

Emissions Inventory and Modeling

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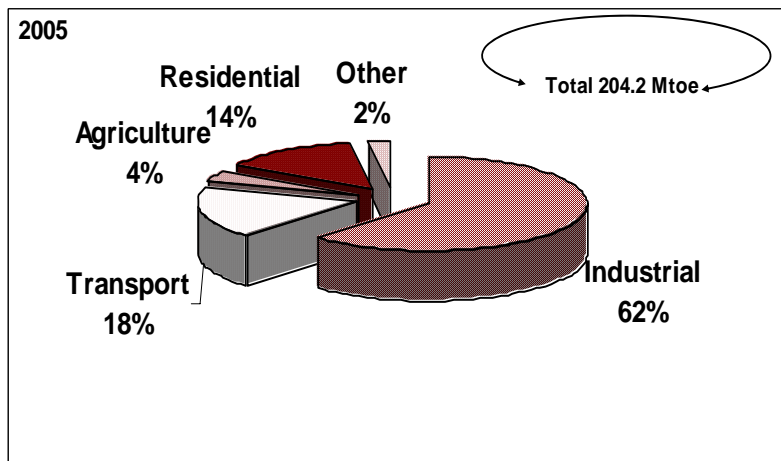
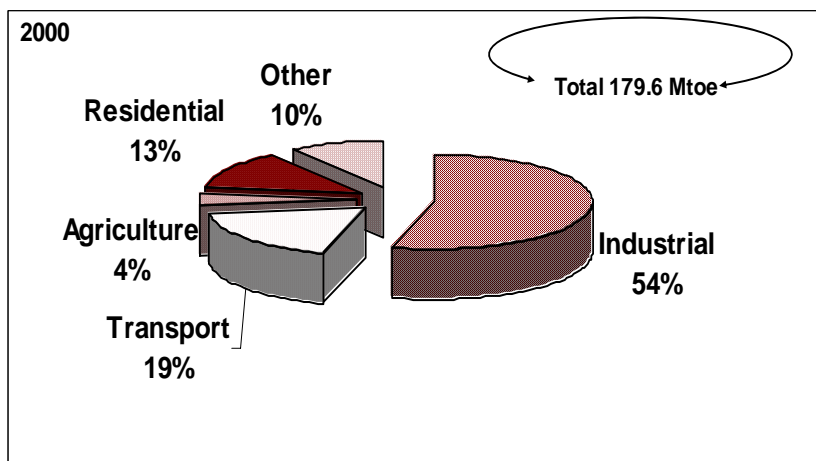
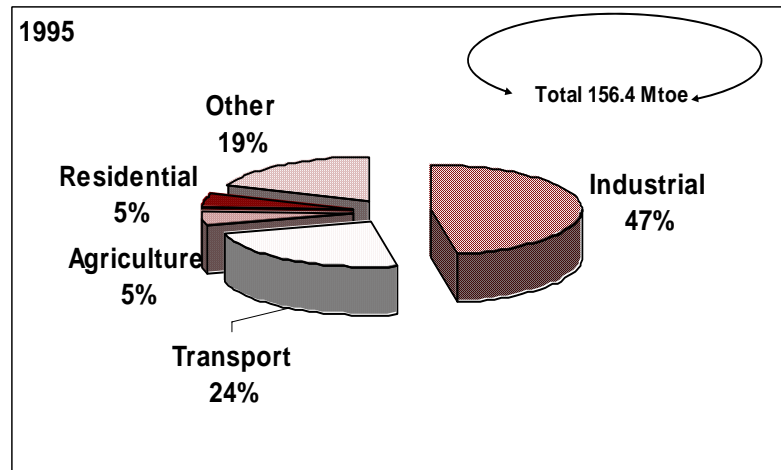
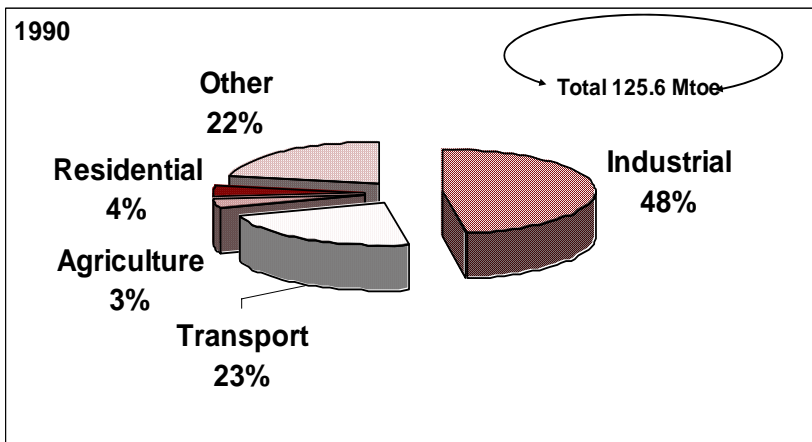
Presentation for the
12th AIM International Workshop
NIES, Tsukuba, Japan, February 19-21, 2007

Agenda

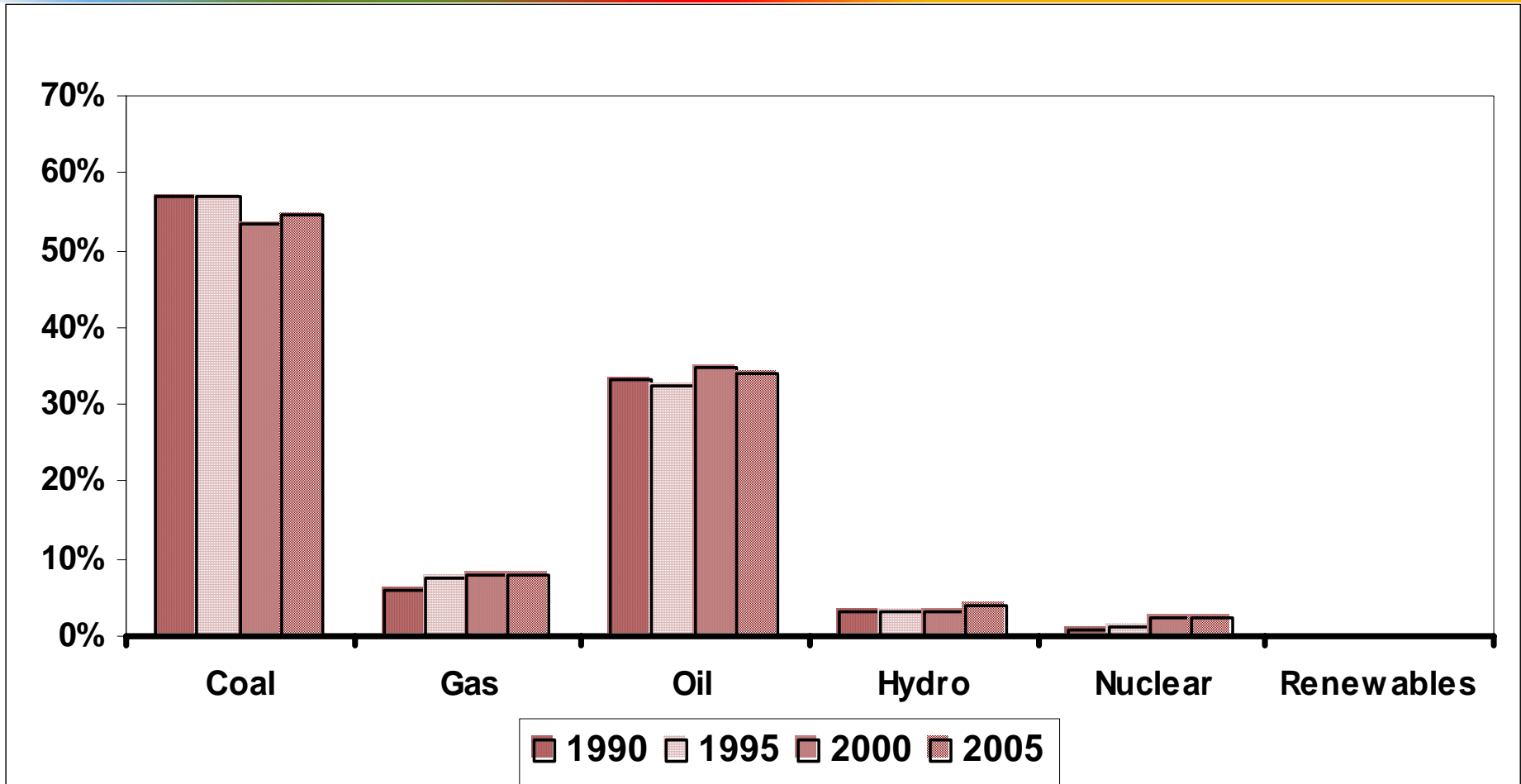
- Energy Overview
- Emissions Inventory of India
- AIM Modeling for India
 - Energy Snapshot (ESS) Model Application
 - AIM CGE Model Application
 - LCS Modeling (separate presentation)

Energy Overview

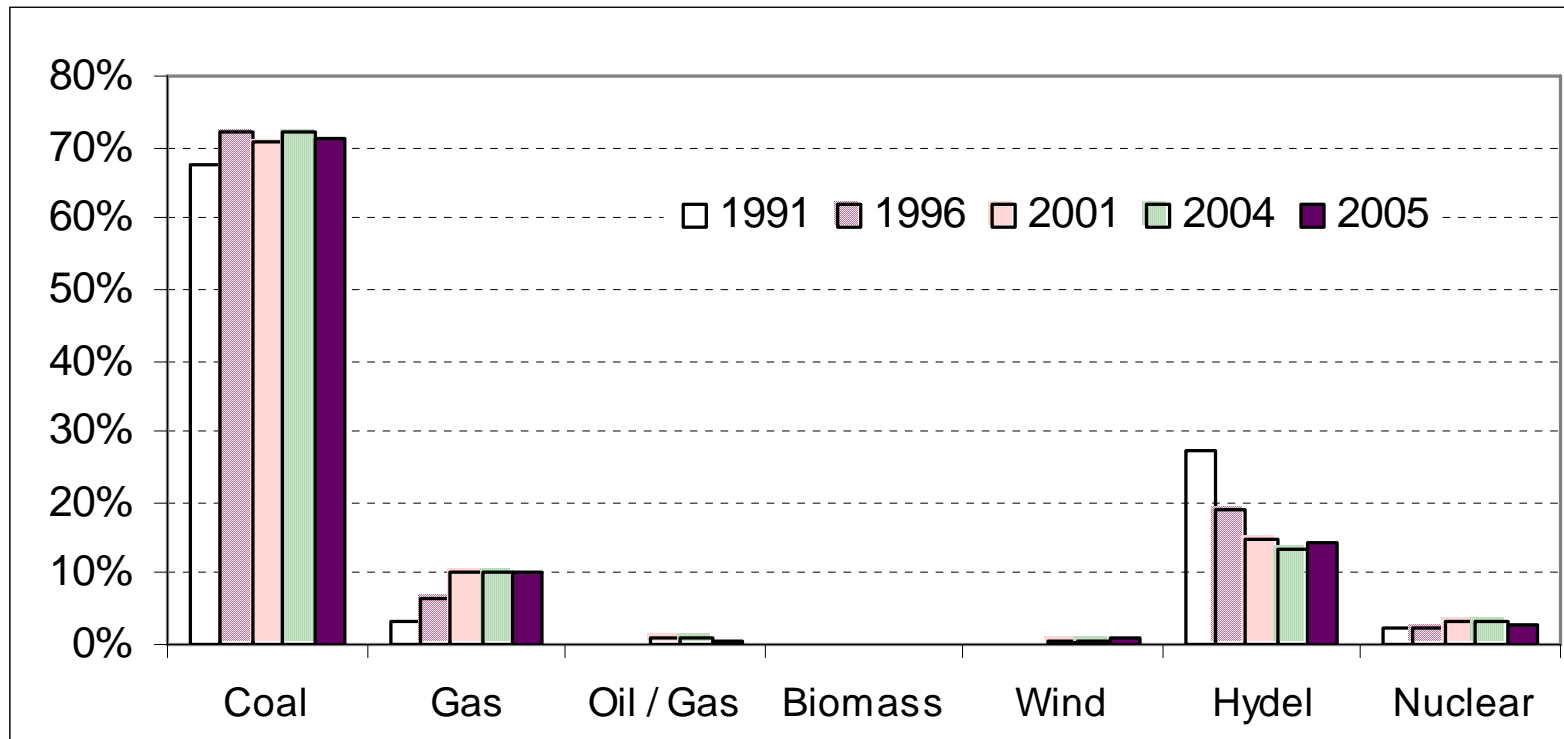
Sector Share in Primary Energy Use



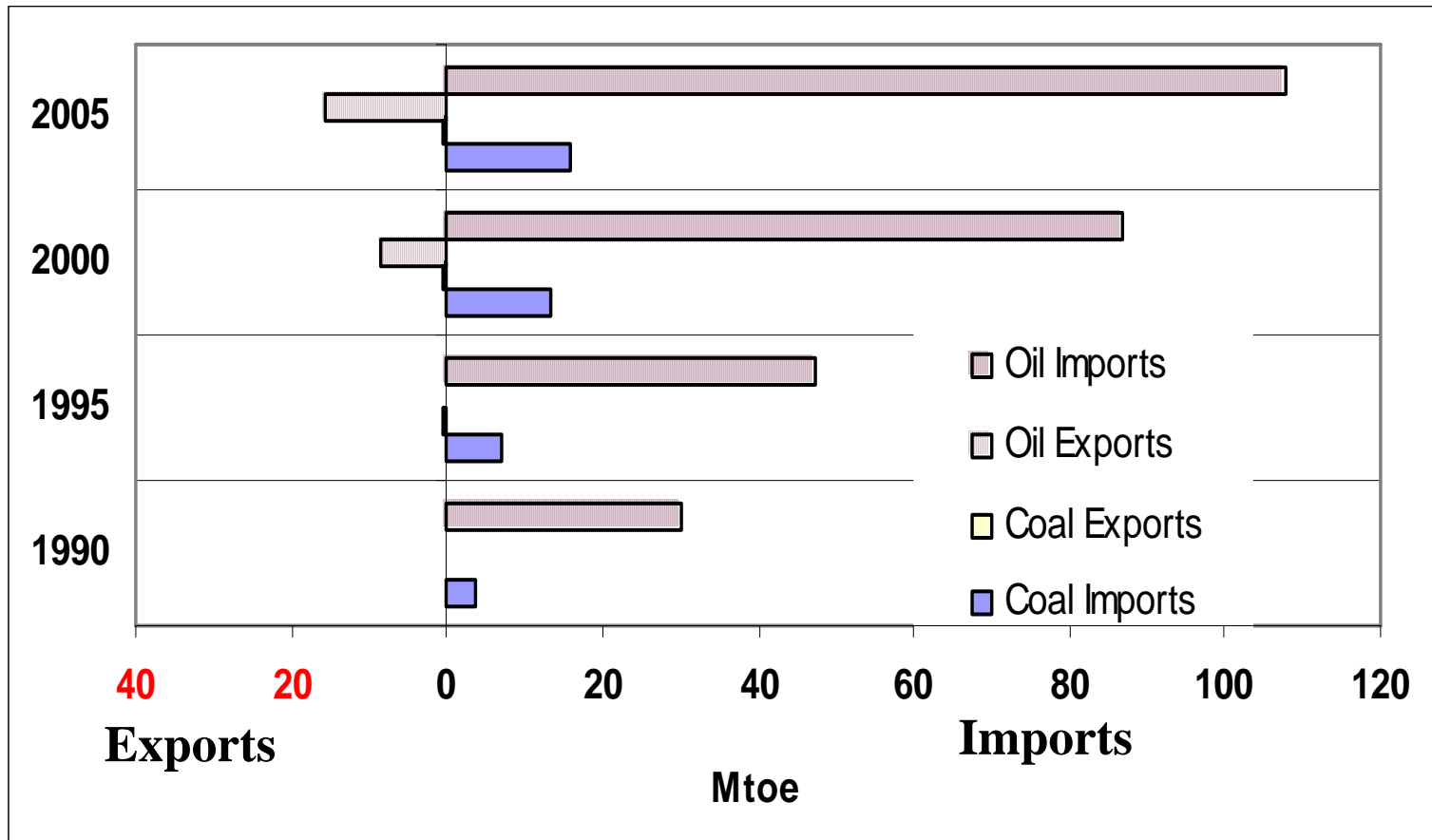
Fuel Share in Primary Energy Use



Fuel-mix Share in Power Generation

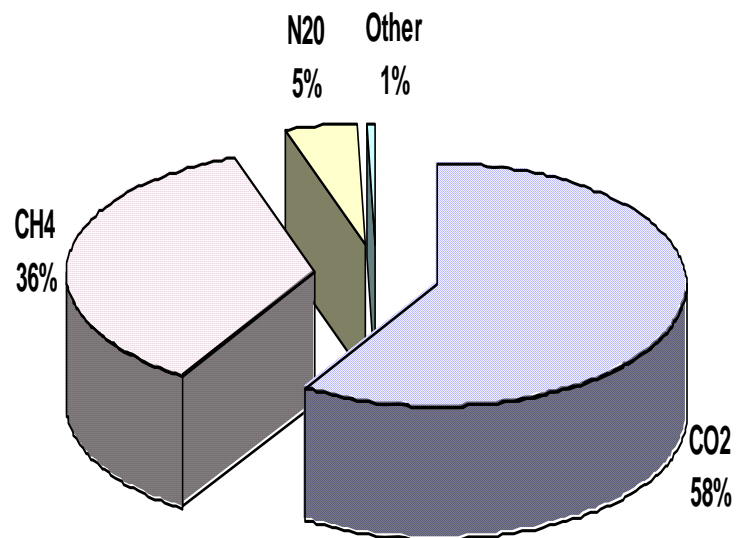


Energy Trade

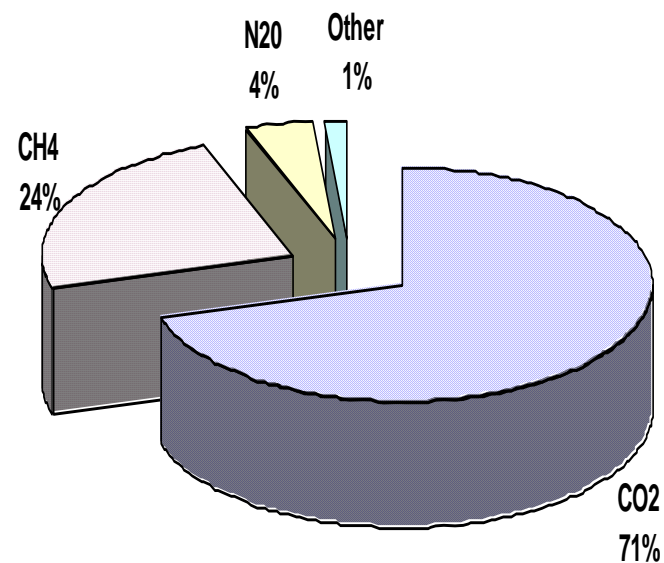


Emissions Inventory Overview

Emission trends for GHG Emissions

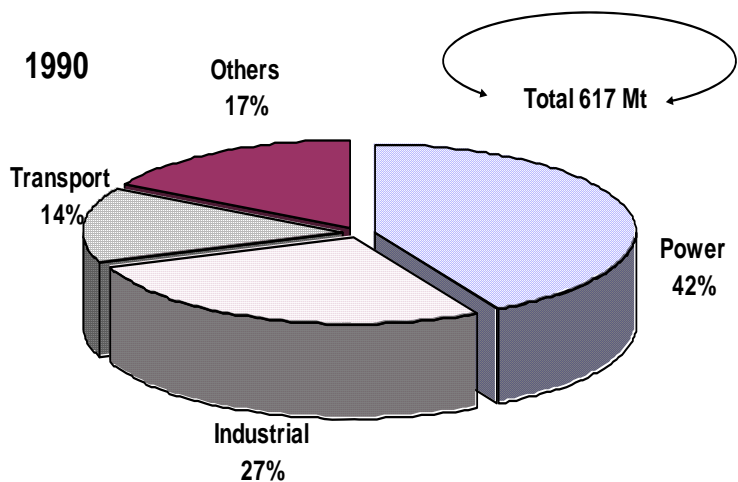


1990

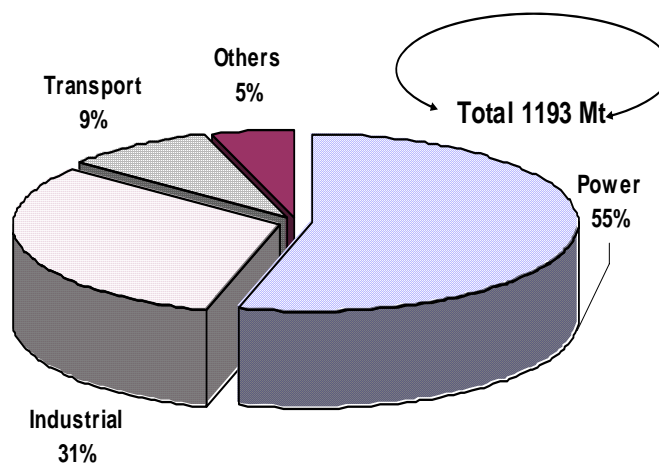


2005

Sectoral shares of CO₂ emissions in India



1990

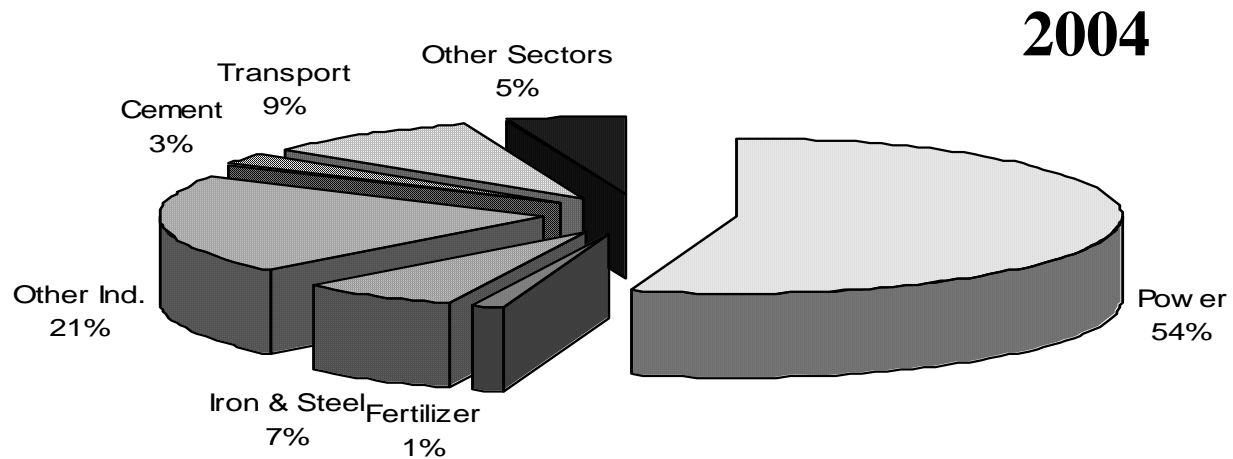
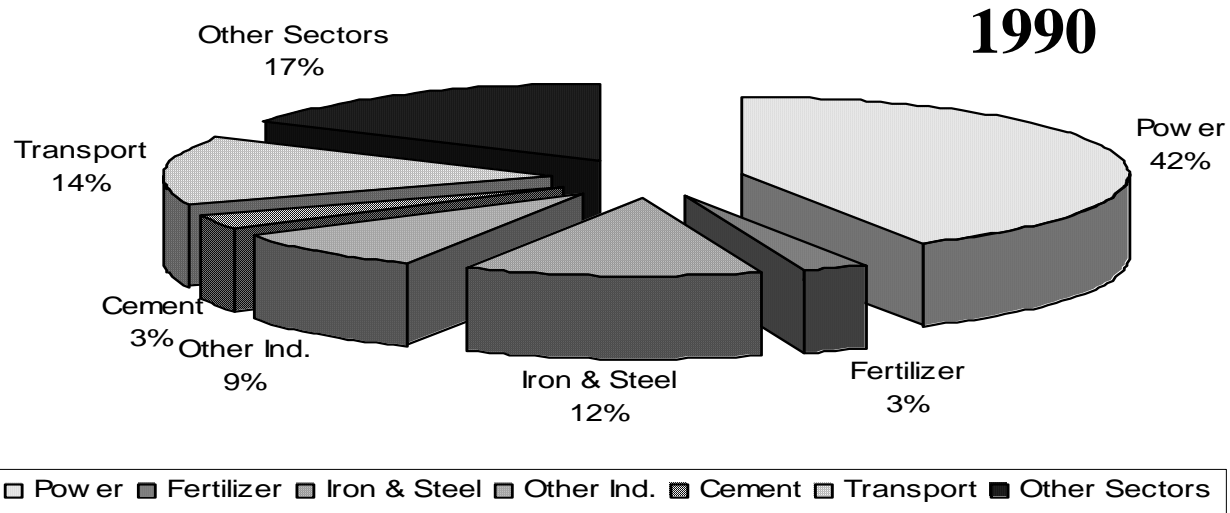


2005

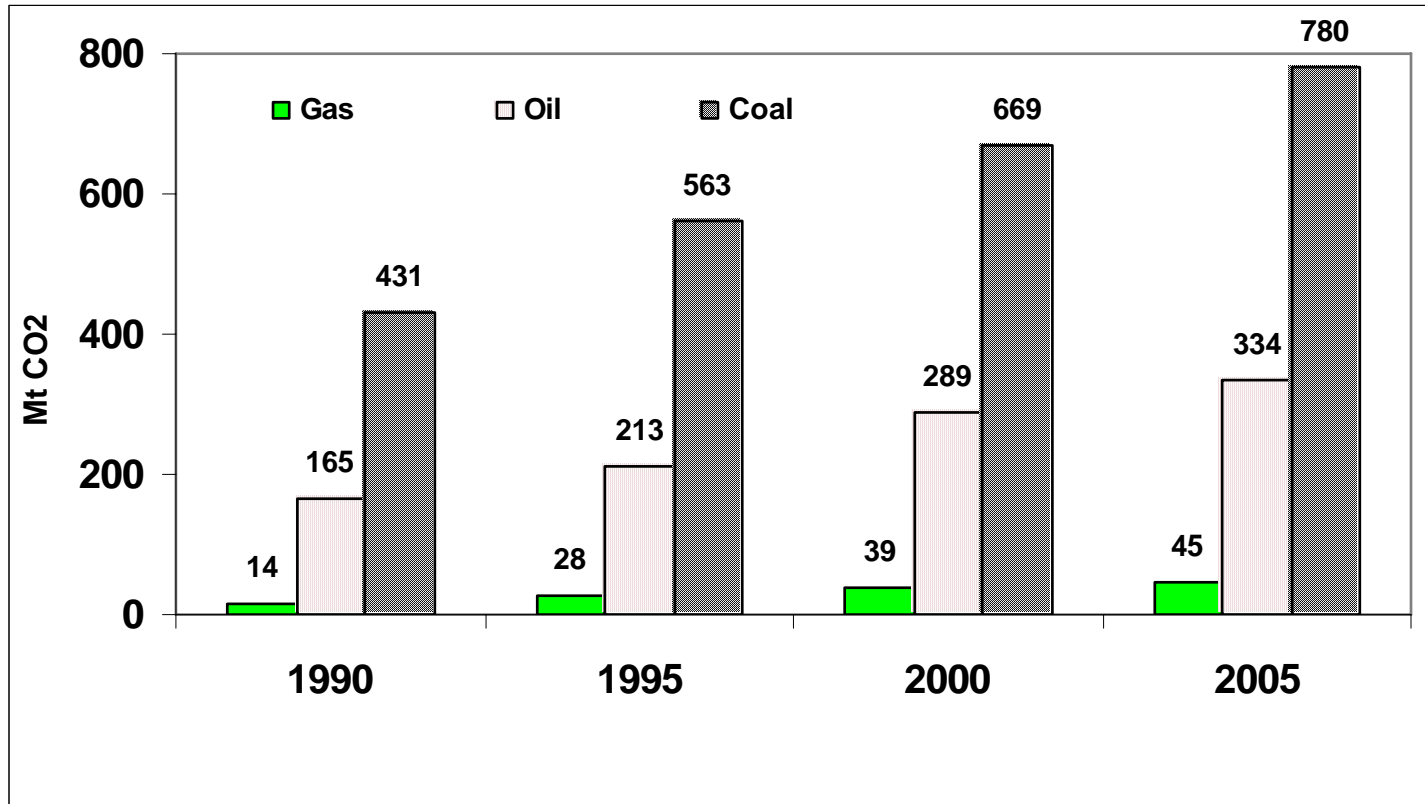
Sector-wise CO₂ emissions for India

| Sector | CO ₂ emissions (Mt CO ₂) | | |
|------------------|---|-------------|-------------|
| | 1990 | 2000 | 2005 |
| Electricity | 261 | 556 | 650 |
| Iron and steel | 75 | 76 | 80 |
| Fertilizer | 18 | 26 | 15 |
| Cement | 19 | 30 | 33 |
| Other Industries | 54 | 140 | 247 |
| Transport | 87 | 100 | 108 |
| Other Sectors | 103 | 105 | 60 |
| All India | 617 | 1033 | 1193 |

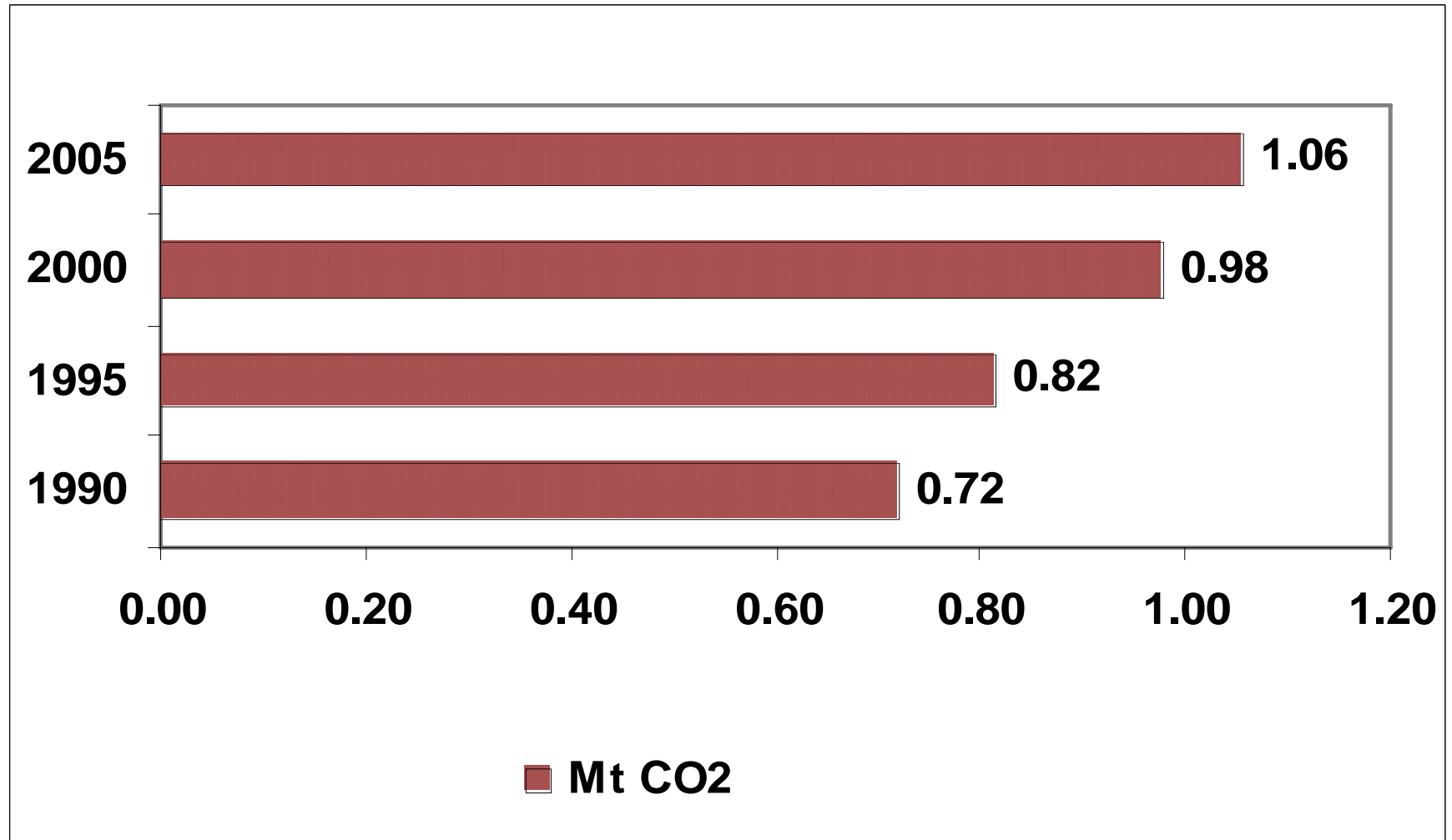
Sector shares in CO2 emissions: India,



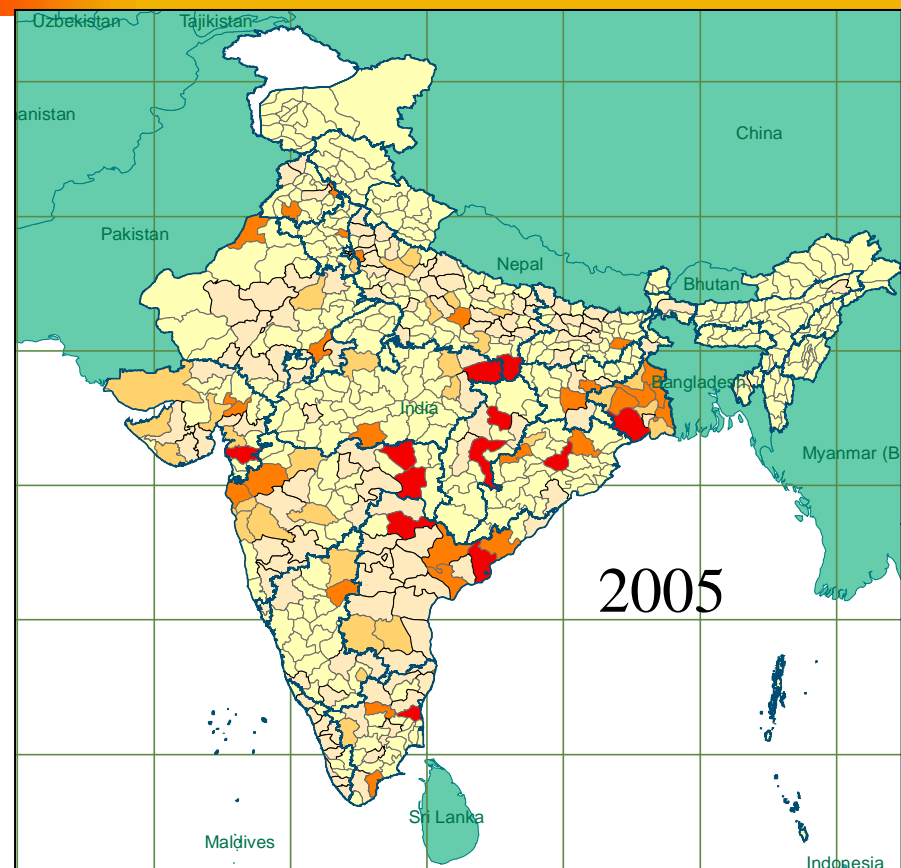
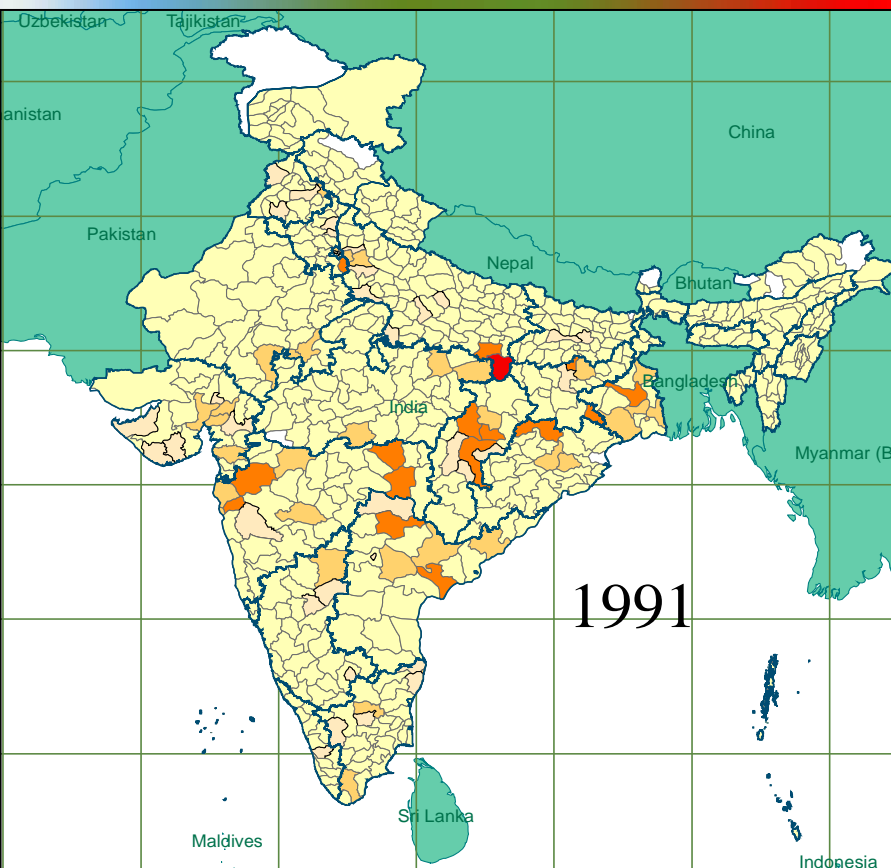
Fuel-wise CO₂ emissions



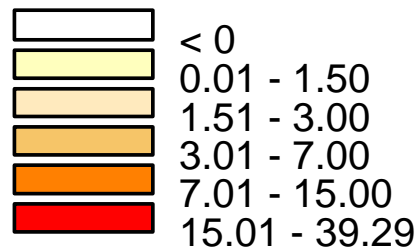
Per Capita CO2 Emission



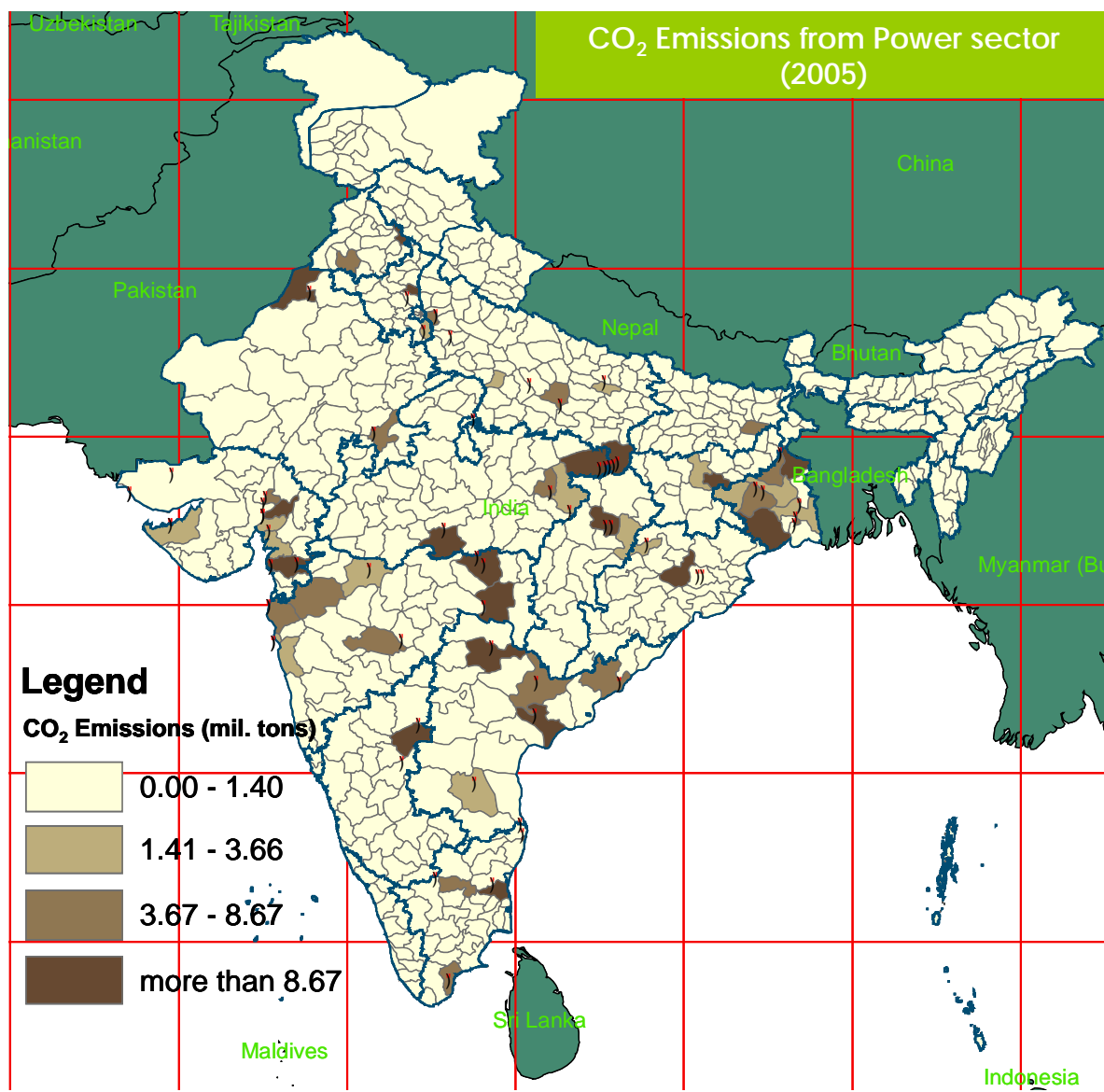
District-wise CO₂ Emissions



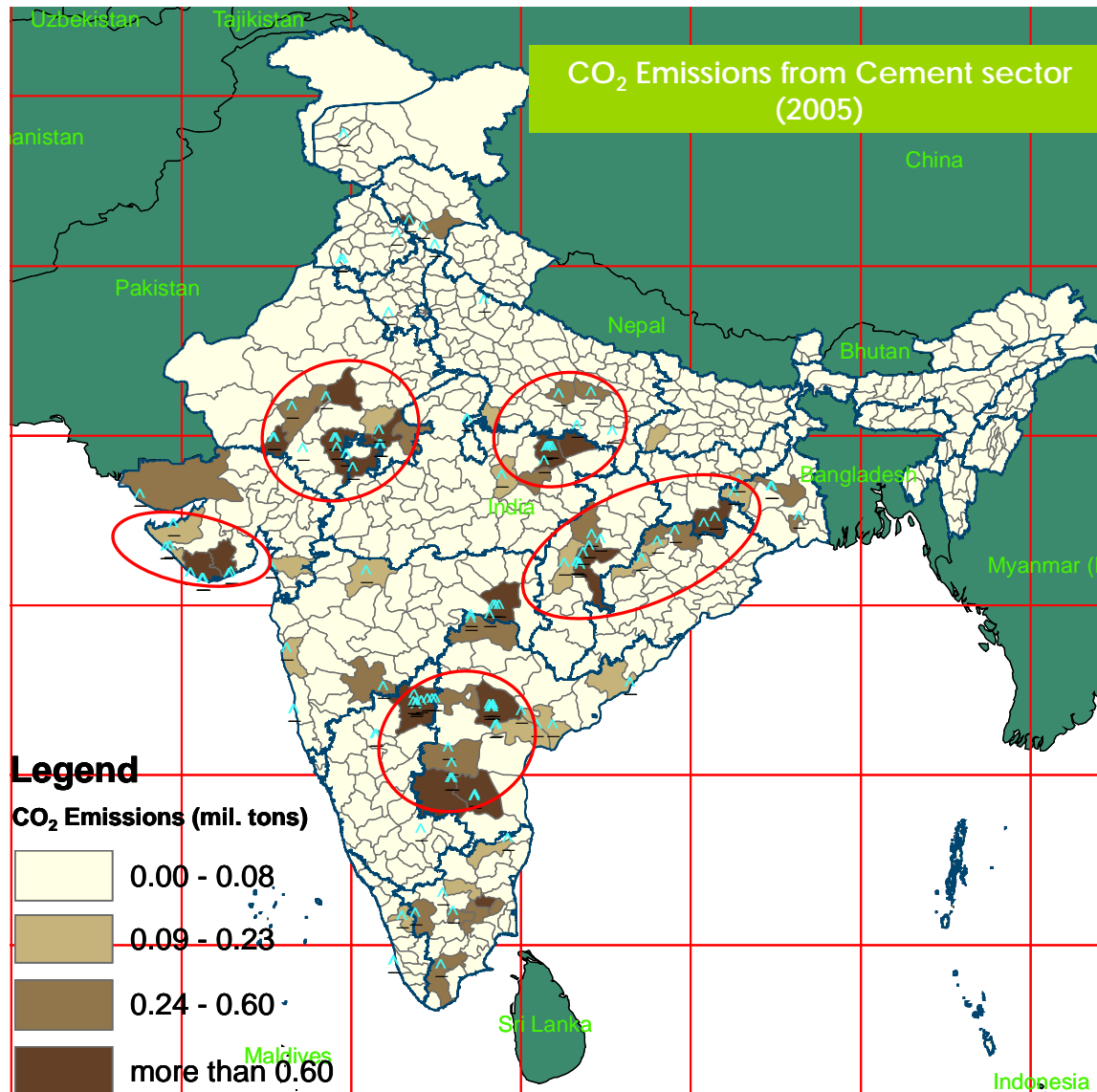
Million ton



CO2 emission from Power Sector (2005)



CO₂ emission from Cement Sector (2005)

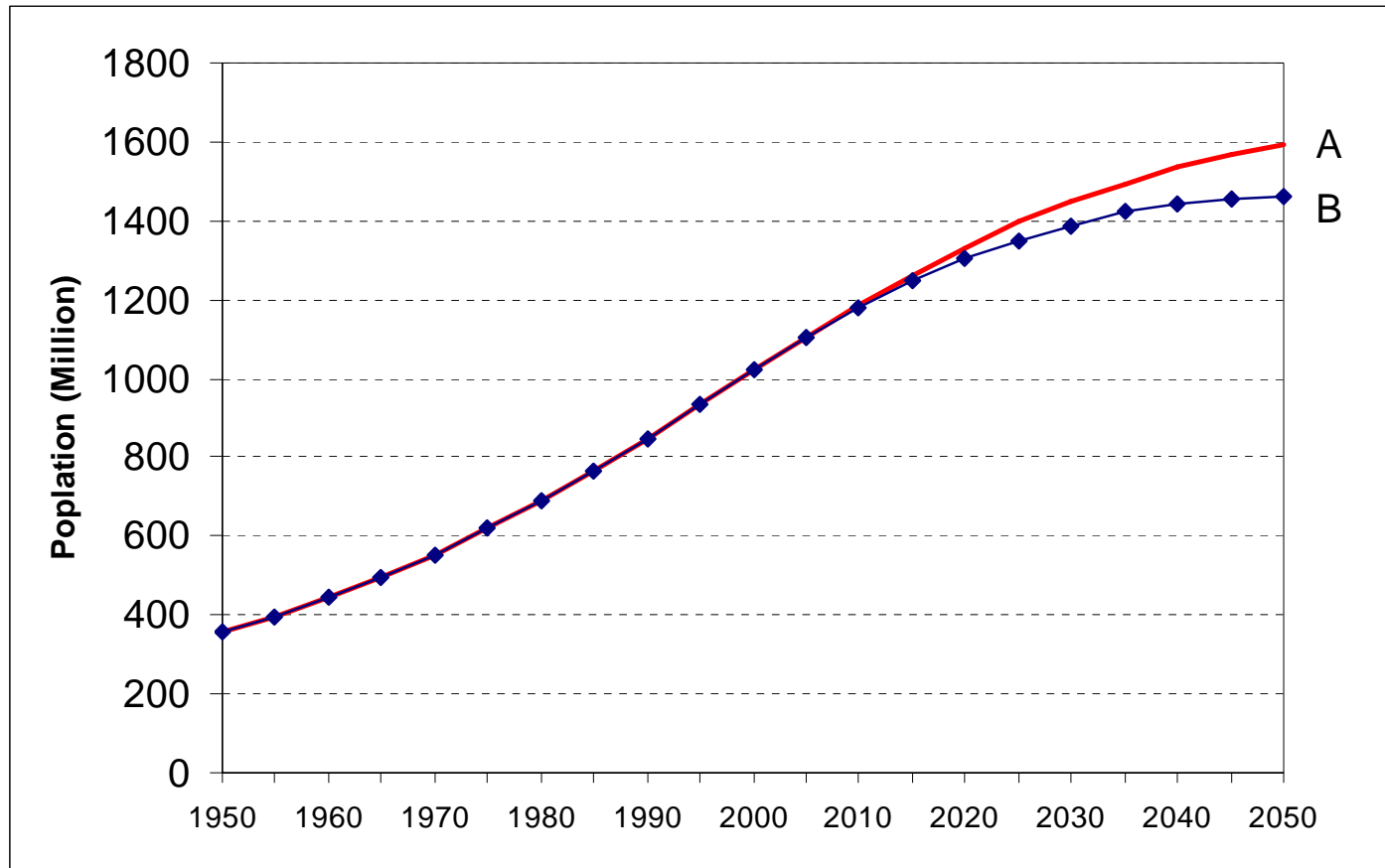


- AIM Modeling for India
 - Energy Snapshot (ESS) Model Application

Scenario Storylines

- Scenario A:
 - India, where a large part still resides in villages though demographic indicators have changed but still a long improvement to go. The economy dependent largely on the manufacturing sector.
- Scenario B :
 - India, which policy makers are aspiring for characterized by high growth rates, rapidly improving demographic indicators, driven by economic reforms and high levels of social spending. Higher penetration of technologies and environmental consciousness amongst people.

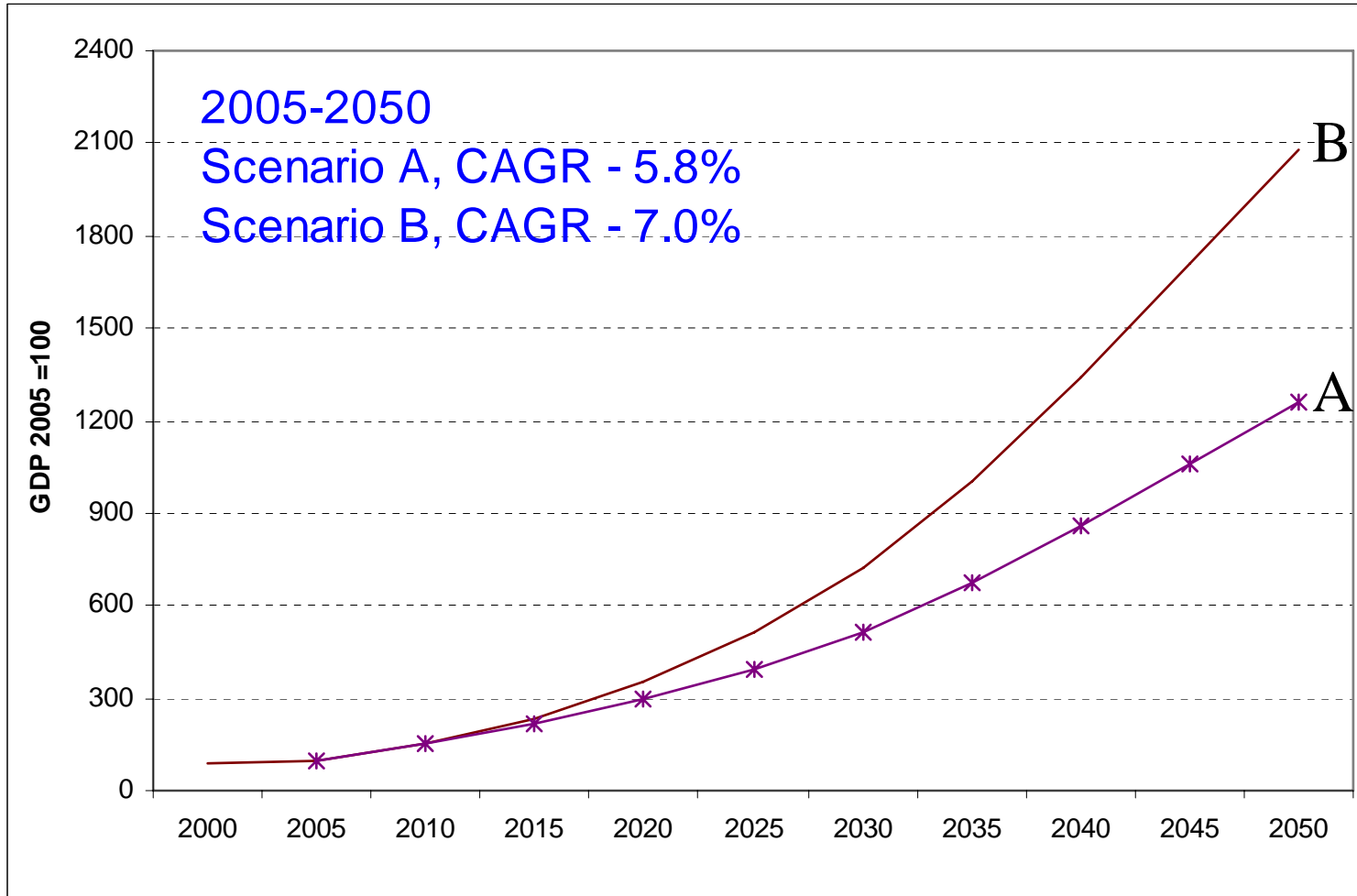
Population Projections of India



Scenario A : As per UN Population Projections

Scenario B : Own projections for a highly urbanized India

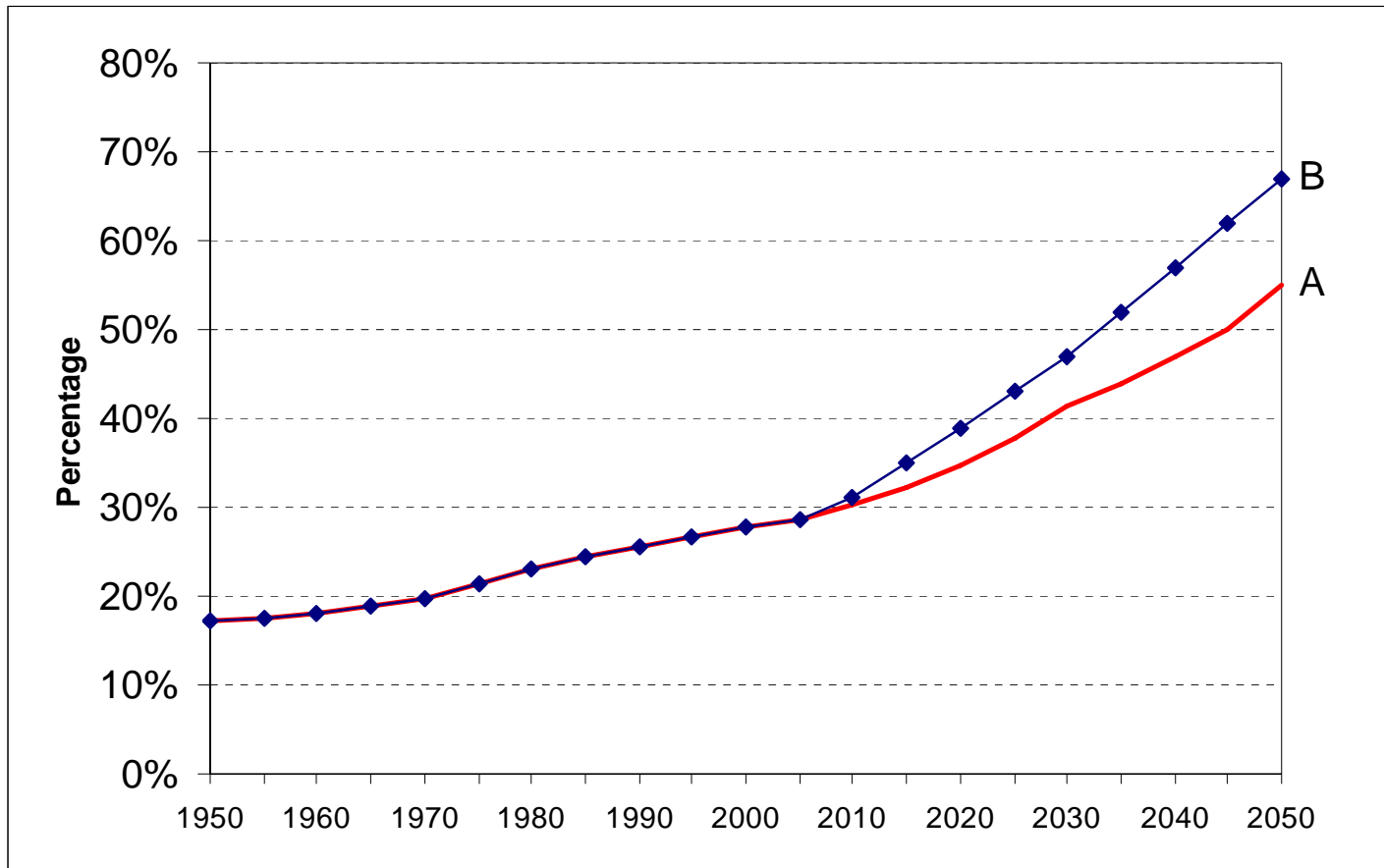
GDP Projections



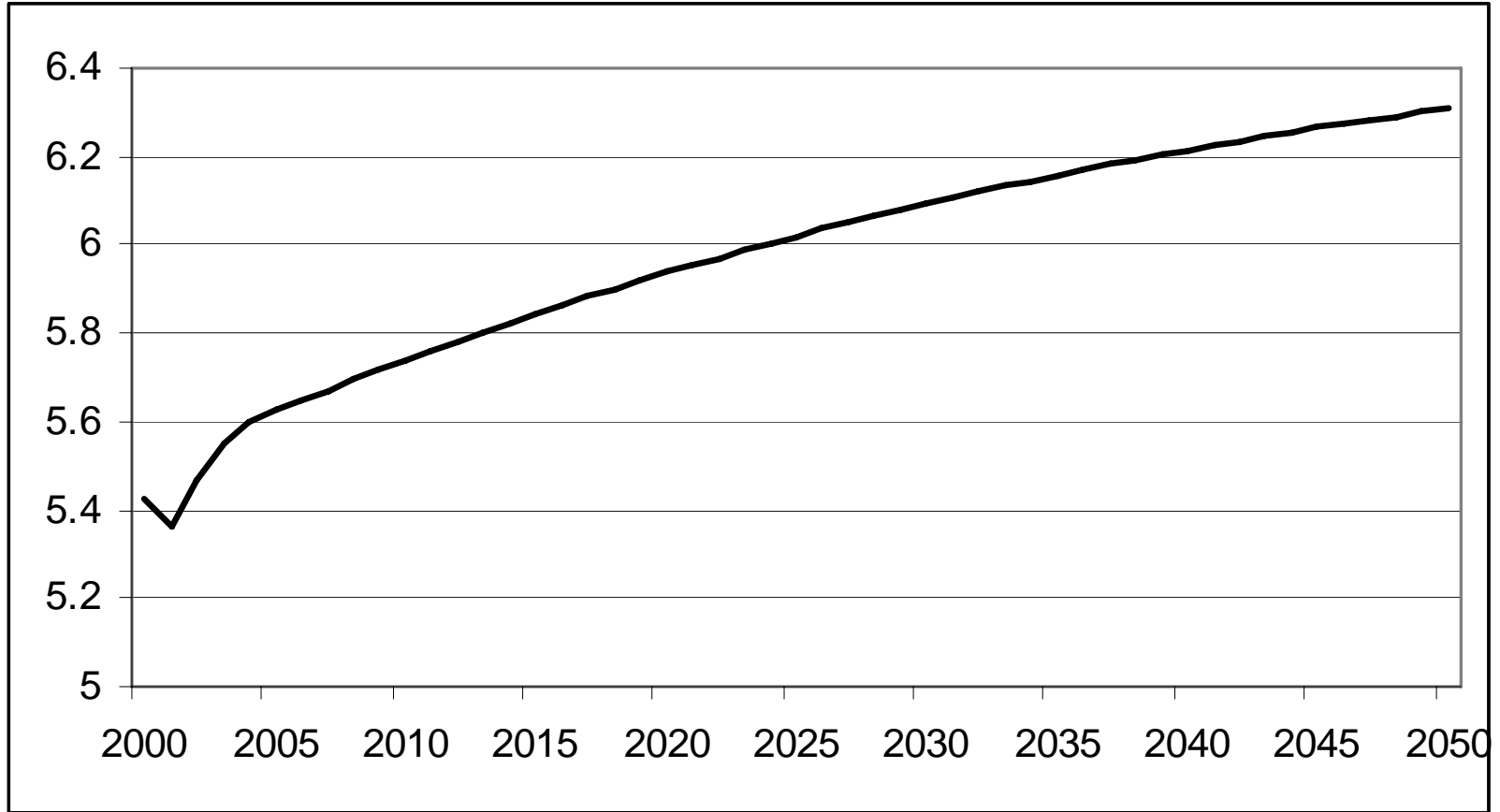
Scenario A : Closer to GDP estimates in the WEO, 2006 of IEA

Scenario B : Assumes 8% CAGR till 2032 as per Planning Commission Estimates

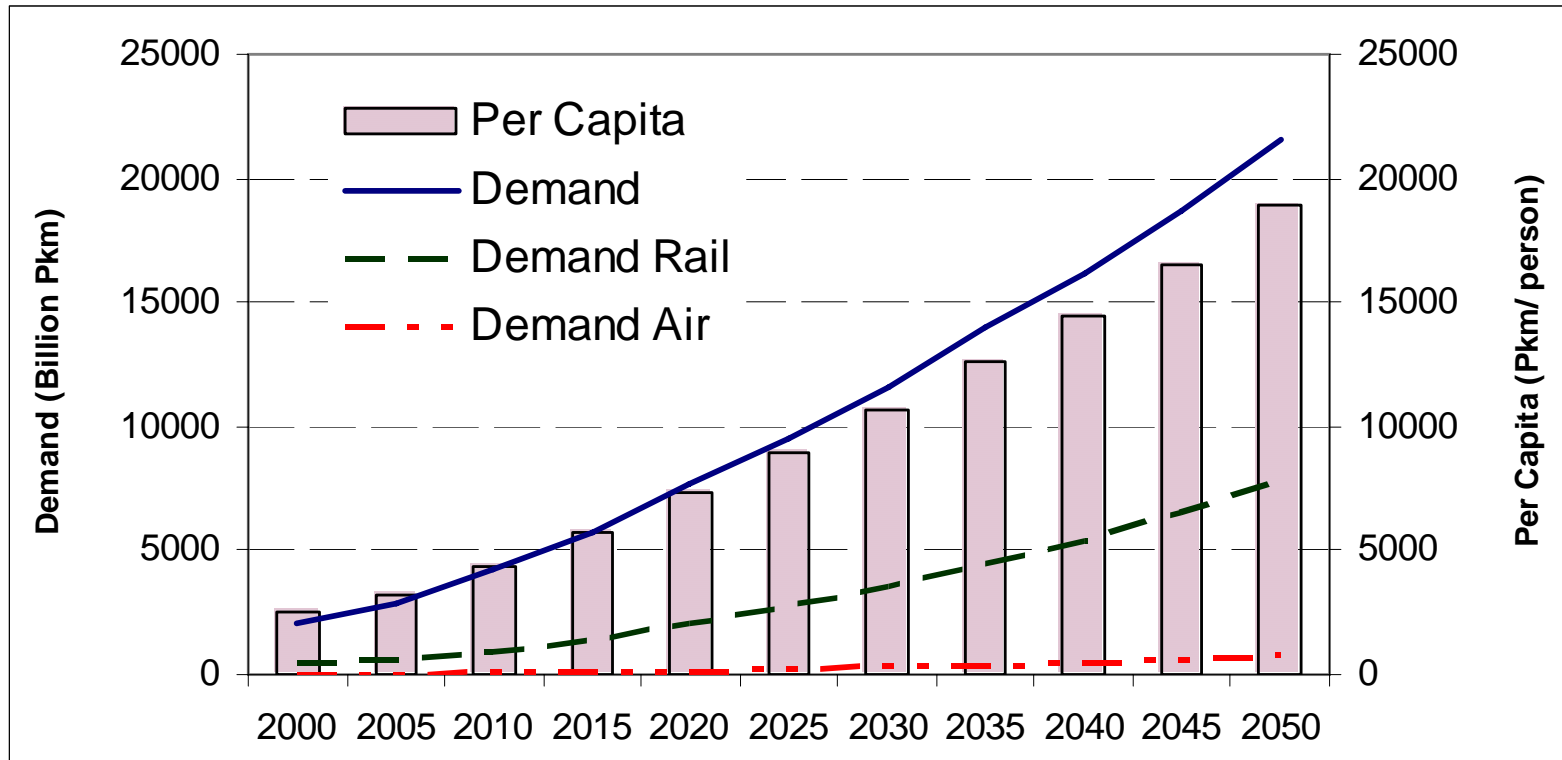
Level of Urbanization



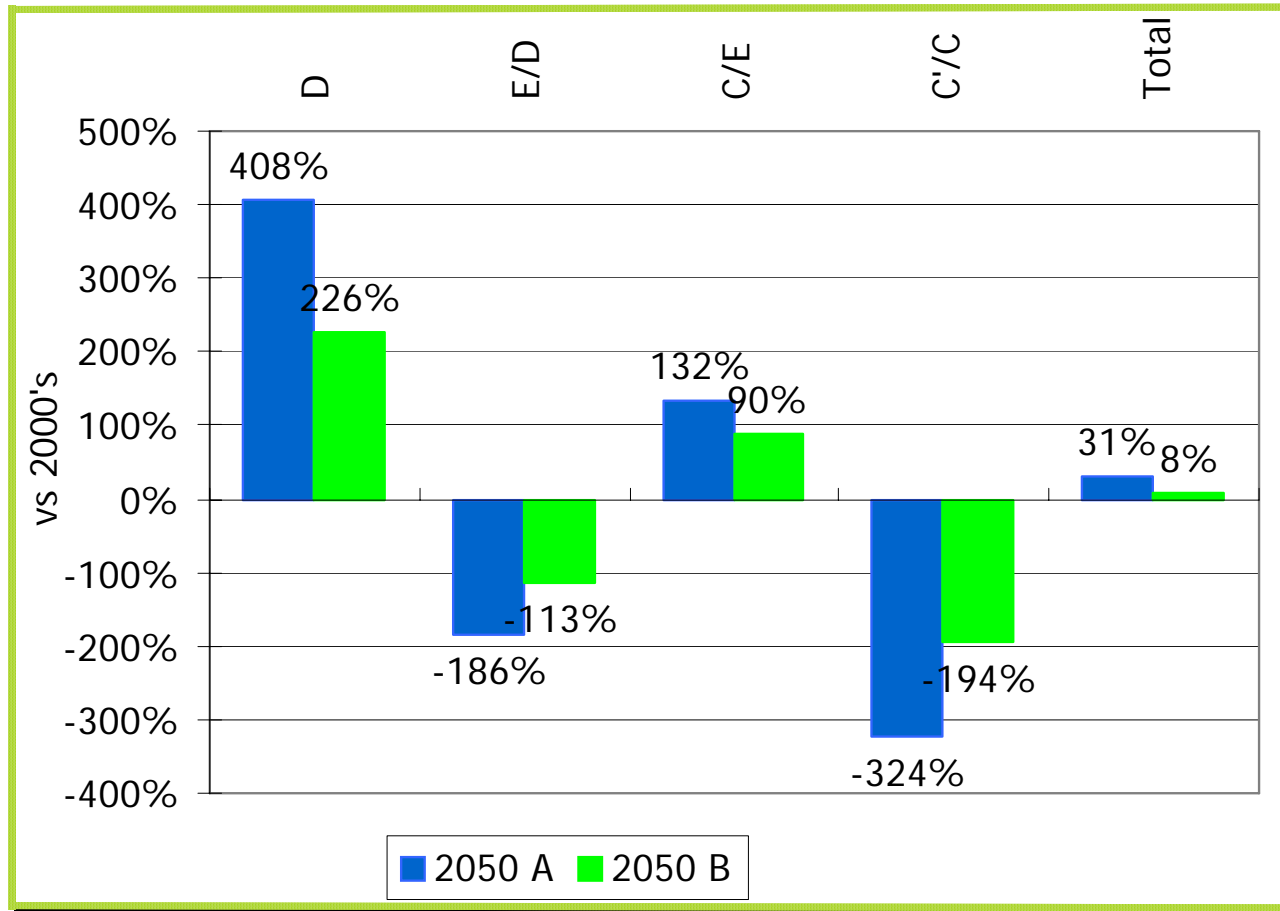
GDP Share Coming from Transport in Future



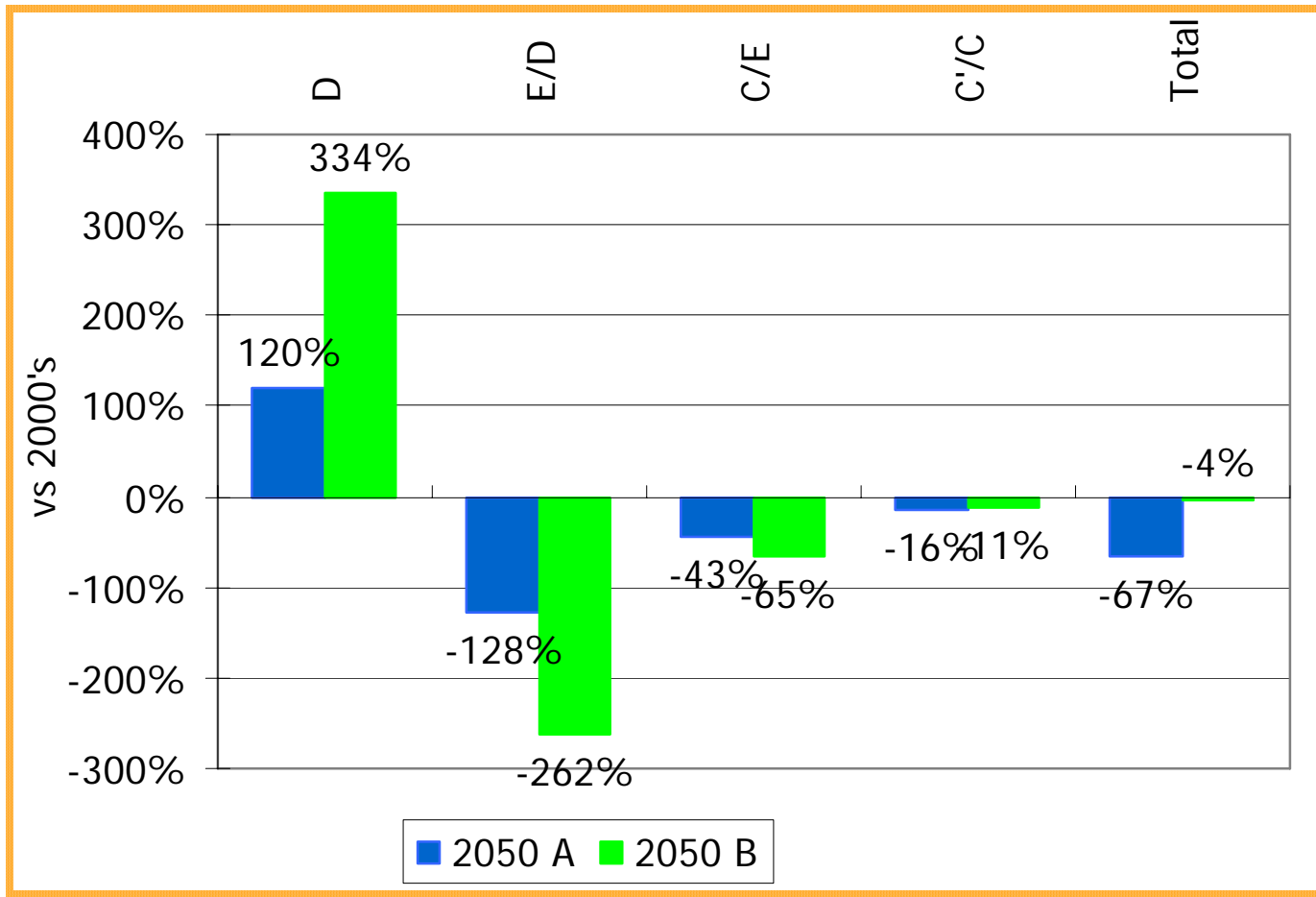
Demand for Passenger Transport in Future



India 2050 : Residential Sector

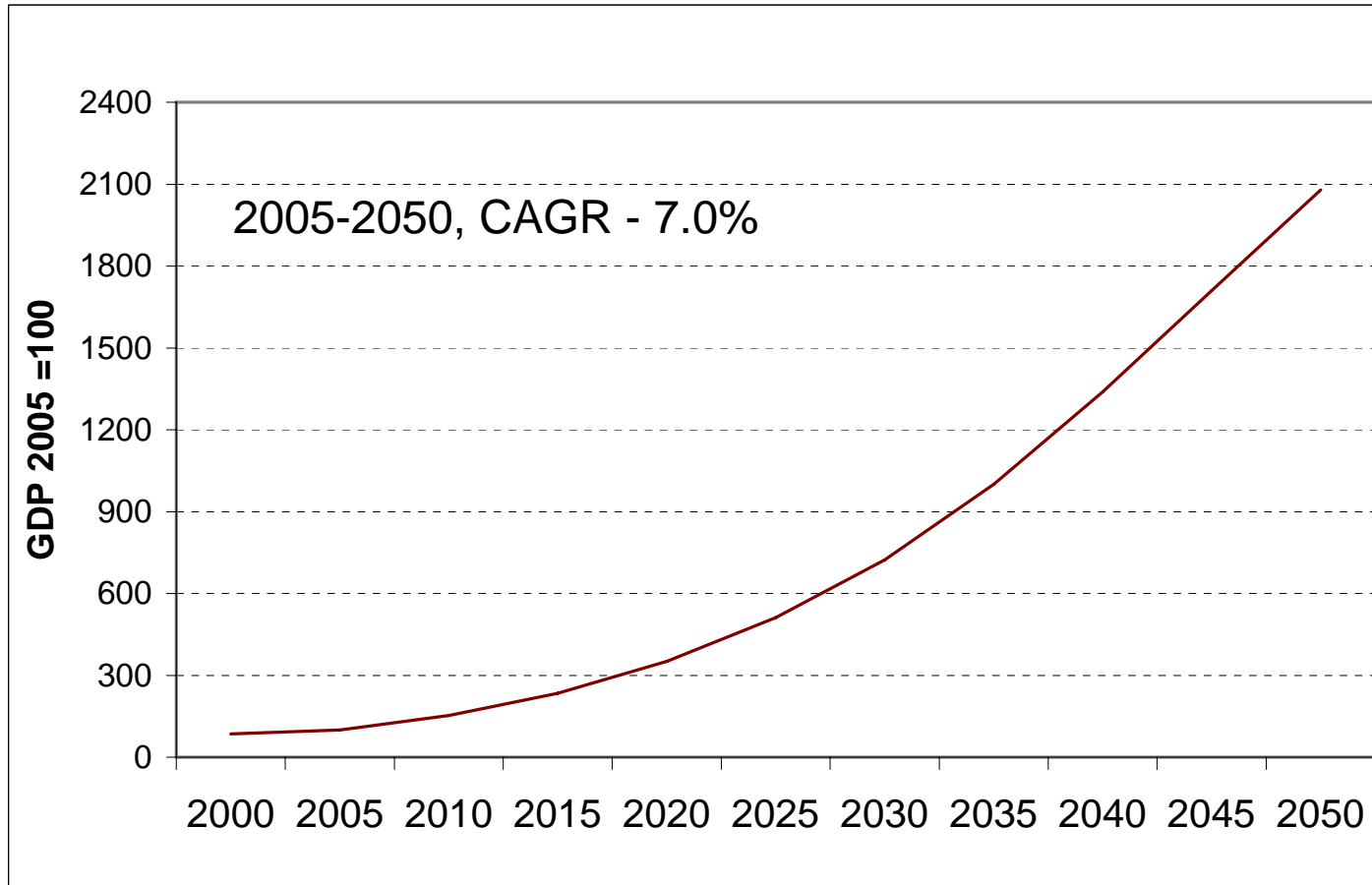


India 2050 : Transport Sector



- AIM Modeling for India
 - AIM CGE Model Application

GDP Growth Projections till 2050



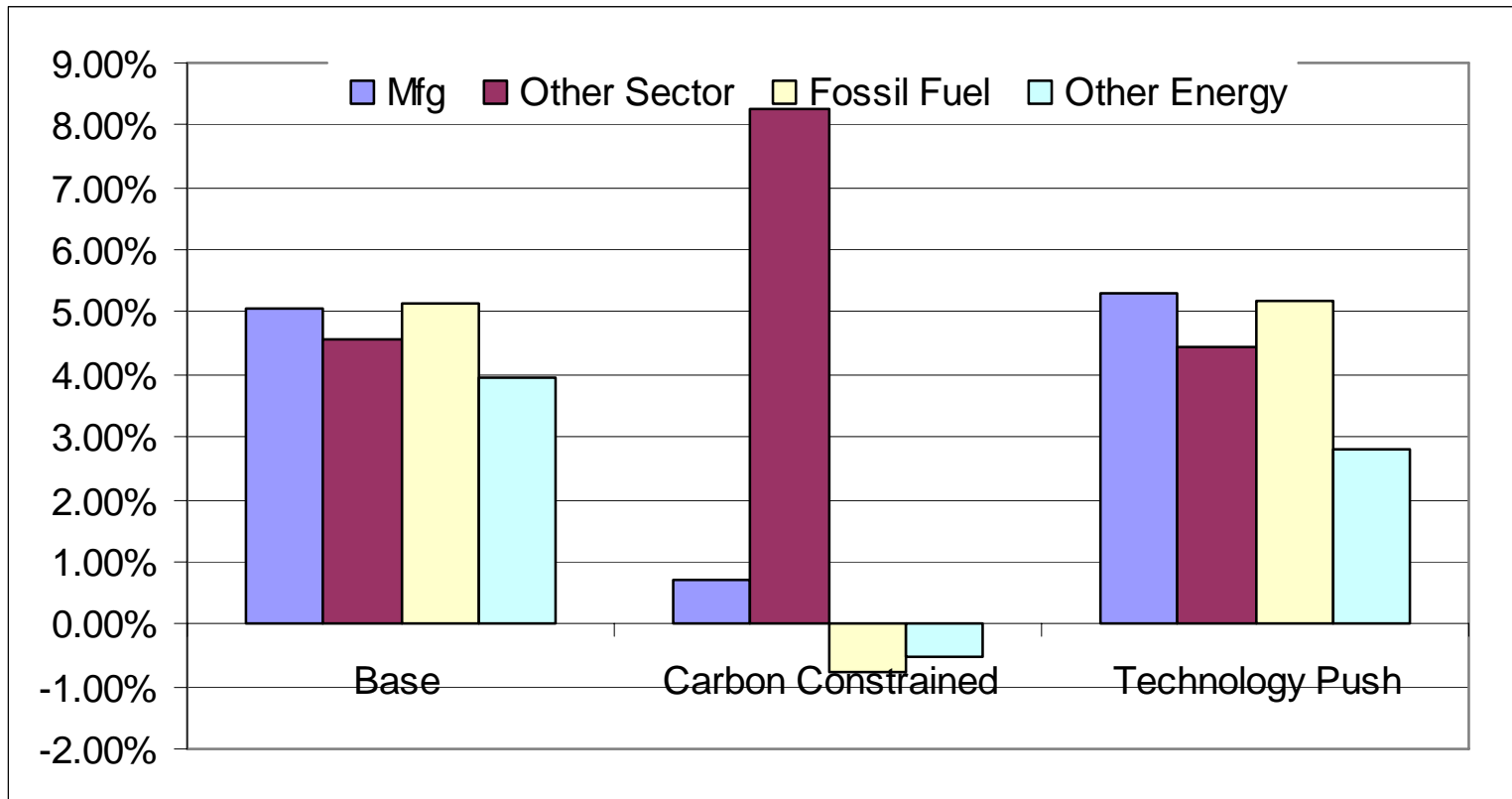
Scenarios

- **Carbon Constraint**
 - Emissions in future restricted at Year 2000 Level
- **Technology Push**
 - Greater Co-operation resulting in technology transfers
 - Similar to Asia Pacific Partnership on Clean Development
 - Faster technological improvements

Model Data Inputs

- **I/O Table India 1999 (Source , CSO)**
 - 115 X 115 Commodities
 - Aggregated to 4 X 4 Commodities
- **AIM/CGE: 4 Sectors/Commodities**
 - 2 Energy and 2 Non Energy Sectors
 - Energy – Fossil & Non Fossil Fuels
 - Non Energy – Manufacturing & Services

Results – Sector Growth Rates (2000-2010)



Results - CO2 Emissions

- Base Case – Increase @ 4.22% CAGR
- Carbon Constraint Scenario – Same as Year 2000
- Technology Push – Reduces Emissions @ 1.12% CAGR (Over Base Case)

LCS Modeling (separate presentation)

Contributions, Capacity Building and Dissemination

1. Multi-gas emissions inventory assessment (**Period: 1985 to 2005**)
 - Mapping of district level and point source level emissions inventory for India
 - Inputs to India's Second National Communications exercise
 - Data for Baseline Assessment for CDM Projects for F-Gases and Electricity Sector

2. AIM Model Applications (**Contributions, Capacity Building and Interfaces**)
 - Energy Snapshot Model Applications for India
 - CGE Model Applications for India
 - Modeling for Low Carbon Society and Stabilization Assessment

3. Dissemination and Interfaces
 - Stern Report
 - IEA's World Energy Outlook (2006)
 - IPCC AR4 & New Scenarios
 - APN's CAPaBLE Project
 - UNEP's "Development and Climate" Project
 - India's Second National Communication
 - EMF 22

Future Work

1. Multi-gas Emissions inventory assessment

- Mapping of New District Level and Large Point Source Emissions Inventories for India
- Emissions Coefficient for New and Future Technologies
- Forestry and Land-use Database

2. AIM model applications

- New Emissions Scenarios – Integrating Innovations, Co-benefits and Sustainability Indicators
- Extended Snapshot Model Application for India for LCS Scenario
- AIM/CGE Model Development for India
- New applications to support global clean energy and climate change programs and initiatives

3. Capacity building, dissemination, interfaces and contributions to National and International Assessment Initiatives together with the AIM team