

# Policy Challenges in linking Energy with Climate Change

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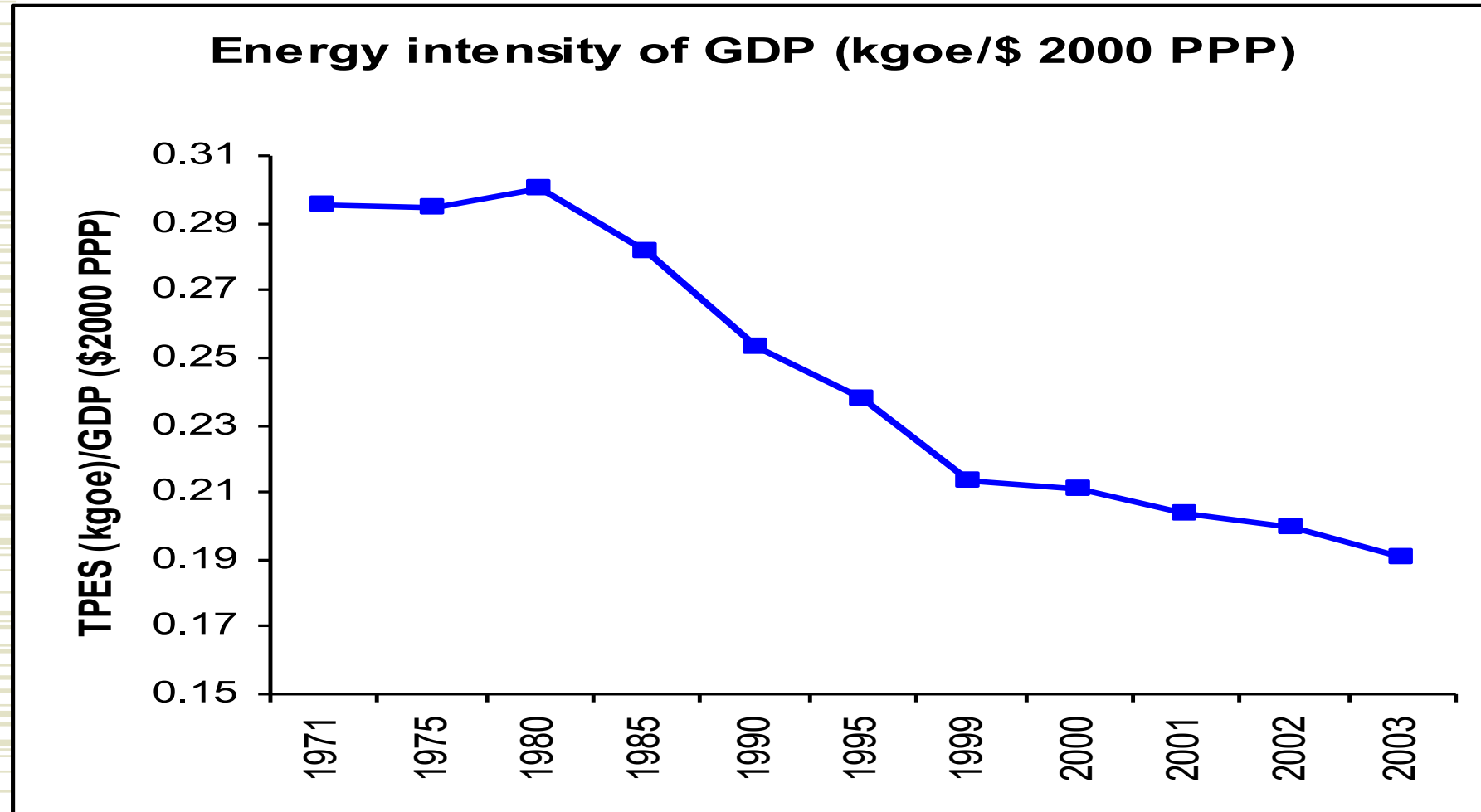
# Research linking energy consumption with climate change

- ◆ Energy Decomposition and GDP in India
- ◆ Explaining inter-firm and inter-industry variation in energy intensity
- ◆ Estimation and Analysis of Carbon Emissions from energy input use at the firm level in Indian manufacturing
- ◆ Energy Consumption Response to Climate Change: Policy Options for India
- ◆ Competitiveness of firms participating in CDM projects
- ◆ Technological Efforts and ISO Environmental Certification in the Manufacturing Sector in India

# India: Current Scenario

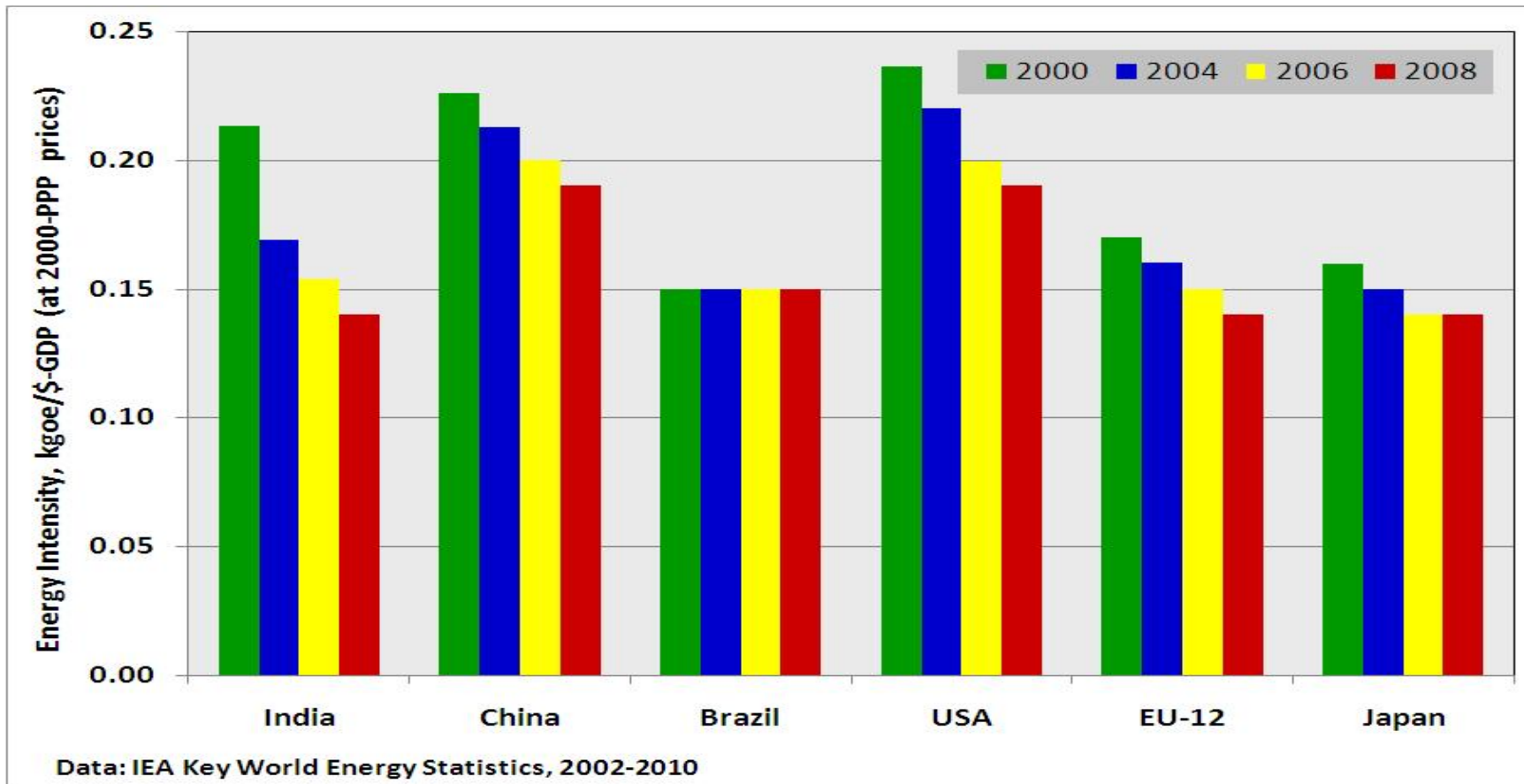
- ◆ India is a responsible nation and is committed to growth with environmental responsibility.
- ◆ India has delivered a GDP growth rate of 8% with only 3.7% growth in its total primary energy consumption.
- ◆ India has achieved energy-GDP decoupling at much earlier stage of its development cycle.
  - GDP growth rate has been higher than projected even though power capacity addition has been lower (only 50% ) than planned
  - Industrial growth and profitability has been high even though oil prices had sky-rocketed

# Trends in Energy Intensity



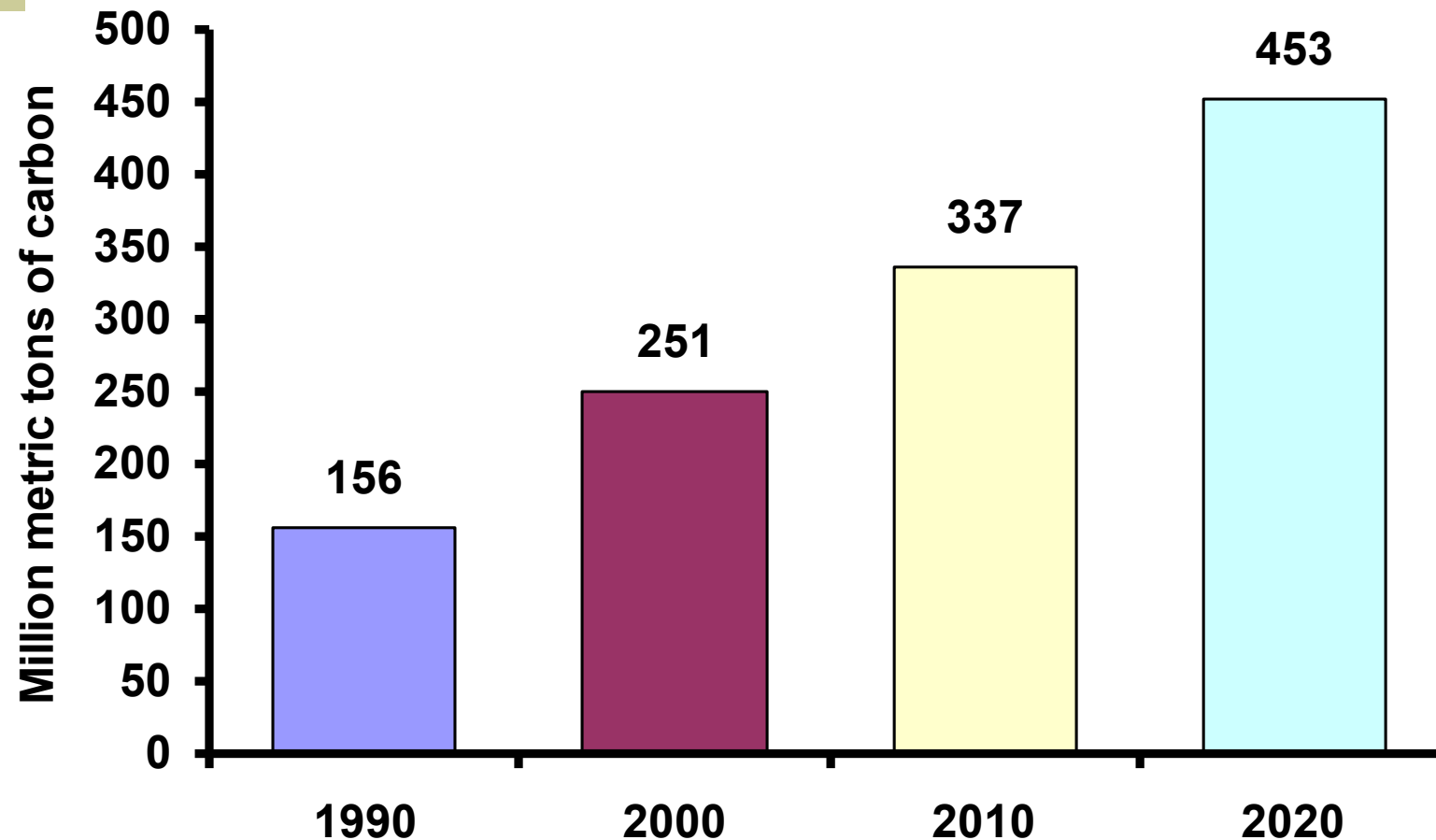
Source: Sahu and Narayanan (2012)

# Energy Intensity: A Comparison



Source: Sahu and Narayanan (2013)

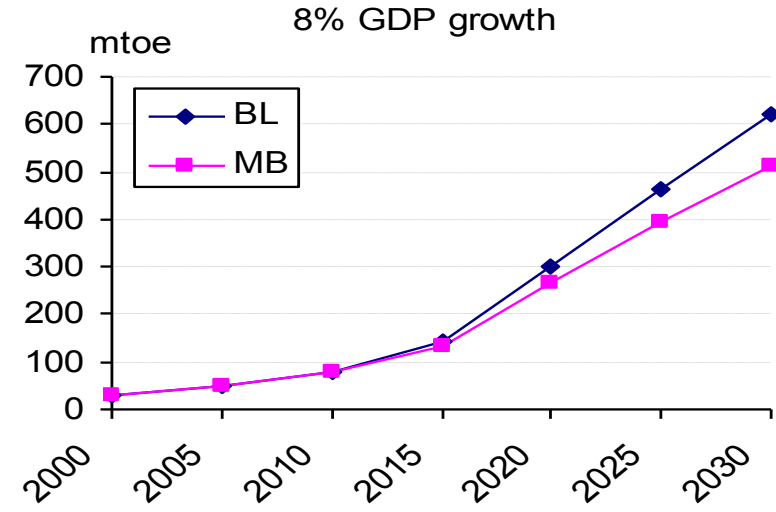
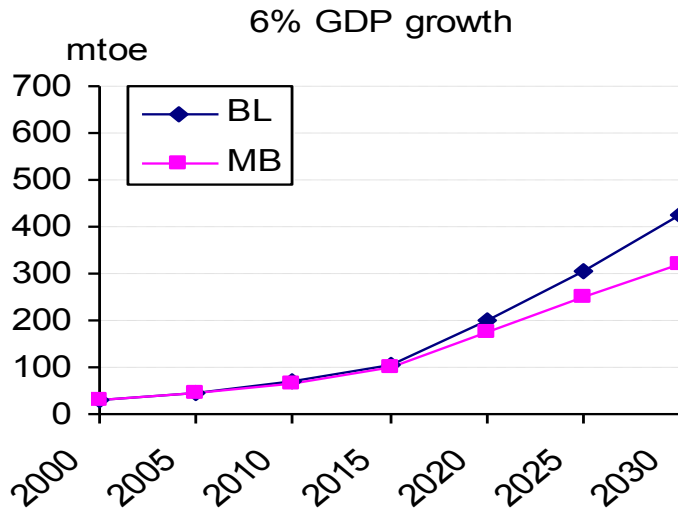
# India's Carbon Emissions



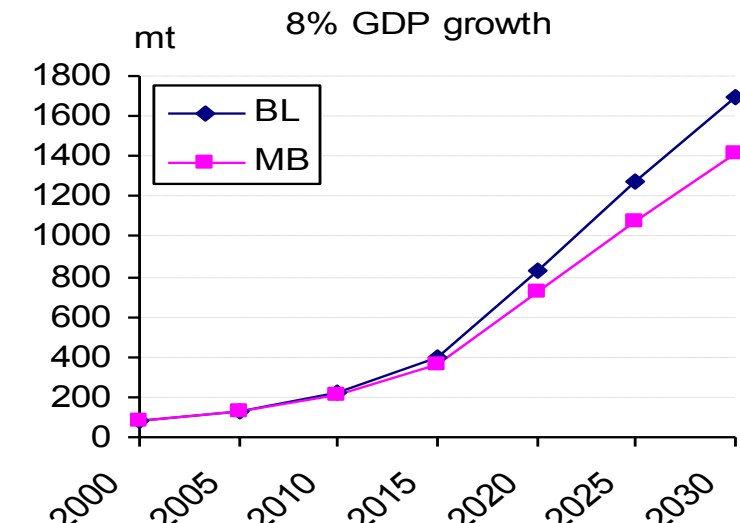
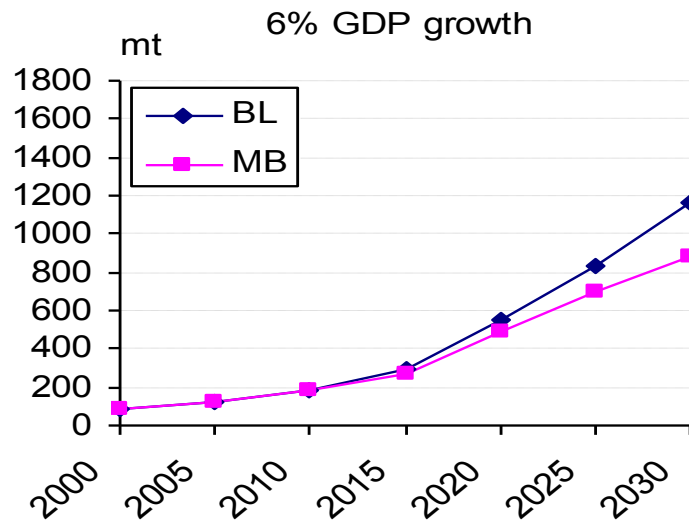
Source: EIA International Energy Outlook 2003 (base case)

# Some Projections

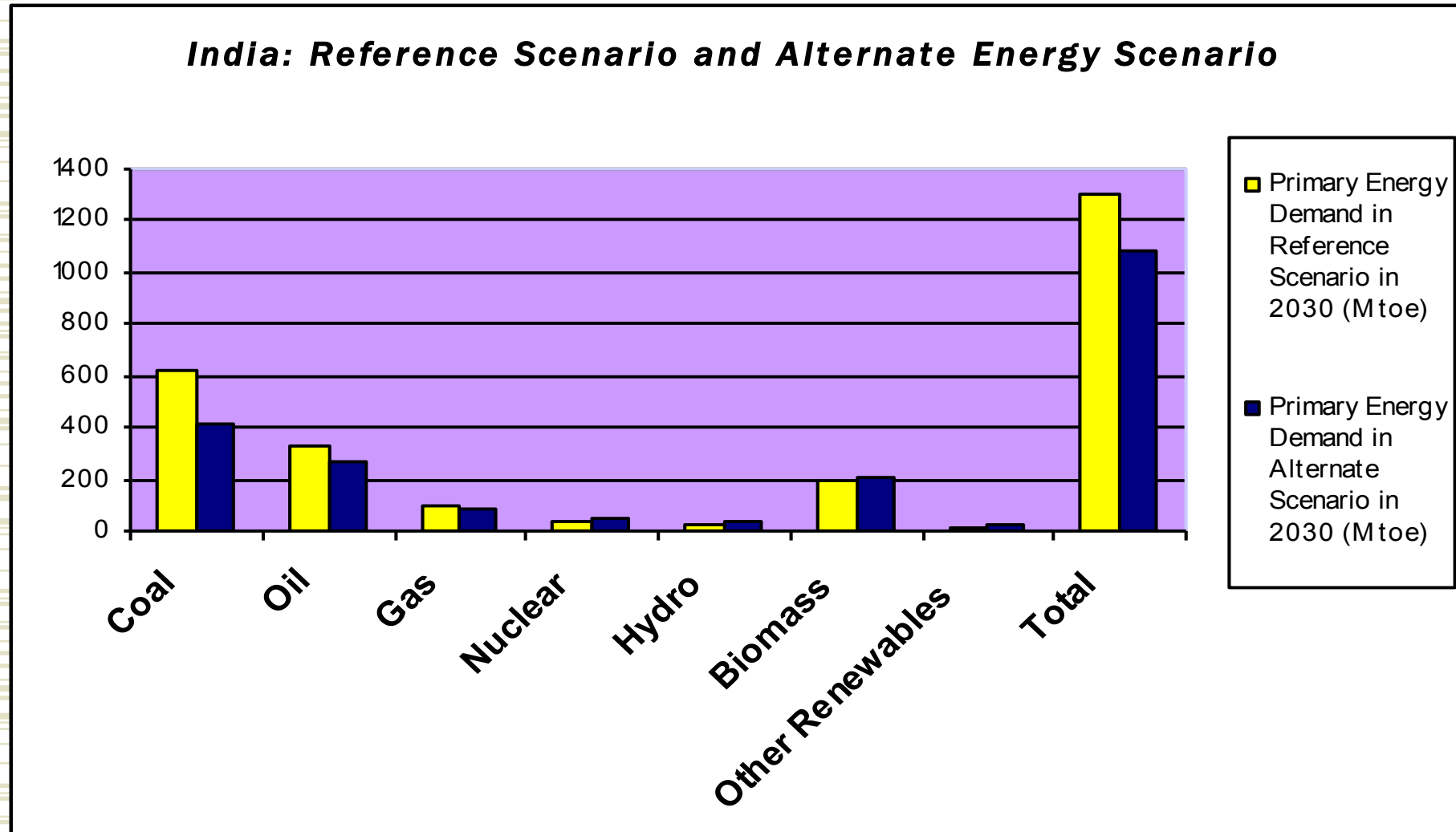
Energy demand



CO2 emissions

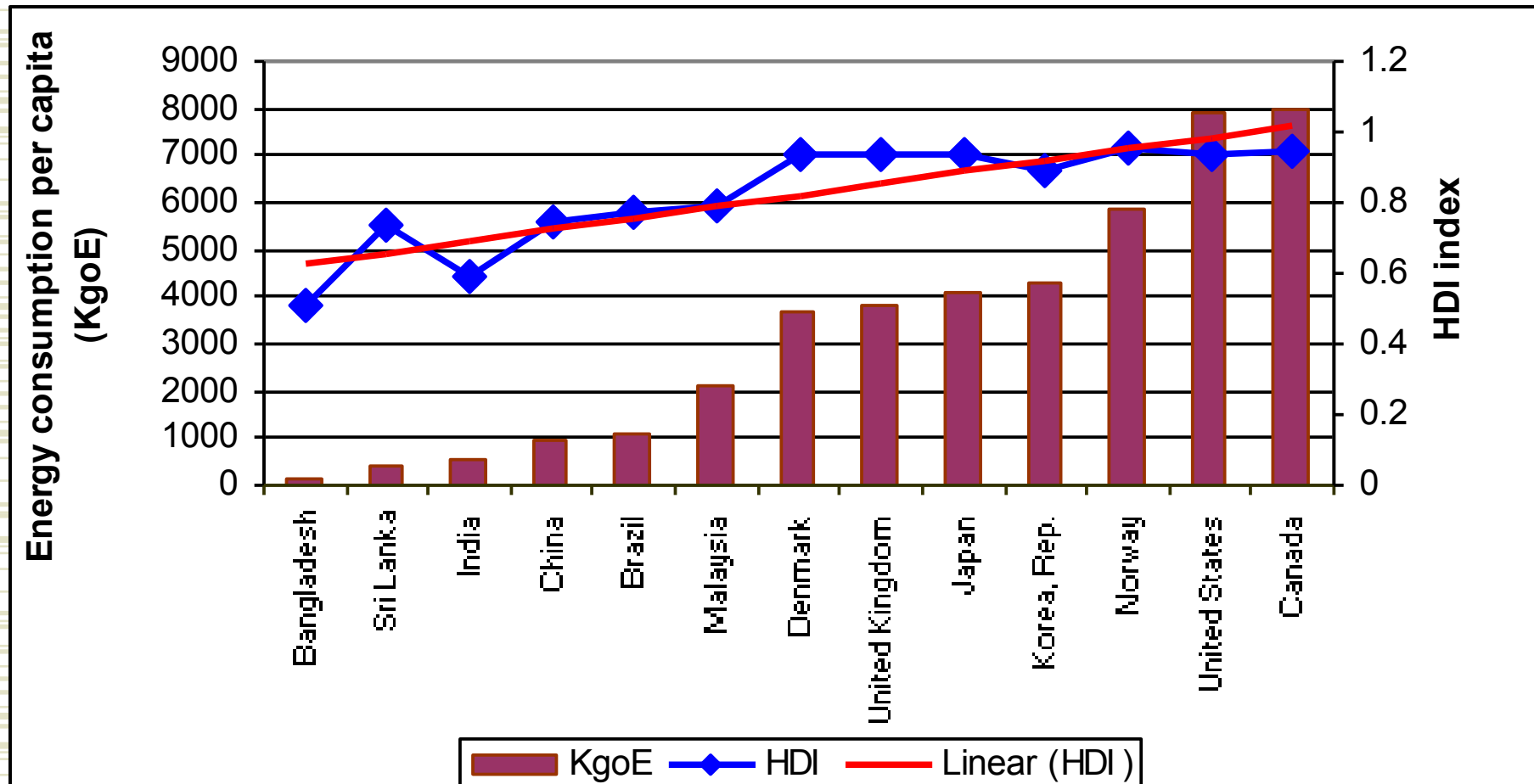


# Total and Sub-sector wise Energy Demand in Reference Scenario and Alternate Scenario





# Energy Consumption and HDI

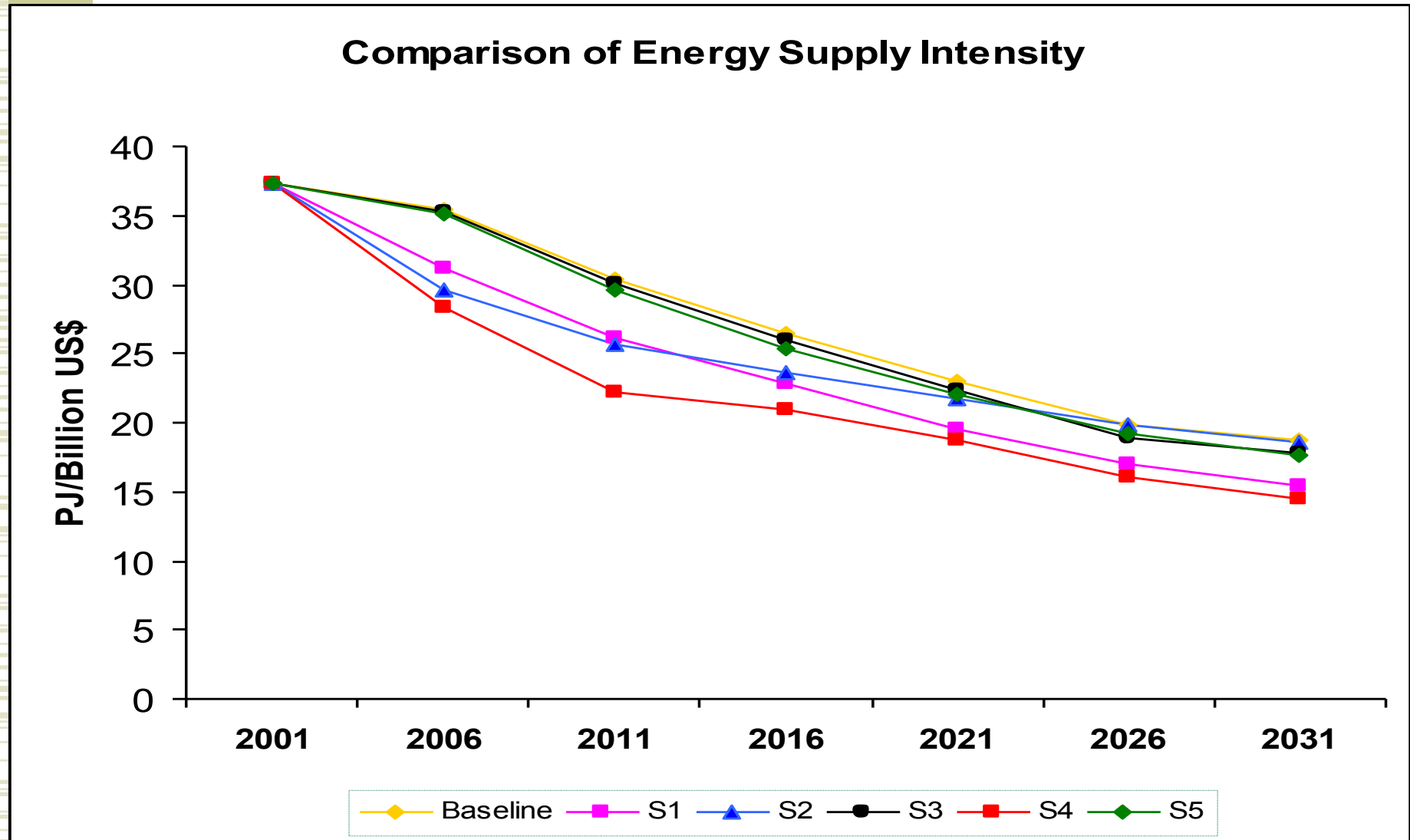


# India's Energy Policies

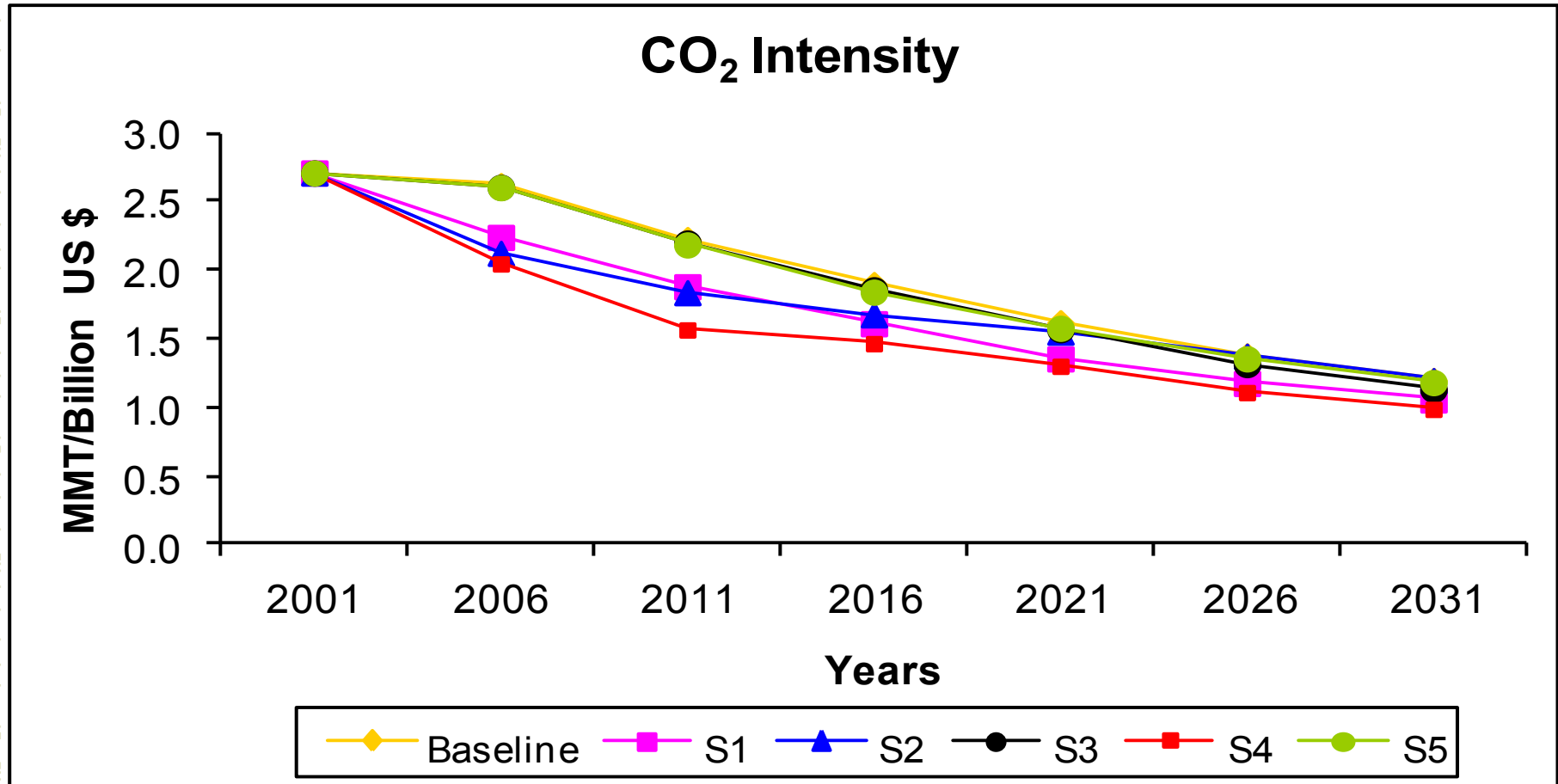
## Scenarios Simulated by MARKAL (2001-2031)

- ◆ **Baseline:**
  - Base year 2001
  - GDP growth 8%
  - Official demographic projections
  - IPCC emissions factors
  - 8% discount rate
- ◆ **S1**
  - Cleaner fuels for power generation
- ◆ **S2**
- ◆ Electricity for all by 2016
- ◆ Decentralized renewable options efficient cook stoves
- ◆ **S3**
  - 20% increase in share of public road transport
  - Greater use of CNG in buses, taxis, 3-W vehicles
- ◆ **S4**
- ◆ **S1+S2+S3**
- ◆ **S5**
  - Average annual GDP growth rate 6.7%

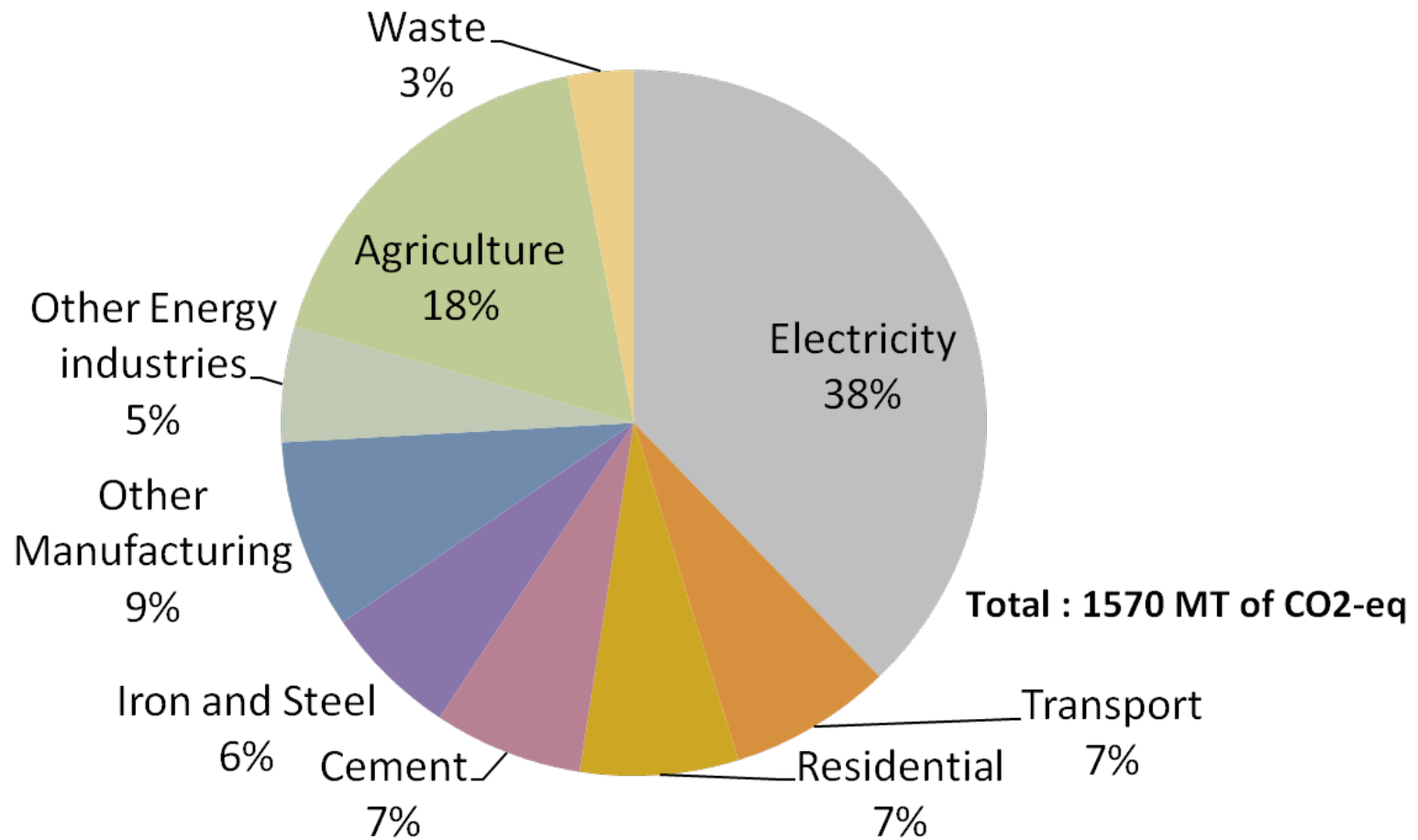
# Energy Supply



# Change in CO<sub>2</sub> Intensity

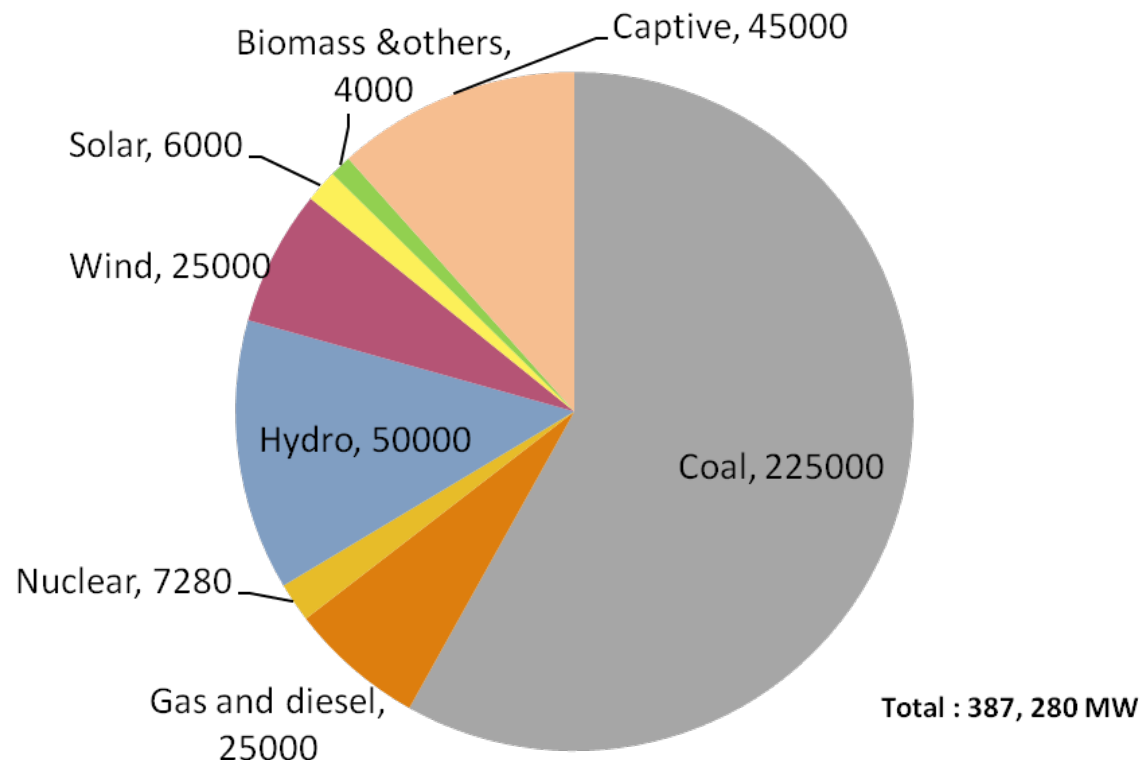


# GHG Emissions in India by Sources



# Projected Fuel Mix - 2020

- ◆ Required capacity in 2020 assuming 8% growth = 387,280 MW in BAU scenario

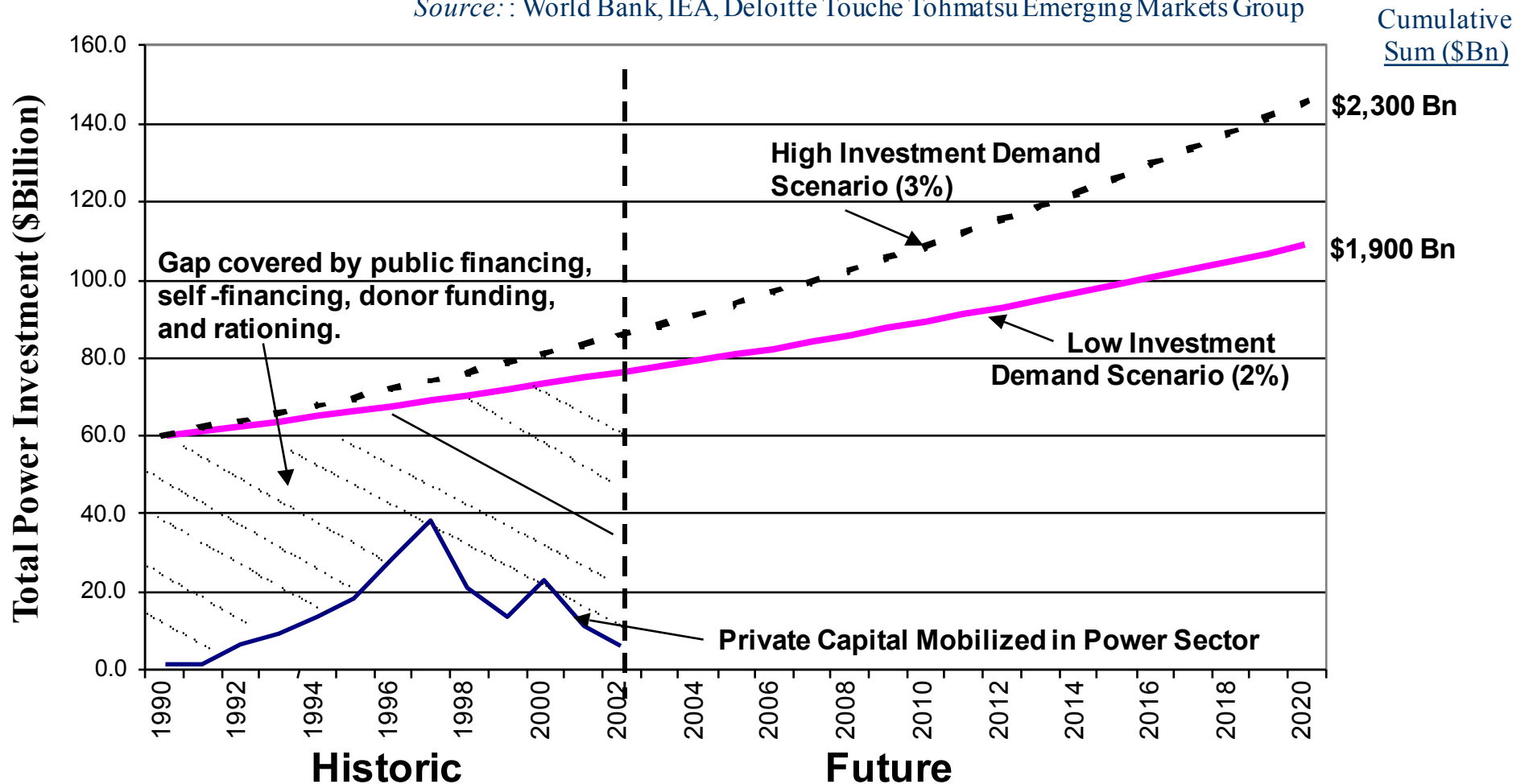


# Energy Efficiency: *Learning*

- ◆ Energy efficiency makes economic sense – and is happening
  - Yet, there are unexploited opportunities – due to market failures
- ◆ Public policy aims to address these market failures through:
  - Information on energy performance
  - Standards, Promoting demand side management and performance contracting
  - Market-based mechanisms
- ◆ International cooperation can accelerate the introduction and early adoption of energy-efficient technologies
- ◆ Energy demand is increasing due to rising incomes, accelerated industrialization, urbanization and population growth
  - 2003-04 :572 Mtoe
  - 2016-17 :842-916 Mtoe
  - 2026-27 :1406-1561 Mtoe

# India's vs Global Investment Requirements in Energy Sector

Source: World Bank, IEA, Deloitte Touche Tohmatsu Emerging Markets Group





# Regulatory Framework

- ◆ **Energy Conservation Act, 2001**
  - Created Bureau of Energy Efficiency
  - Appliance standards and labeling
  - Energy consumption norms, and energy-use reporting requirements for energy-intensive industrial units
  - Energy Conservation Building Code for commercial buildings
  - Certified Energy Managers and auditors
- ◆ **National Action Plan for Climate Change, 2008**
  - National Mission on Enhanced Energy Efficiency provides mandate for market-based mechanisms to promote energy efficiency
  - National Mission on Sustainable Habitat seeks to incorporate energy-efficiency requirements in building byelaws

# Technological Change

- ◆ **Installation of energy-efficient infrastructure, equipment and appliances is essential for**
  - Meeting energy demand
  - Managing energy security, and
  - Meeting climate goals
- ◆ **Technological transitions – both deployment and development - are important in**
  - Power generation
  - Buildings, especially commercial buildings
  - Equipment and appliances
  - Industry
  - Mobility

# Research and Development

- ◆ Enhance science and engineering capabilities and create long-term opportunities for research and development relevant from climate change stand point
- ◆ Collaborative R&D on promising projects/concept should be undertaken on public-private partnership mode
  - IPR should be shared appropriately among various countries
- ◆ R&D on advanced industrial technologies, alternative energy technologies would be of prime importance
- ◆ A dedicated fund required to finance climate-friendly technologies

# Strategies

- ◆ Moderate Energy Demand by Increasing Energy Efficiency
- ◆ Improve Vehicle Fuel Efficiency
- ◆ Implement Building Energy Codes
- ◆ Enlarge the Scope of Appliance and Equipment Standards
- ◆ Increase Industrial Sector Energy Efficiency
- ◆ Accelerate Deployment of Renewable Energy Technologies
- ◆ Further exploitation of renewable energy
- ◆ Switch Towards Cleaner Conventional Energy Technologies
- ◆ Strengthen and rely upon free and open market, wherever possible, to produce efficient solutions

# Adaptation

- ◆ 2% of CDM proceeds to be used to help developing countries with their adaptation efforts (Article 12, Paragraph 8, Kyoto Protocol)
- ◆ Clean Energy Deployment

State	RE Capacity (MW) 2009	RE Contribution (%)
Maharashtra	2370	3757 MU / 3.95% (2009)
Andhra Pradesh	644	1163 MU/ 1.75% (2009)
Tamil Nadu	4703	7615 MU / 11.96% (2008)
Gujarat	1574	~1,100 MU / 2.23 % (2009)
Odisha	--	375 MU/ 3.2% (2009)

# Mitigation

## Industry

- Wide-scale upgrading and innovation
- Replacement and deployment of best available technologies
- Information programmes to promote energy efficiency
- Efficiency in material use, recycling and waste reduction
- Collaborative approaches across firms and sectors

## Transport

- Technical and behavioral mitigation measures (energy efficiency and vehicle performance improvements)
- Infrastructure and urban redevelopment investments (more compact urban form that supports cycling and walking, high-speed rail systems)

## Buildings

- Adoption of very low building codes for new buildings
- Retrofits for existing buildings
- Lifestyle, culture and behavior influence energy consumption in buildings

# Collaborations

## Government

- Collection/collation of targeted information
- Develop understanding of climate change impacts on India and response options
- Focus on Adaptation
- Supporting and Leveraging private actions
- Create Climate-friendly technologies fund
- Policy and regulation

## Industry

- Adoption of Best Practices
- Focus on Small-Scale Industries
- Leverage Climate-friendly technologies fund
- Partner R&D efforts to develop low/no carbon technologies
- Measure carbon footprint, and develop reporting systems

## Civil Society

- Promote awareness about impacts of climate change
- Campaign to effect behavioral change
- Work with Government and other role players as partners in sustainable development

# Acknowledgement

- ◆ I thank Dr. Santosh Kumar Sahu, Assistant Professor at Madras School of Economics, Chennai who is my co-author in research on:
  - Economic Analysis of Climate Change and
  - Linking energy consumption with indicators of Climate Change for the manufacturing sector in India

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*Thank You*

