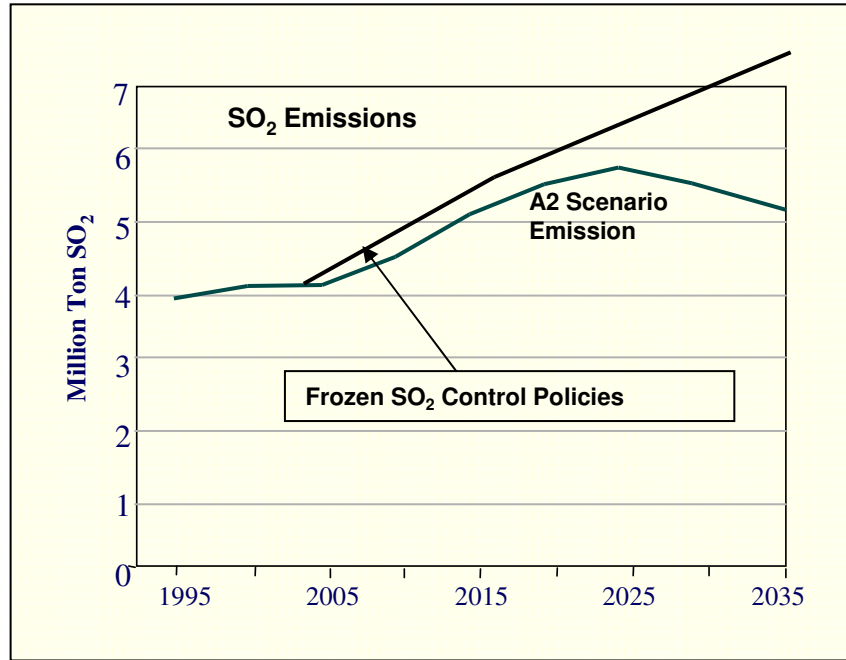


Year: 2030





# Co-Benefits: Joint SO<sub>2</sub> and CO<sub>2</sub> Mitigation



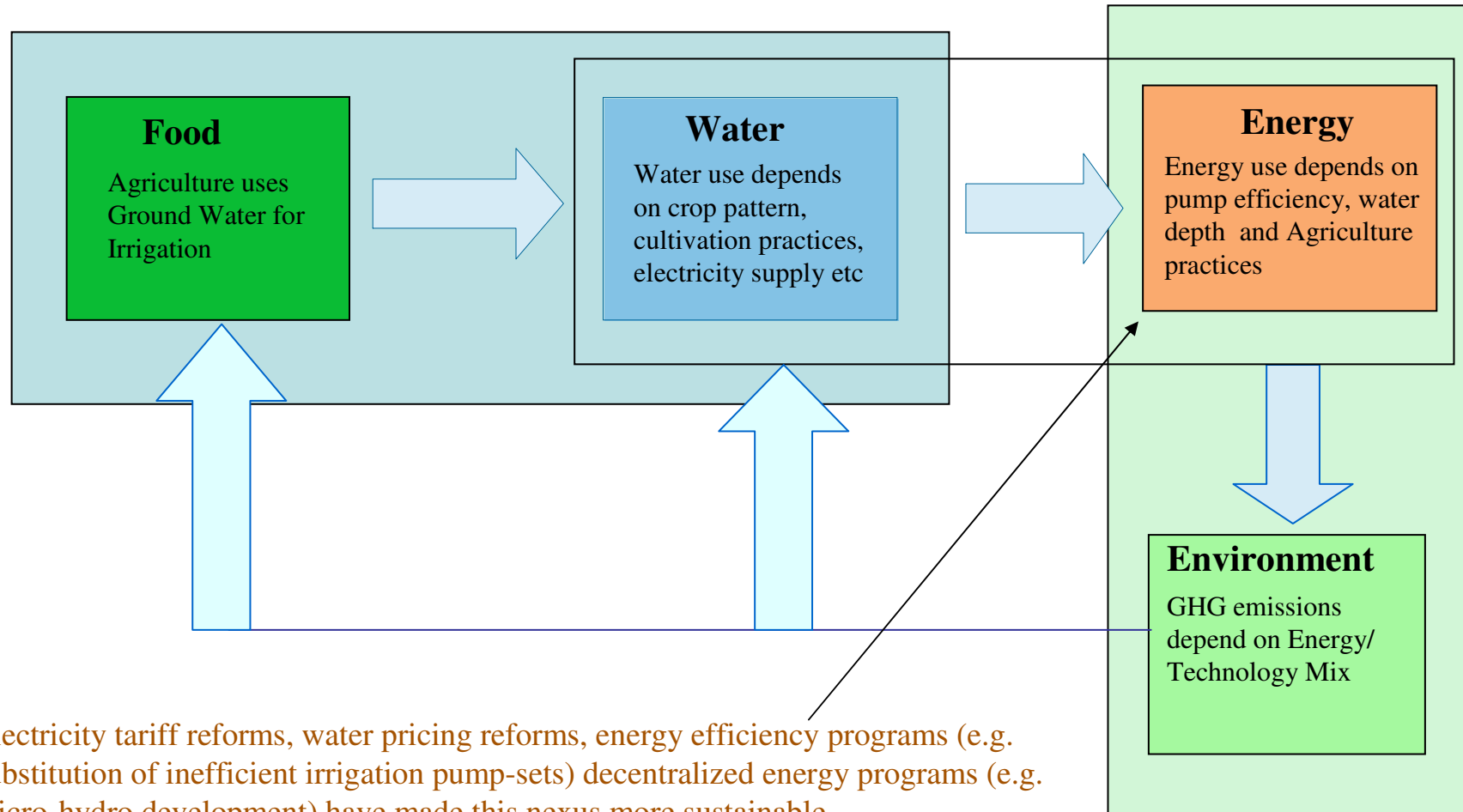
## Joint Mitigation (Period 2005-2030)

Mitigation Regime	Co-benefits
<i>SO<sub>2</sub> mitigation alone</i>	<b>Little carbon mitigation</b>
<i>Joint Mitigation: CO<sub>2</sub> mitigation @ \$5/ton &amp; same SO<sub>2</sub> target</i>	<b>Joint mitigation costs \$400 Million less</b>

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# Food–Water–Energy–Environment Nexus

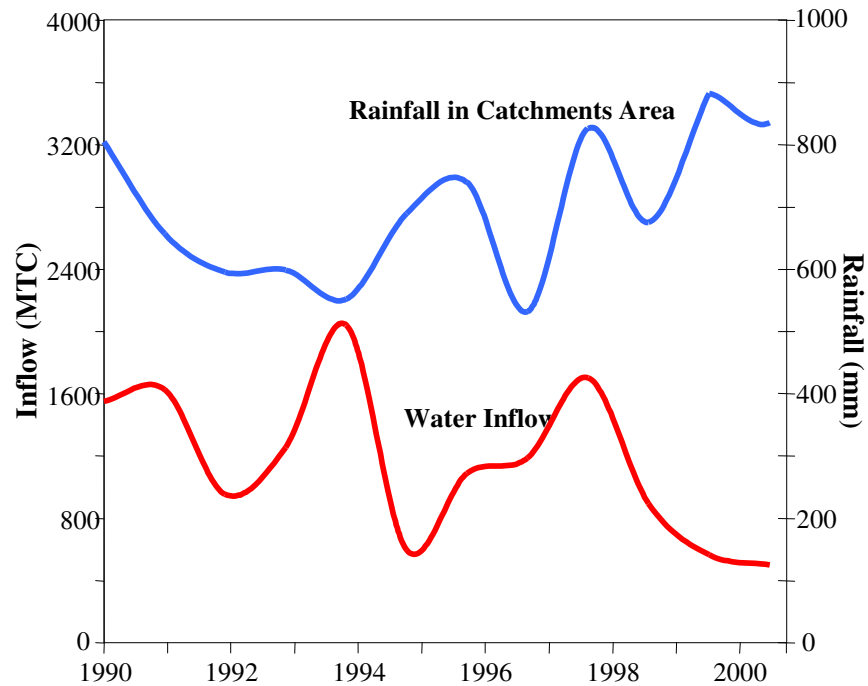


Electricity tariff reforms, water pricing reforms, energy efficiency programs (e.g. substitution of inefficient irrigation pump-sets) decentralized energy programs (e.g. micro-hydro development) have made this nexus more sustainable

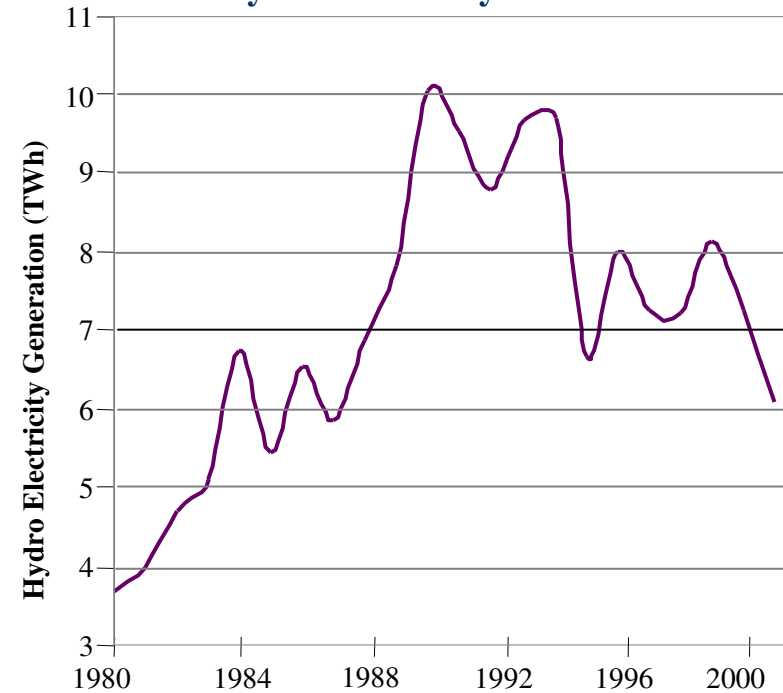
# Rainfall, Inflows and Hydro Electricity Generation

## State of Andhra Pradesh

### Rainfall and Water Inflows



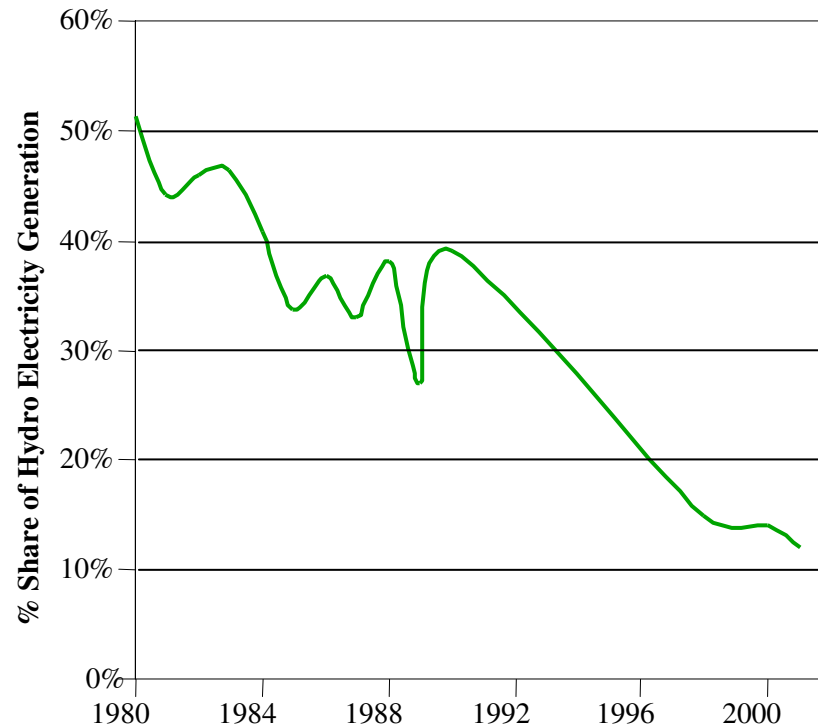
### Hydro Electricity Generation



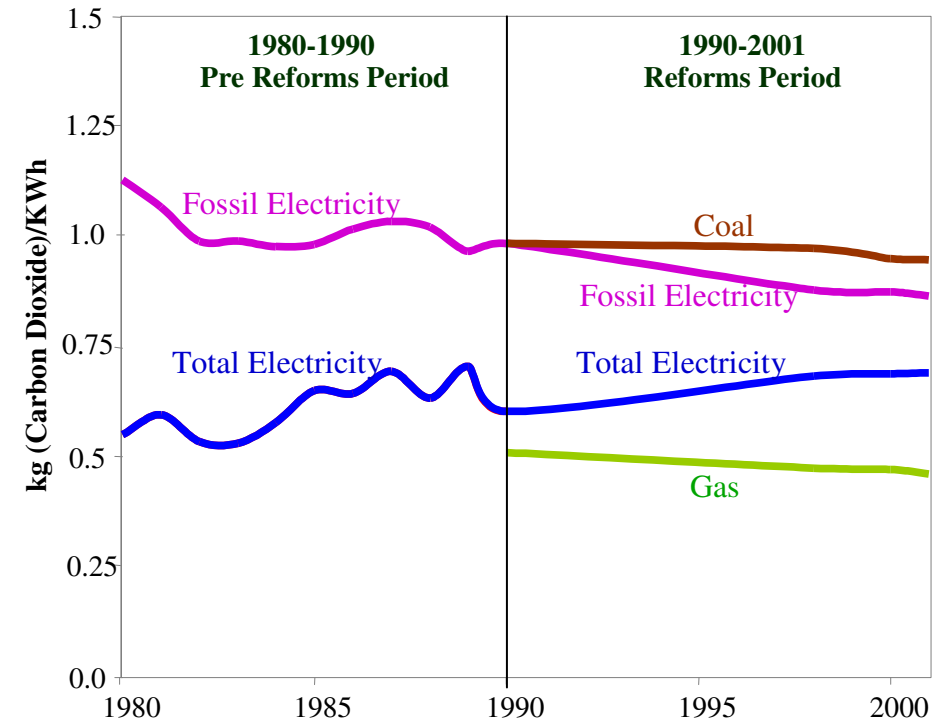
# Rainfall, Inflows and Hydro Electricity Generation

State of Andhra Pradesh

Share of Hydro



Carbon Emissions Baseline of Andhra Pradesh



# South-Asia Energy Cooperation

## Integrated South-Asia Energy Market



## Spillover Benefits:

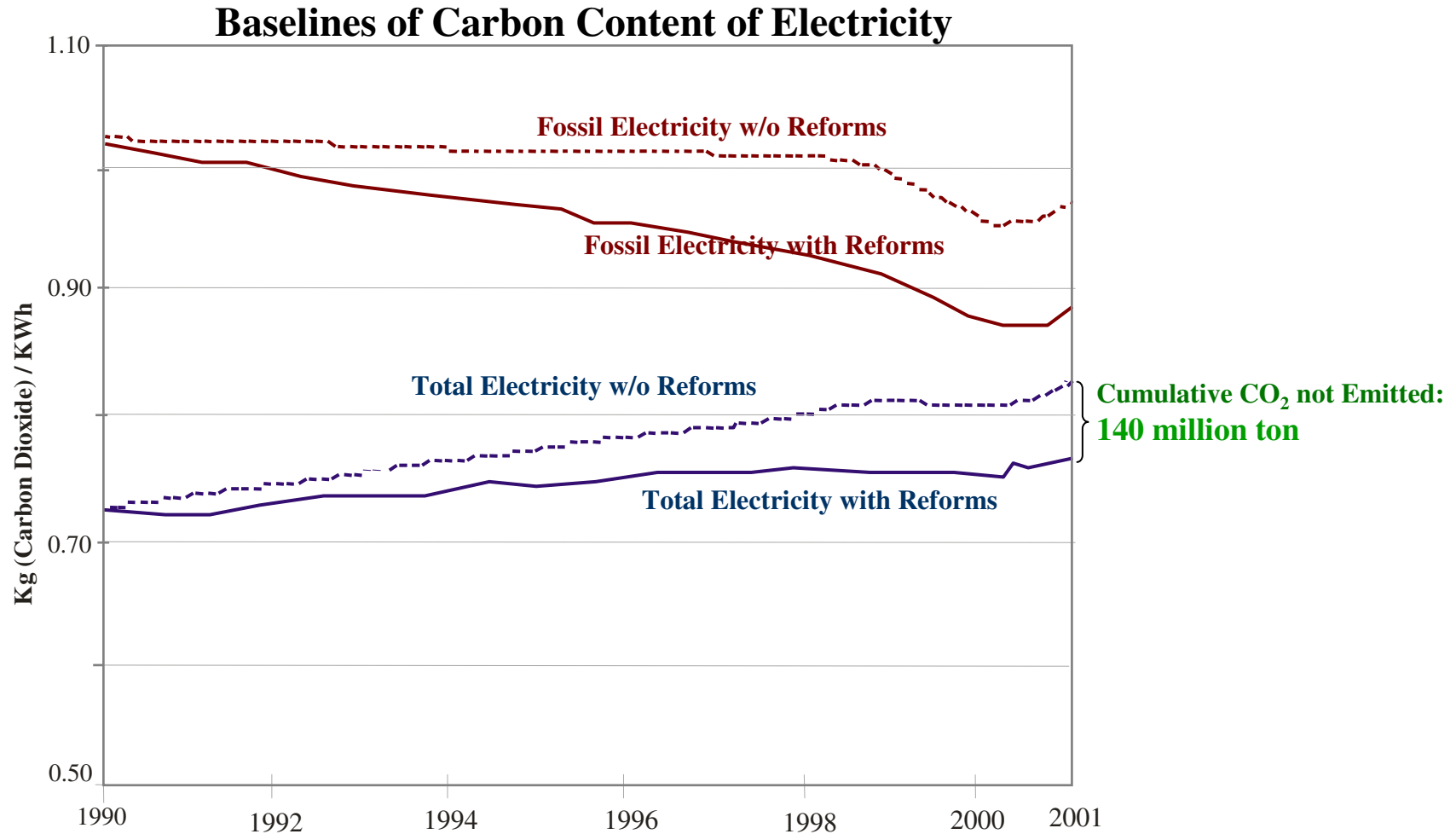
- 16 MW additional Hydropower
- Flood control
- Lower energy prices would enhance competitiveness of regional industries

Benefit (Saving) Cumulative from 2010 to 2030		\$ Billion	% GDP
Energy	60 Exa Joule	321	0.87
CO <sub>2</sub> Equiv.	5.1 Billion Ton	28	0.08
SO <sub>2</sub>	50 Million Ton	10	0.03
<b>Total</b>		<b>359</b>	<b>0.98</b>

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# Carbon Dioxide Emissions Saved by Electricity Reforms

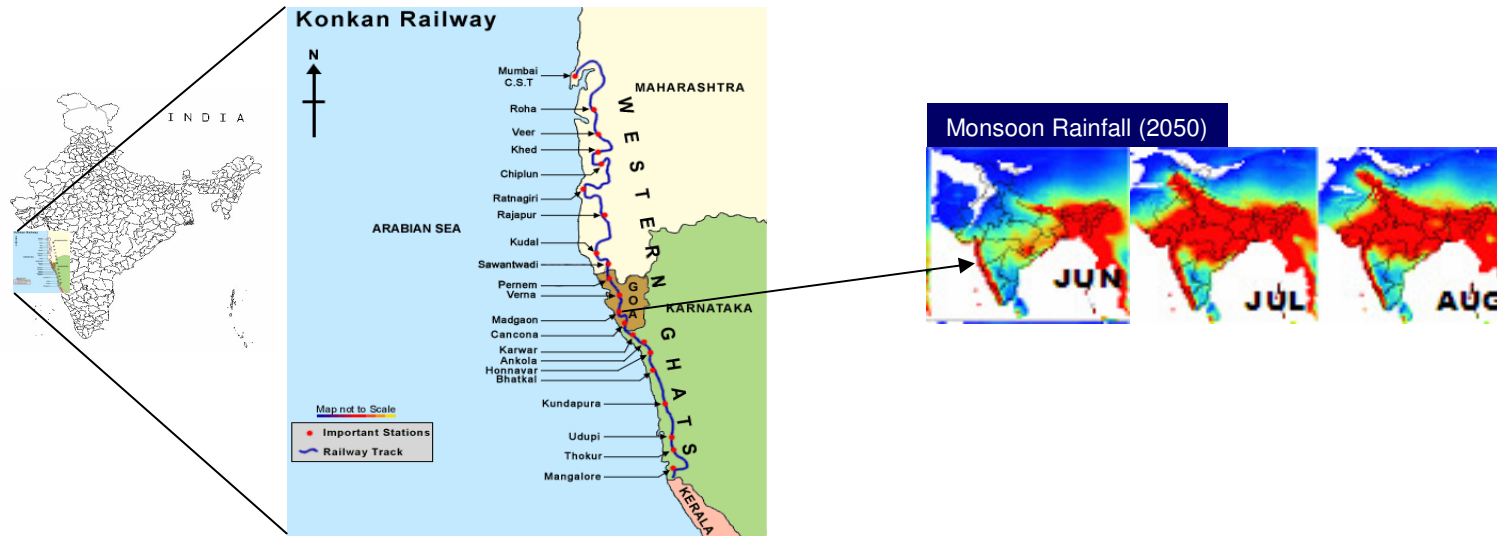




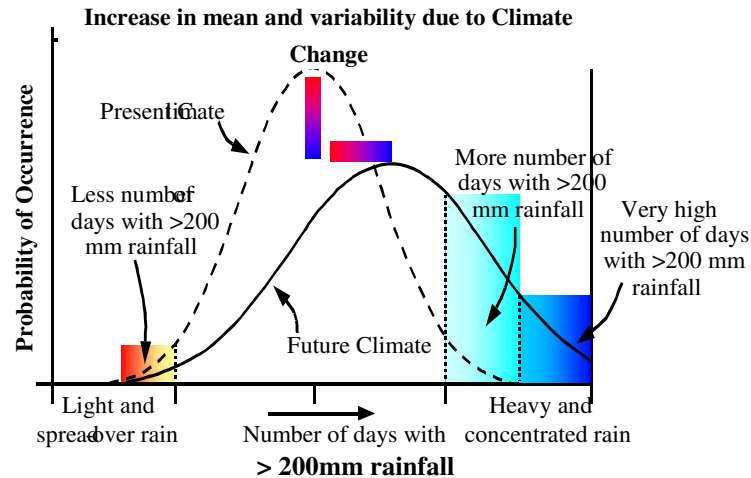
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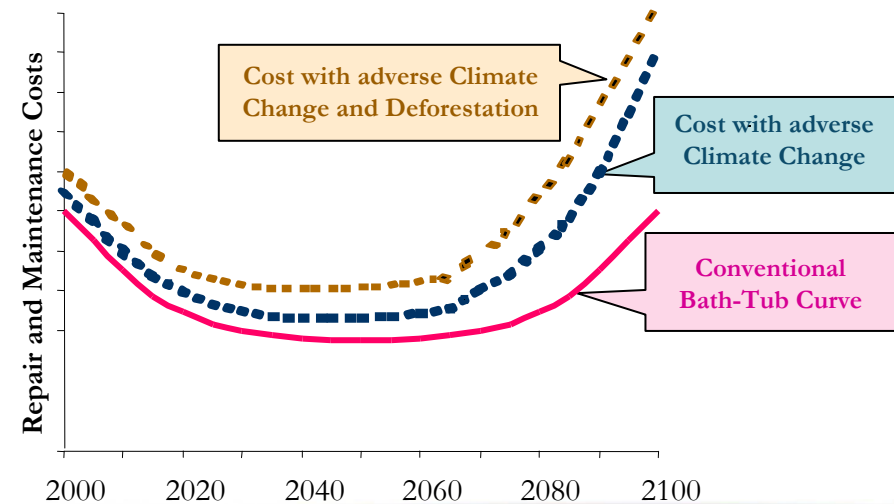
# Sustainable Development & Climate: Impacts on Infrastructure



## Increase in Climate Intensity and Variability



## Maintenance Cost Curve



# Conclusions: Aligning Development and Climate

## Transiting to Low Carbon Society

- Global development along high carbon path is **untenable**
- Stand-alone decarbonization is **costly**
- Most **sustainable development actions** are climate friendly
- **Mainstreaming** climate change in development actions reduces welfare losses

## Low Carbon Society and Developing Countries

- Developing countries will have low **per capita emissions** throughout the century, but their **emissions intensities** will be high
- Significant opportunities exist in developing countries for gaining **co-benefits**
- Developing Countries have opportunities to decide the **development pathway**
- Mitigation and adaptation cost for any stabilization scenario is lower where **development pathway follow sustainability goals**

## Low Carbon Society and India

- India's population throughout the century will remain around **a sixth** of global population
- India's development along the **sustainable path** is vital for global sustainability
- Stabilization regime would induce significant mitigation and adaptation in India; **altering energy system and imposing significant costs**
- India's **Low Carbon Transition** would deliver sizable global benefits