

Indian Energy Trends: The Climate and Development Challenge

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Agenda

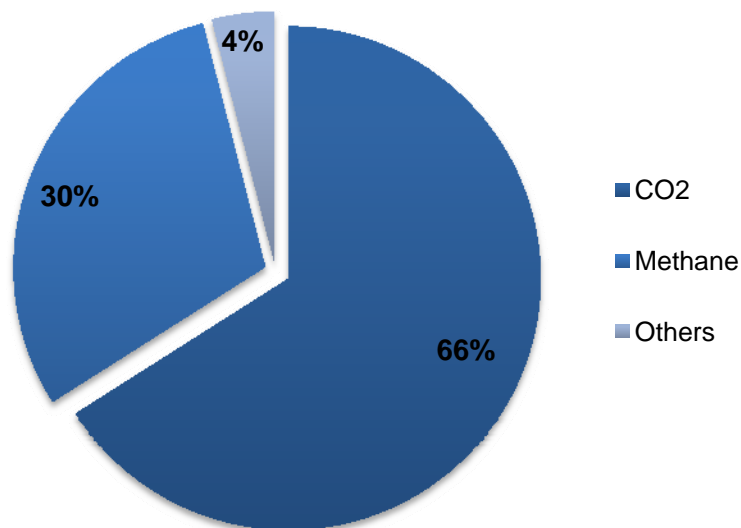
- Economy Trends and Performance
- Policy Initiatives
- The Development Challenge
- Clean Growth Opportunities/Barriers

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- Economy Trends and Performance
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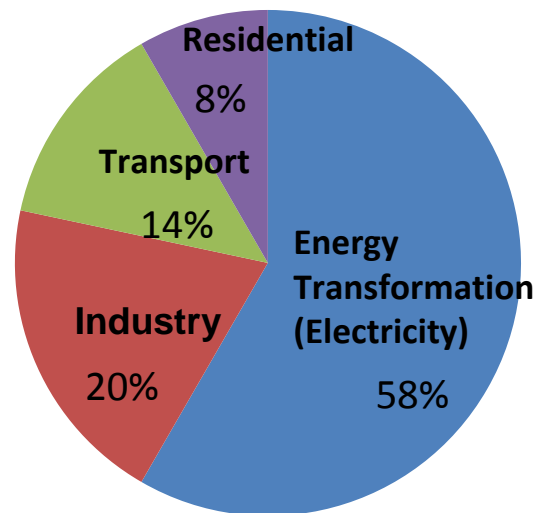
Where do India's Emissions Come From?

GHG Emissions (2005)



Total: 1.8 billion tons

Energy-Related CO2 Emissions (2005)



Total: 1.2 billion tons

Source: World Resources Institute

Economy Trends and Performance

$$GDP \times \text{Energy Intensity} \times \text{Carbon Intensity} = \text{Emissions}$$

\$

(Joules/\$)

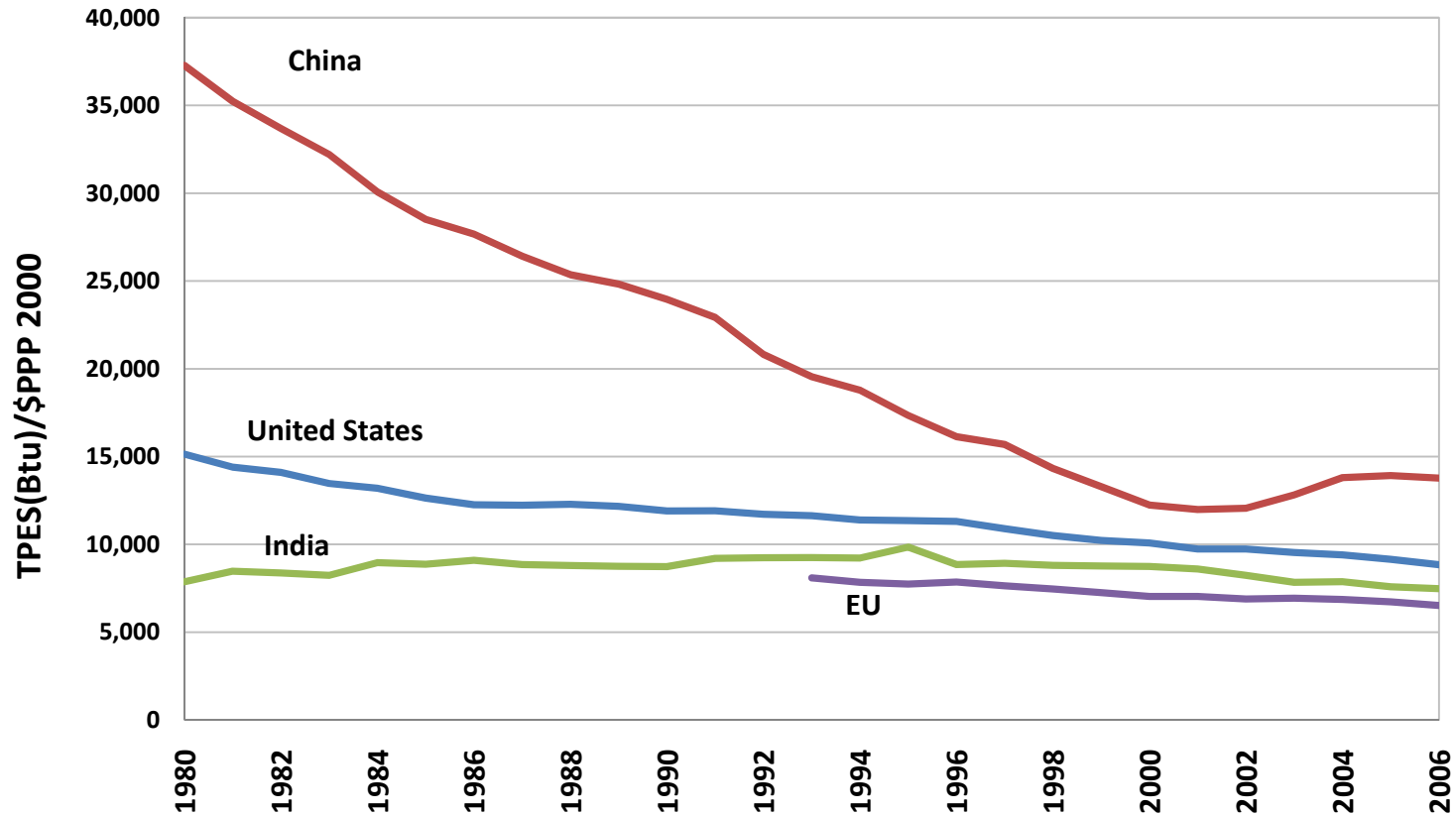
(Tons/Joules)

= (Tons)

Industry
Transportation
Residential

Economy-wide Energy Intensity

Total Primary Energy Supply (Btu/\$PPP 2000)

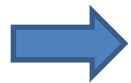


India's energy intensity has been falling since the mid-nineties. Current trends would imply continued decline in the near future.

Source: Energy Information Administration, USDOE

Economy Trends and Performance

$$GDP \times Energy Intensity \times Carbon Intensity = Emissions$$



Industry

Transportation

Residential

Electricity

Energy Intensity – Industry

Industrial growth (7% p.a between 2000 - 2005) has decoupled from its energy consumption growth (3% p.a)

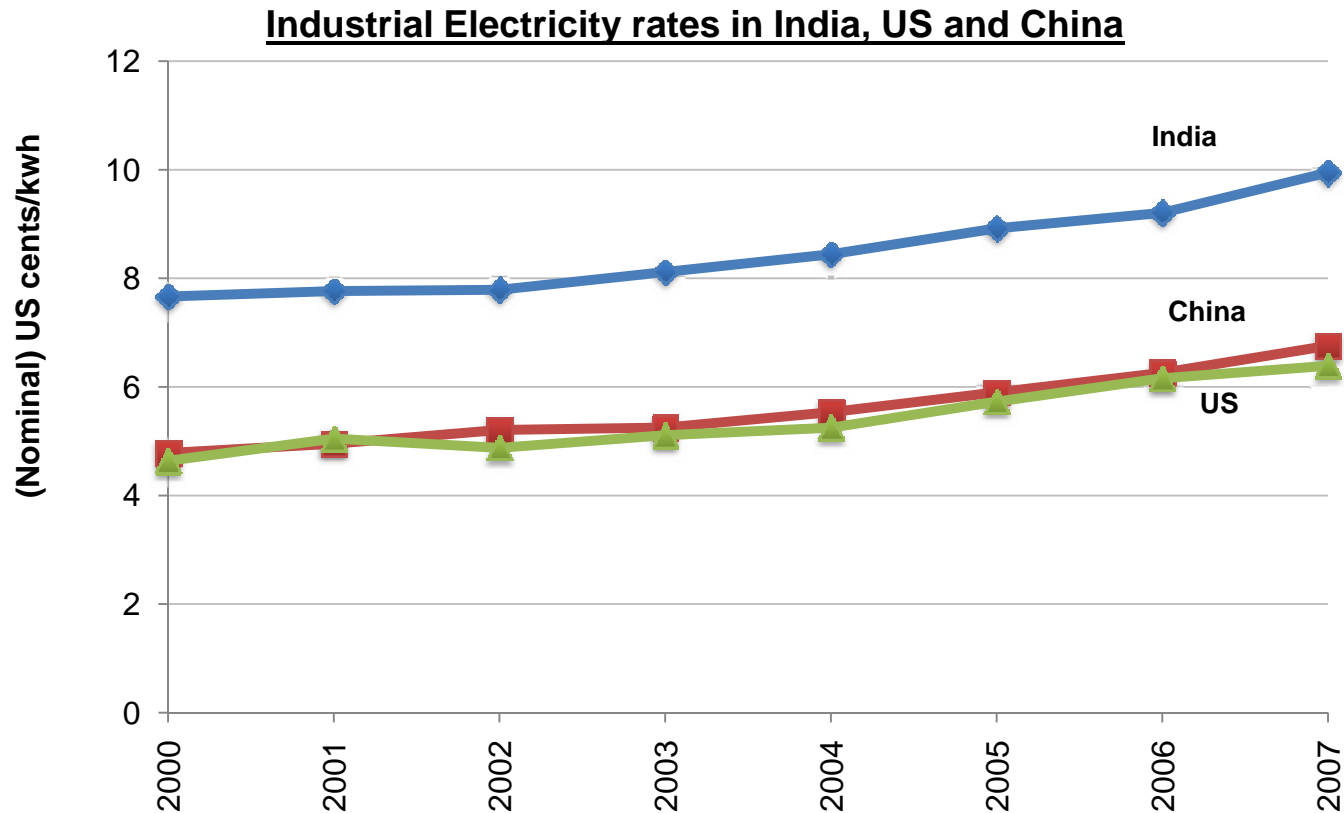
	Specific Energy Consumption in GJ / ton				
Type of Industry	1990	1995	2000	2005	AAGR (1990-2005)
Iron and Steel	41.9	37.6	33.3	29.1	-2.41%
Cement	3.6	3.4	3.3	3.1	-1.10%
Ammonia	55.3	60.4	51.9	42.9	-1.67%
Aluminum	399.0	393.8	380.5	364.9	-0.59%
Pulp and Paper	35.0	31.3	27.6	24.0	-2.48%

The Indian cement industry's electricity intensity is one of the lowest in the world.

Source: Lawrence Berkeley National Laboratory,, 2009

Drivers of Industrial Energy Intensity

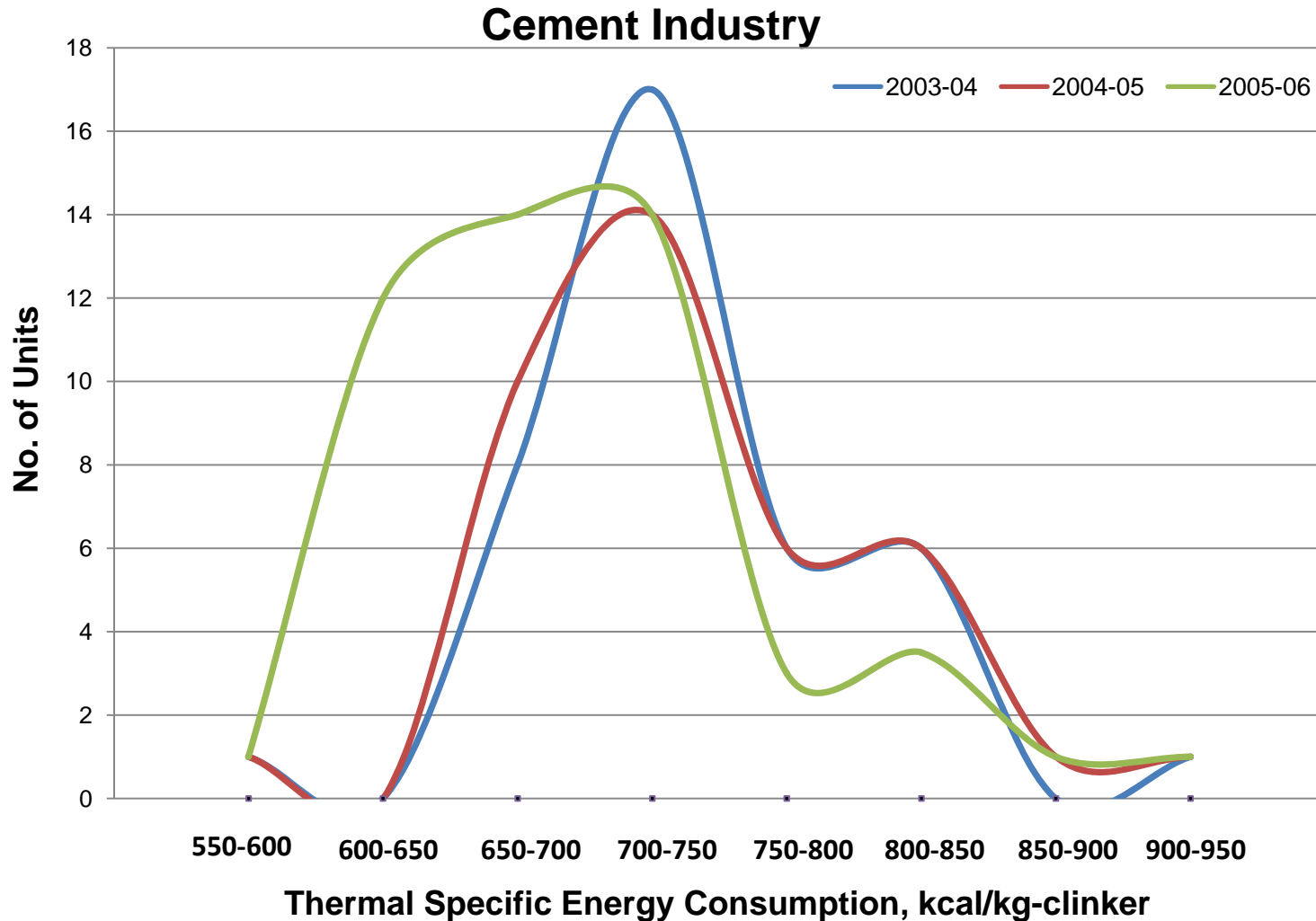
High industrial electricity rates encourage energy efficiency.



Source: US Energy Information Administration, Indian Planning Commission, Power Finance Corporation, Lawrence Berkeley National Laboratory

Challenges for Industrial Energy Intensity

Most industries exhibit a wide range of performance.



Source: Bureau of Energy Efficiency, India

Industry Mitigation Opportunities

- Scale Best Available Technology penetration
- Small scale industries (1/3rd of output)
- Electricity sector production and delivery
 - Low plant efficiency (30% vs. best of 40%)
 - High Transmission/Distribution losses (30%)
 - Poor price signals to agriculture

Economy Trends and Performance

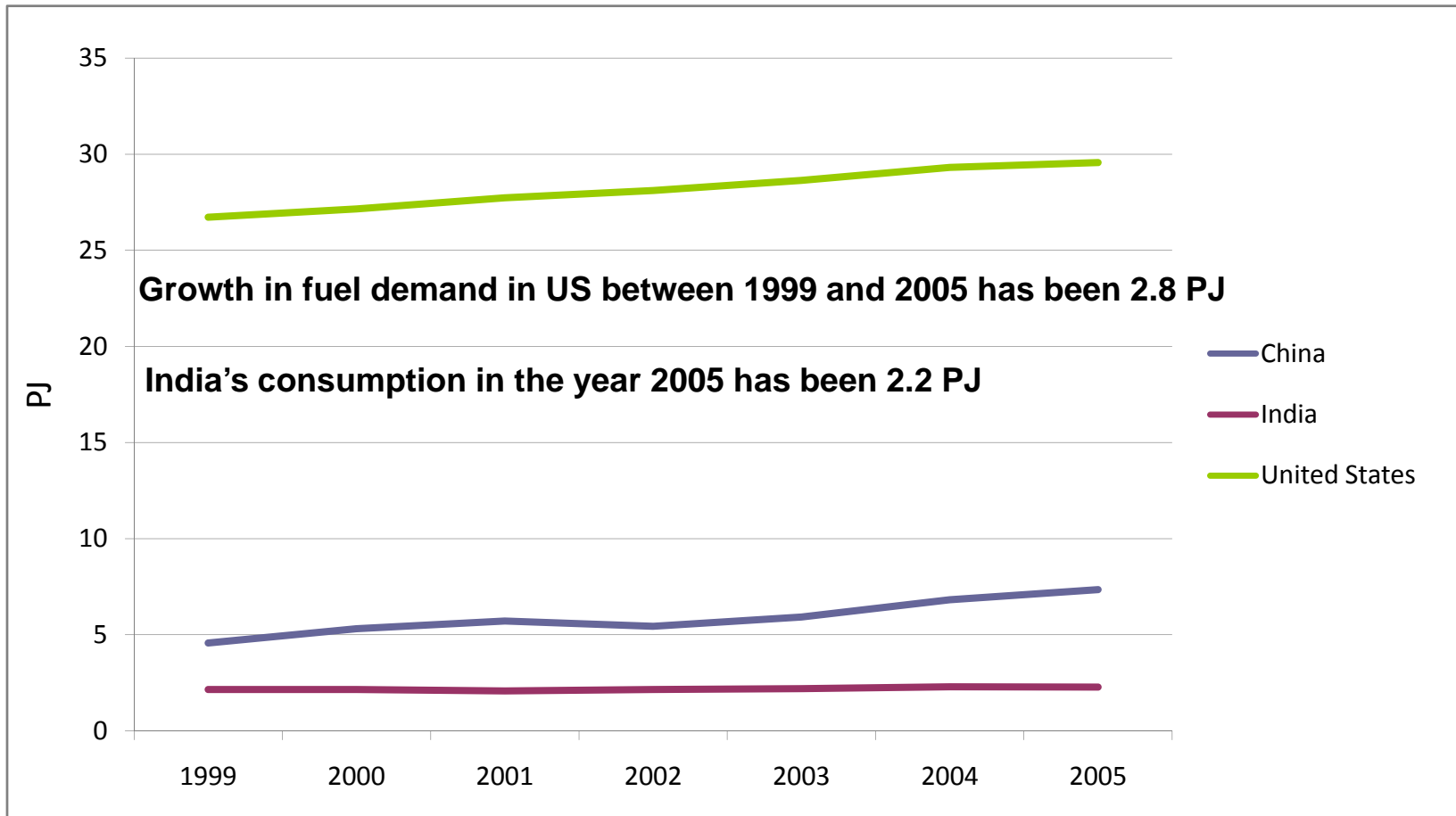
GDP x Energy Intensity x Carbon Intensity = Emissions



Transportation Sector Energy Demand

Transport fuel demand growth is relatively low.

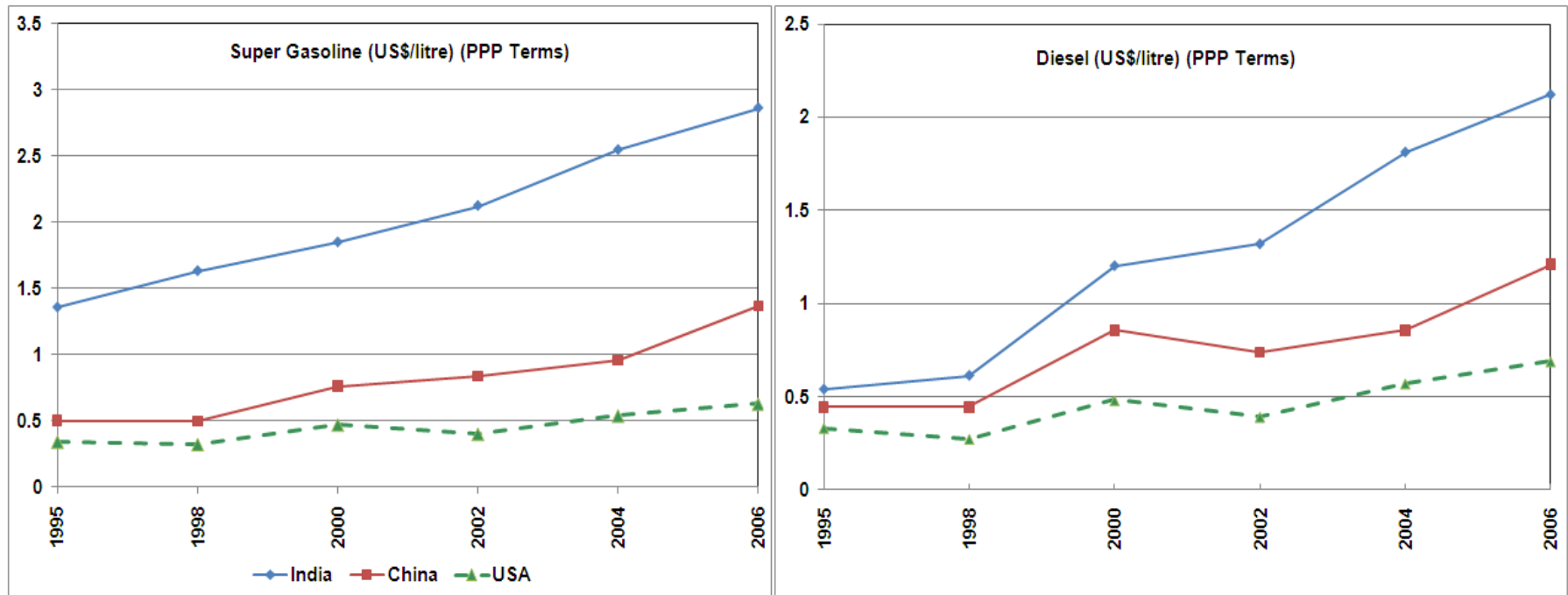
Transport Energy Demand



Source: Energy Information Administration, USDOE

Drivers of Transport Energy Intensity

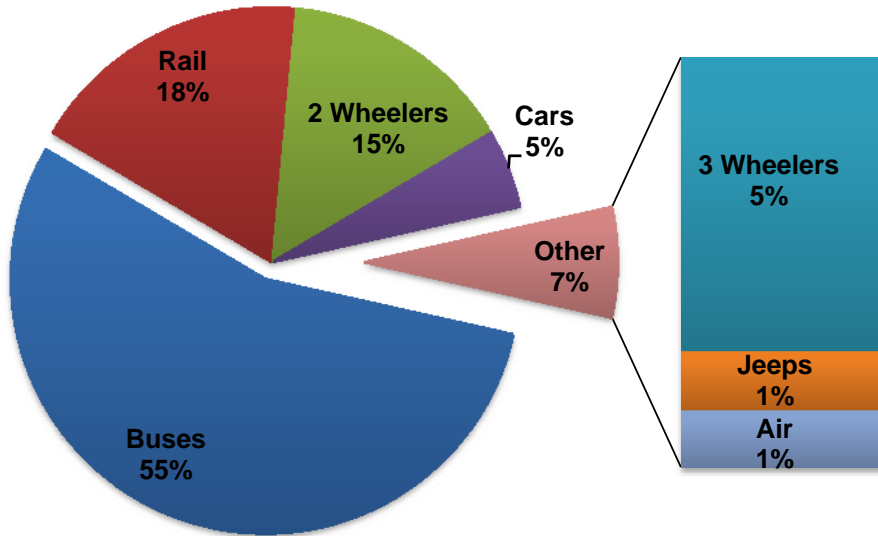
High fuel prices, with a high share of taxes, help discipline fuel demand growth.



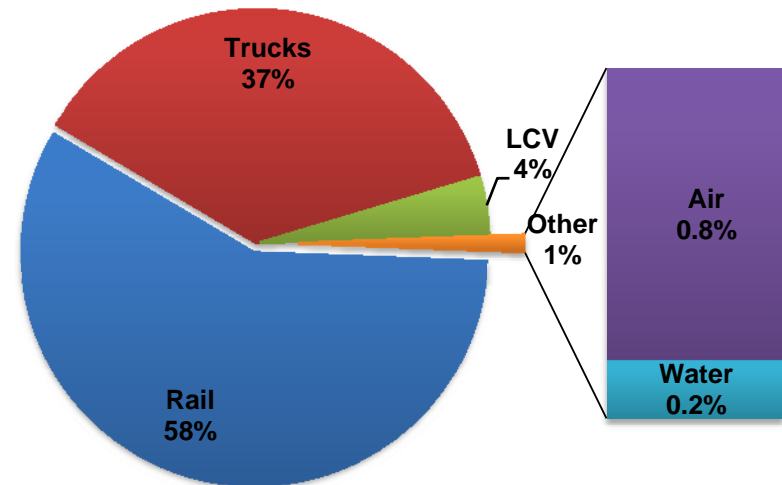
Source: GTZ, International Fuel Prices 2007

Modes of Transportation

Break - up of passenger km



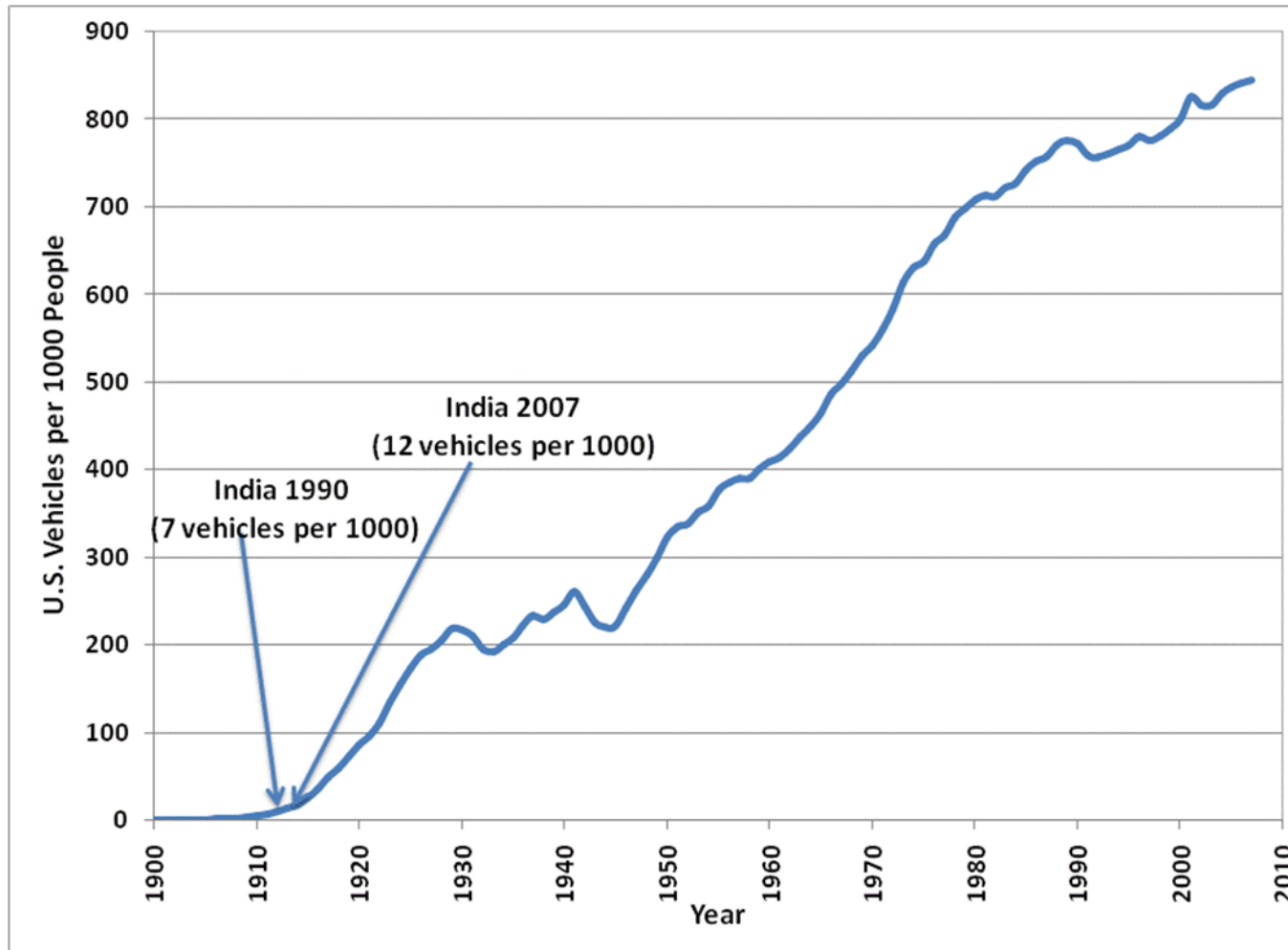
Freight Tonne-km per Mode



Source: LBNL, 2009

Transportation Sector Passenger Vehicles

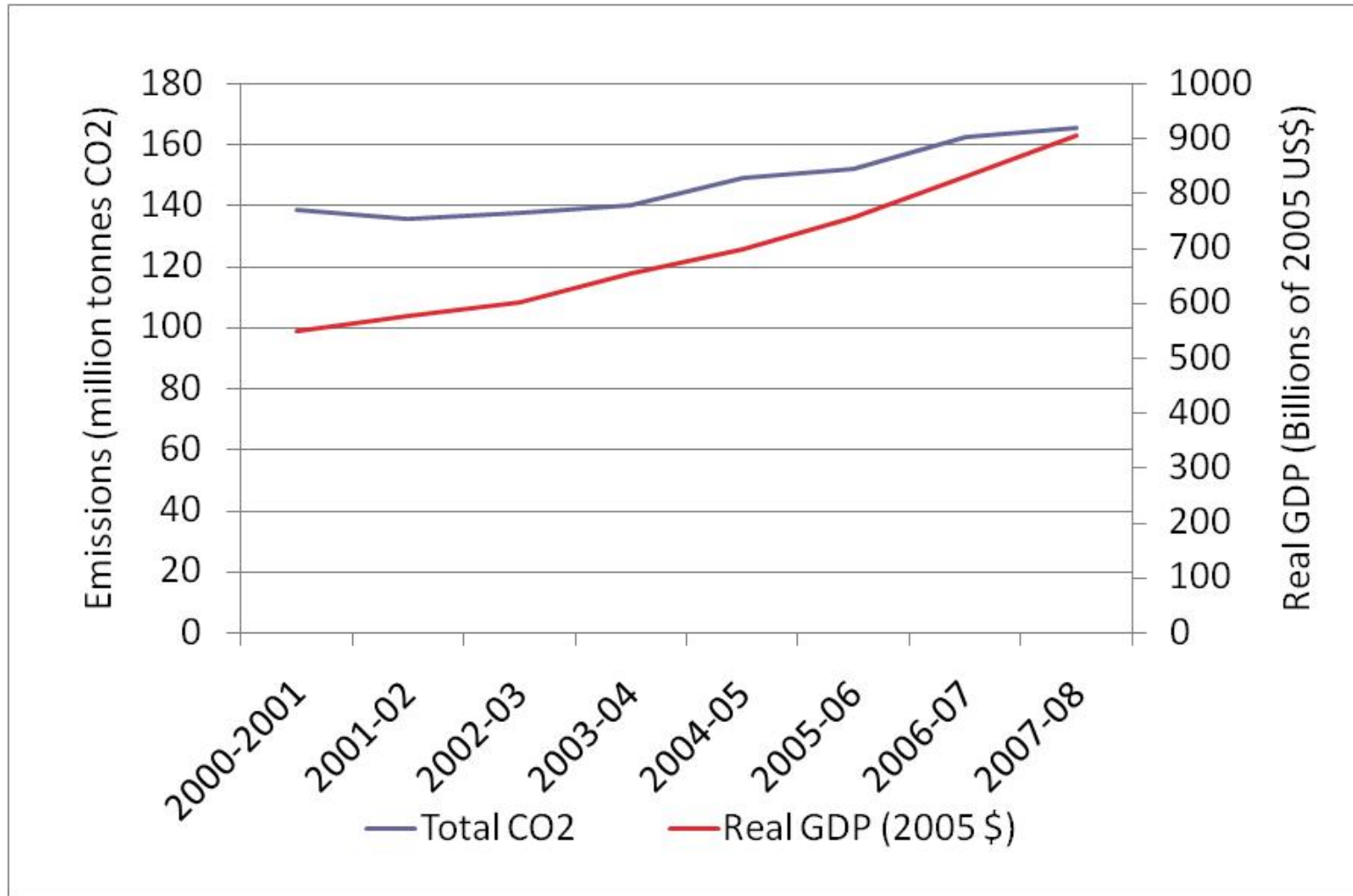
From a small base, passenger vehicle sales are growing fast.



Source: Oak Ridge National Laboratory, US (<http://cta.ornl.gov/>)

Transportation Sector Emissions Trend

Total emissions growth is high, but lags GDP growth.



Source: Ministry of Petroleum and Natural Gas, India 2009; Economic Research Service, US Department of Agriculture, 2009

Transport Mitigation Opportunities

- Vehicle Fuel Economy
- Public transportation
- Improved urban design
- Road/traffic management infrastructure

Potential Co-benefits

- Reduce accident fatalities
- Reduce local pollution, congestion
- Reduce oil imports

Economy Trends and Performance

$$GDP \times Energy Intensity \times Carbon Intensity = Emissions$$

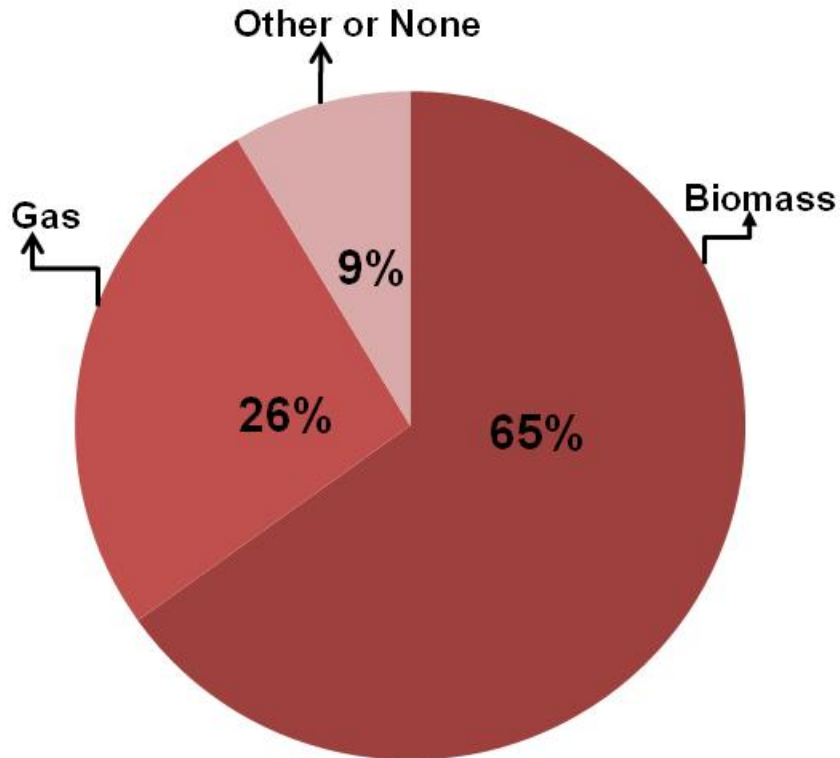
Industry

Electricity

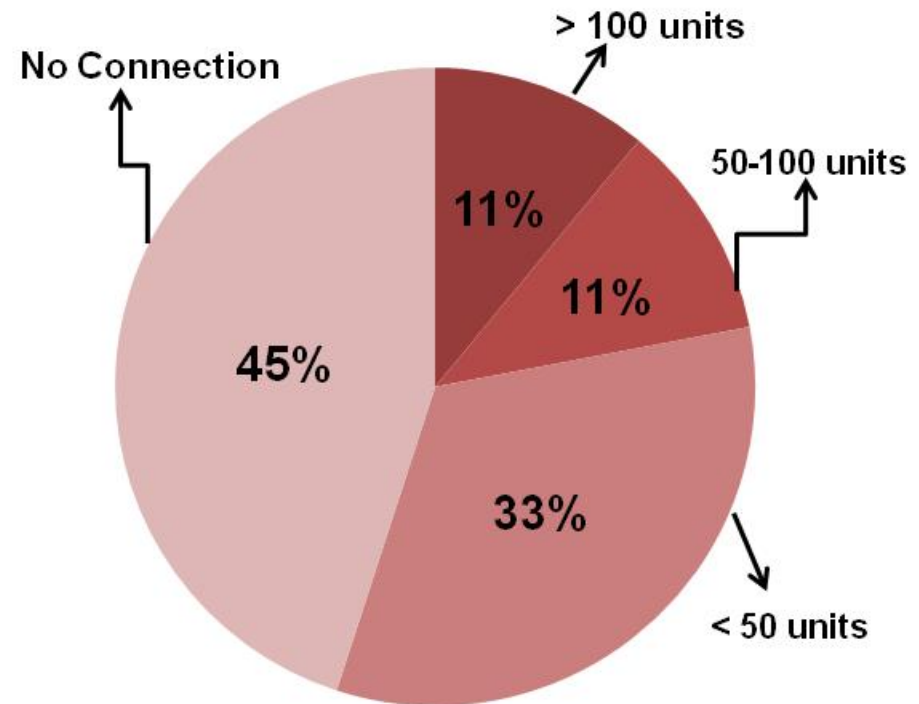
Transportation

 **Residential**

Residential Sector Energy Use and Poverty



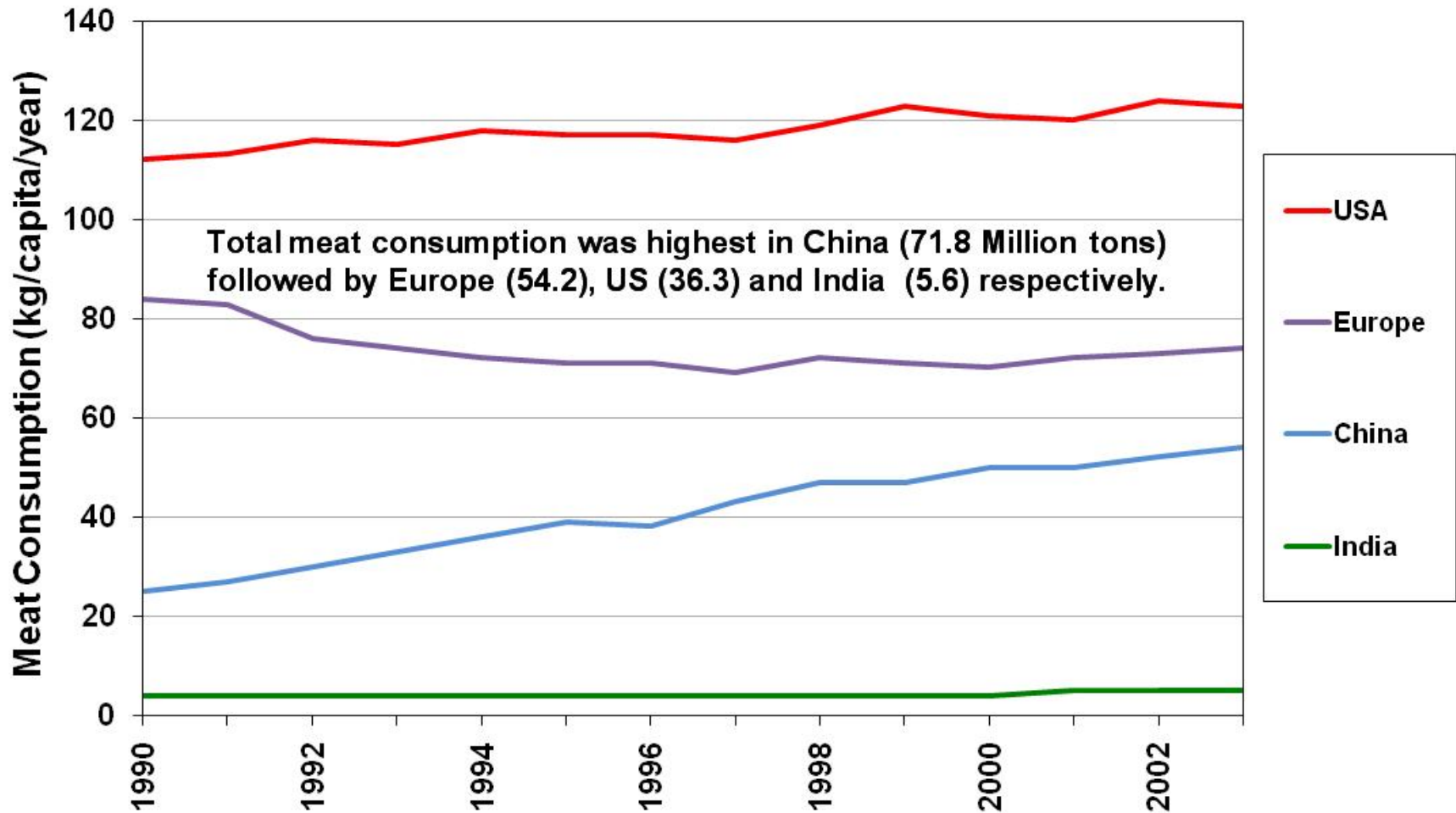
Household Cooking Fuel Options



Household Electricity Consumption

Residential Sector - Lifestyle Matters

Food is the primary source of indirect emissions from households.



Source: FAO, (<http://faostat.fao.org/site/569/default.aspx#ancor>)

Residential Sector – Emissions Impact

- Eight percent of CO₂ emissions from direct energy use
- Providing all households with modern cooking fuels will have a negligible (<1 percent) impact on emissions
- Electricity growth from appliance use is the primary driver

Mitigation Opportunities

- Efficient electric appliance penetration
- Clean cook stoves

Potential Co-benefits

- Improved health
- Reduce power sector investments

Economy Trends and Performance

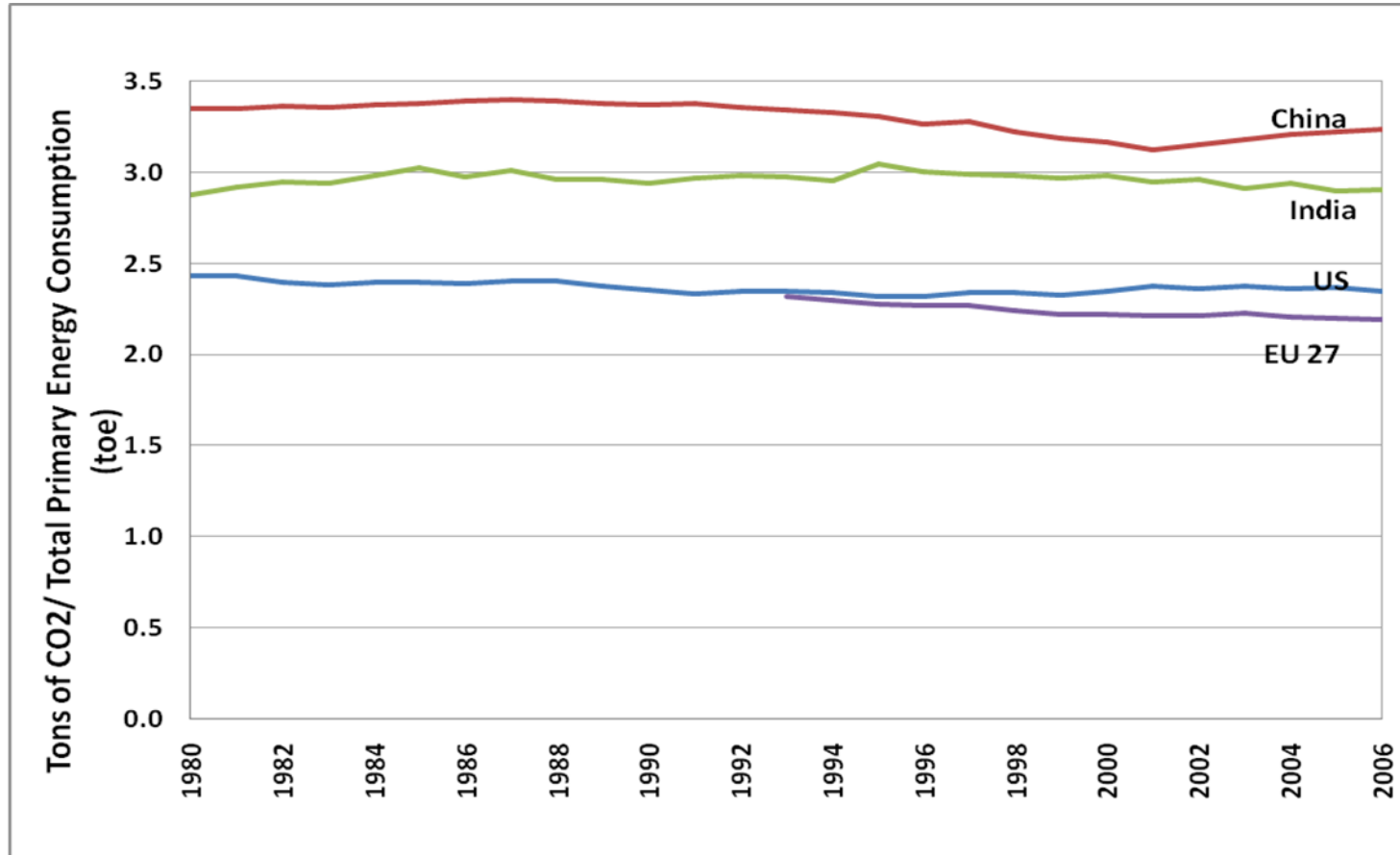
$$GDP \times \text{Energy Intensity} \times \text{Carbon Intensity} = \text{Emissions}$$

Industry
Transportation
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Electricity

Carbon Intensity of Energy

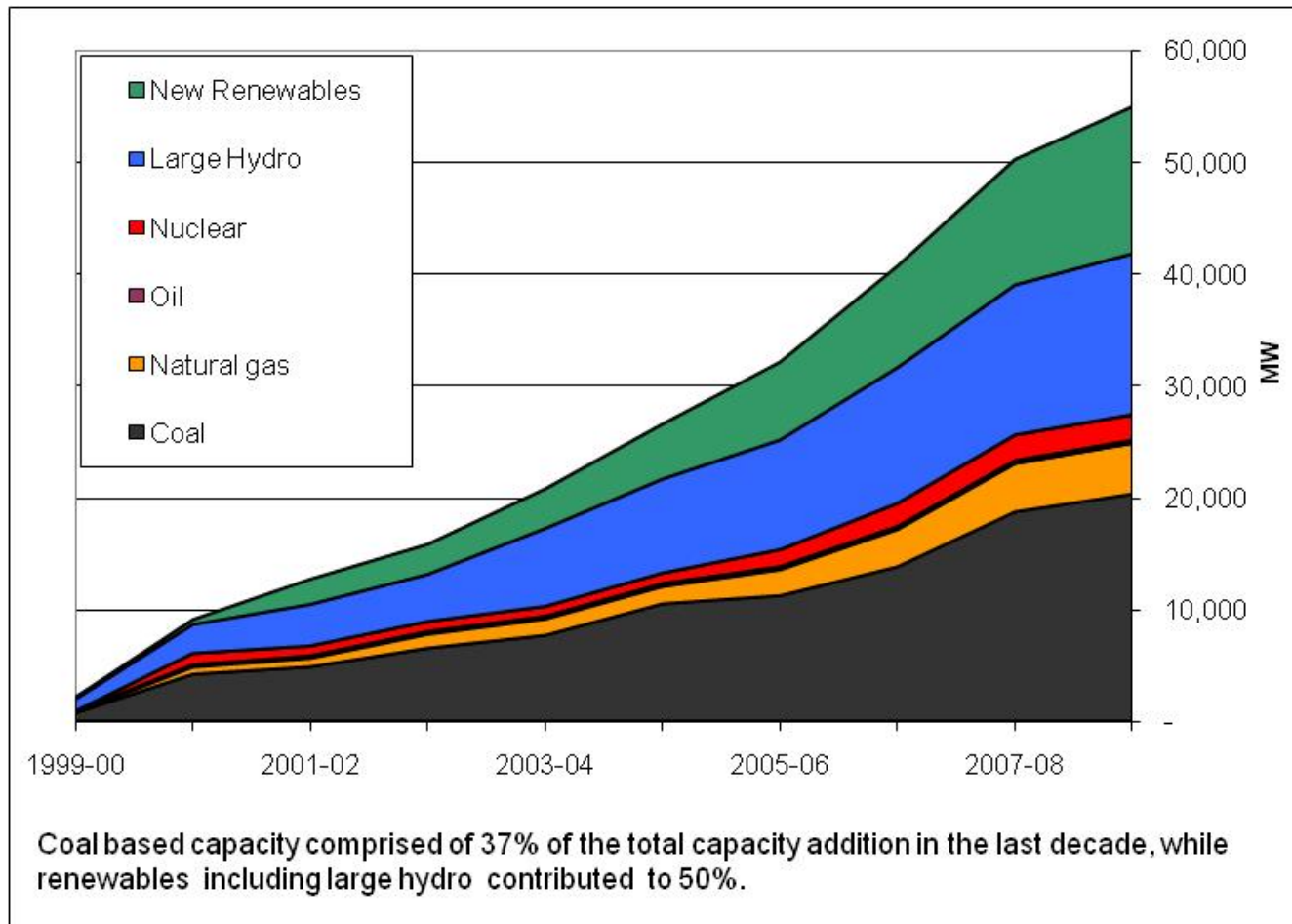
Not impressive, but declining...



Source: Energy Information Administration

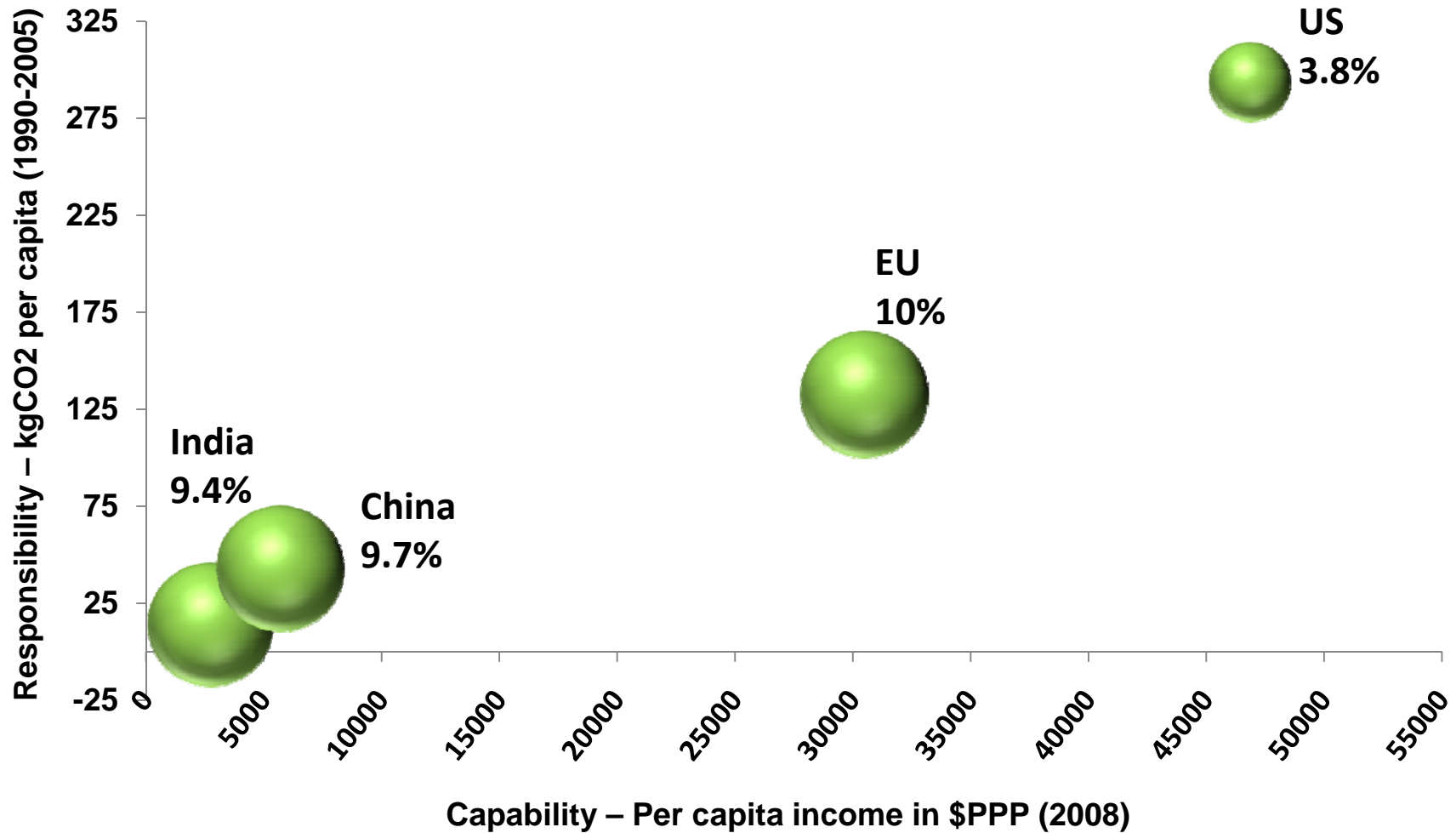
Carbon Intensity – Electricity Sector

...mainly due to the growth in renewables capacity.



Source: Ministry of New and Renewable Energy, Central Electricity Authority

Carbon Intensity – Renewables Achievement



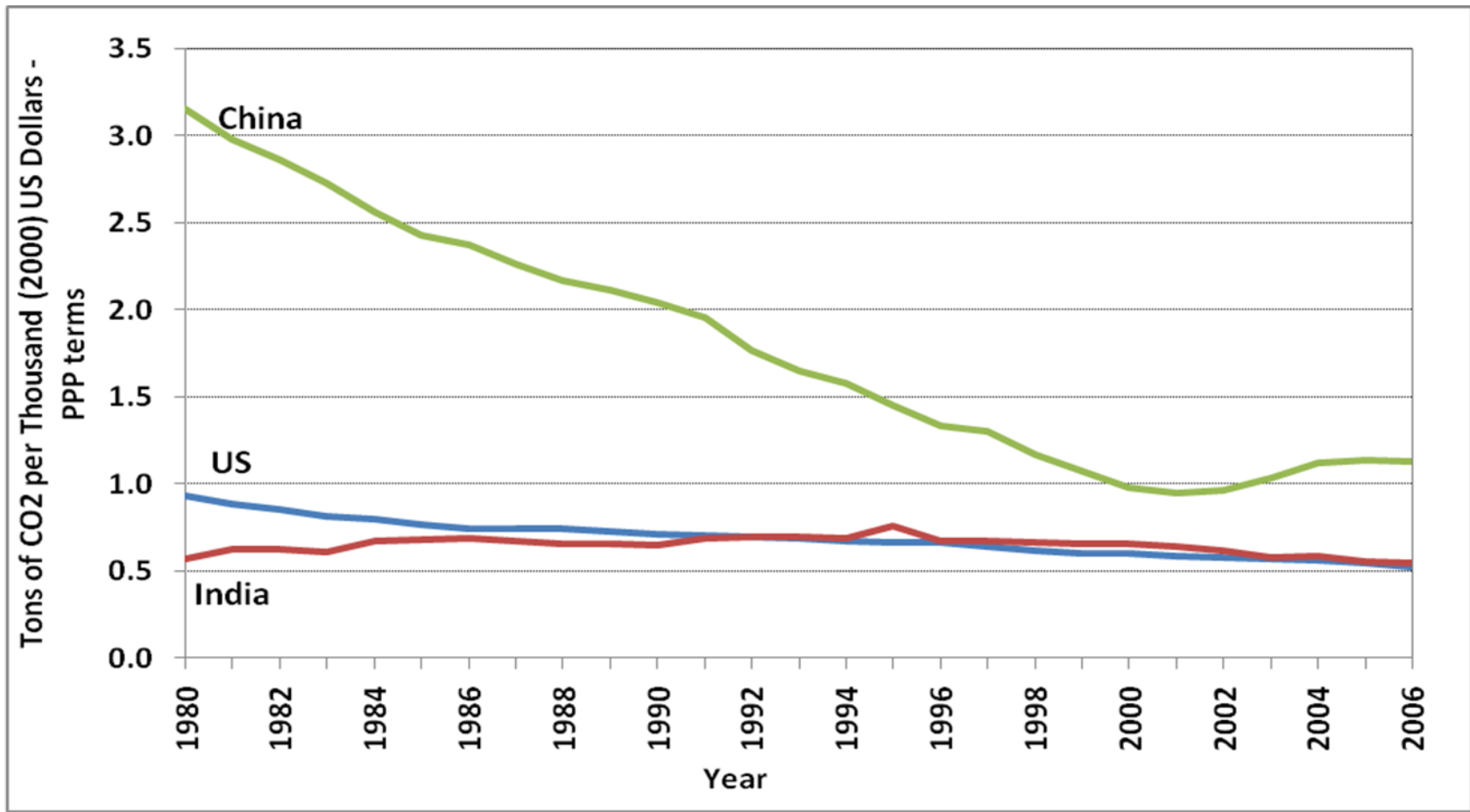
Source: Population and Income Data - CAIT WRI, IMF, Renewable Data - US: EIA, India : MNRE; CEA; EU 27: EuroElectric, China: IEA and Various Sources

Mitigation Opportunities – Coal Sector

- Coal power plants in India use sub-critical technology with low efficiencies (about 29%).
 - Ultrasupercritical plants have an efficiency of about ~40%
- Renovation and Modernization of Coal plants
- Coal mining in India also needs technology improvements.

Economy Trends and Performance - Summary

Overall carbon Intensity of GDP is comparable to that of the US.



Source: Energy Information Administration

Economy Trends and Performance - Summary

- The Indian economy has a relatively low carbon intensity
 - High energy prices
 - Low-carbon lifestyle
- Opportunities for Efficiency Improvement
 - Electricity production and delivery
 - Industry/manufacturing laggards
 - Household appliances

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Renewables Policies

- National Initiatives
 - Electricity Act 2003
 - Custom/tax benefits
- State Initiatives
 - Renewable Purchase Obligations

Recent

- Renewable Energy Law

Energy Efficiency Policies

- Innovative Programs and Institutions
 - Standards and labeling
 - Appliances, energy Conservation, building code
 - Training and capacity building
- State Demand Side Management (DSM) Programs
 - Compact Fluorescent Light distribution
- Investment /Financing
 - Electric grid upgrade

Fuel Diversification Policies

- National Gas market development
 - New Exploration and Licensing policy
- Nuclear power (20 GW)
- Large Hydro emphasis (50 GW)



***Face controversy
and implementation
challenges***

National Action Plan on Climate Change

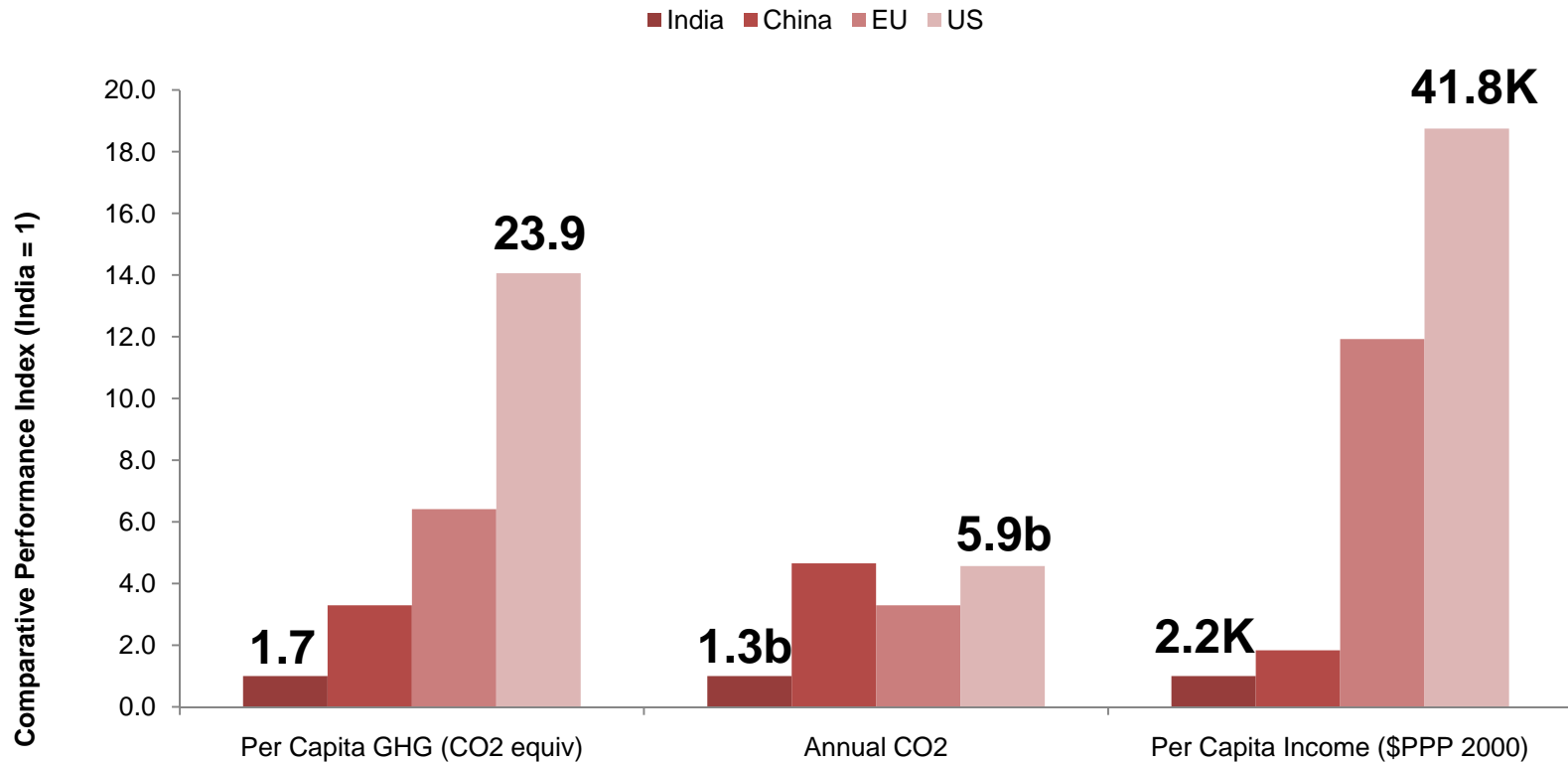
- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission for a 'Green India'
- National Mission on Sustainable Habitat

- National Mission for Sustainable Agriculture
- National Water Mission
- National Mission for Sustaining the Himalayan Ecosystem
- National Mission on Strategic Knowledge for Climate Change

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India in the Global Climate Context



Reference year 2006

Sources: WRI, European Environmental Agency, US Energy Information Administration, International Monetary Fund

Poverty

Poverty rates have declined, but not absolute poverty.

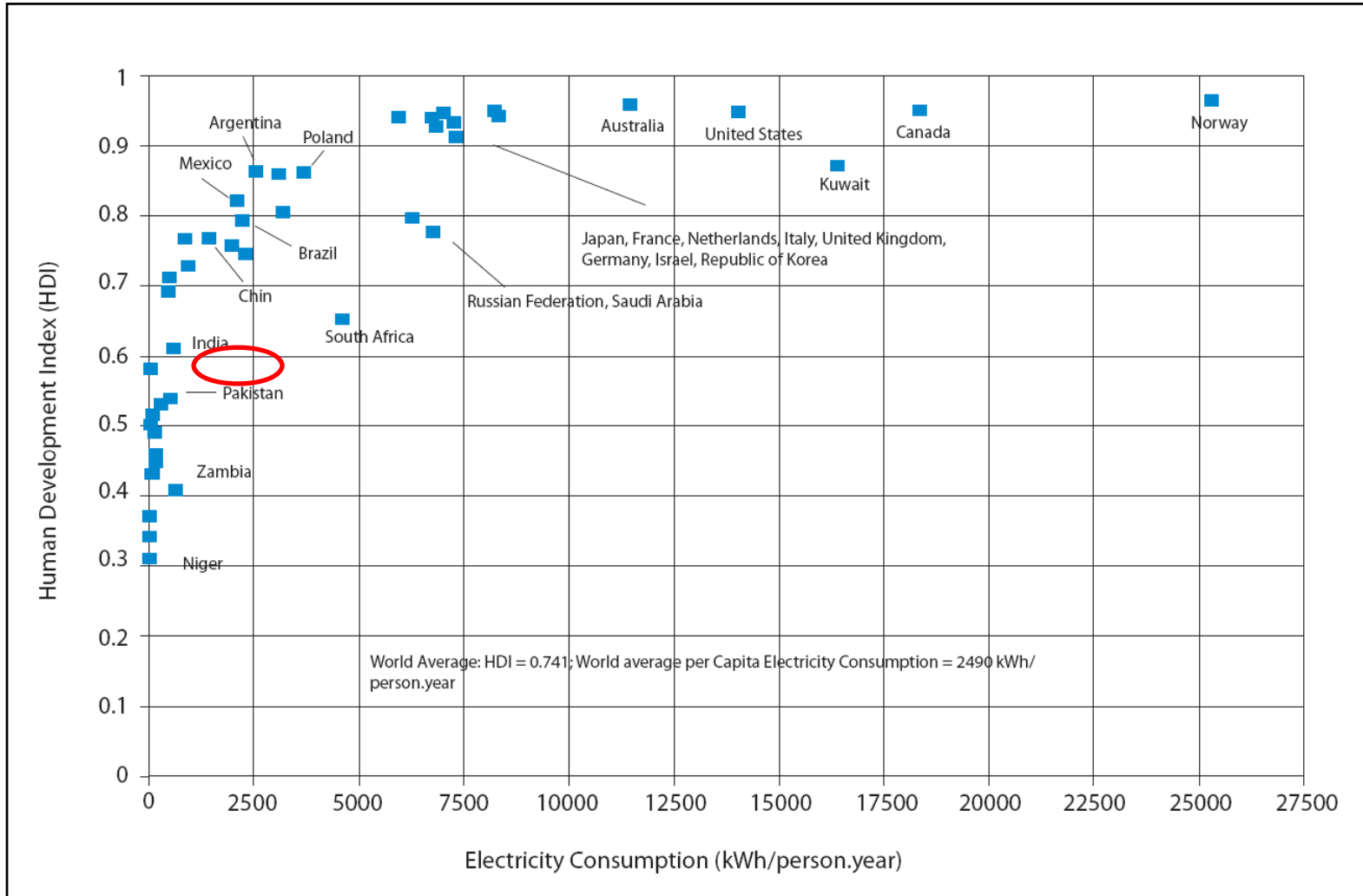
	People living below \$1.25		People living below \$1	
	Absolute Number	Percentage	Absolute Number	Percentage
1981	421 million	60	296 million	42 percent
2005	456 million	42	267 million	24 percent

Source: World Bank

On crude comparison, 99 percent of Indians live below the US poverty line.

Sources: Martin Ravallion, "The developing World's bulging (but vulnerable) Middle Class", Development Economics Group Policy Research Working Paper 4816, January 2009, p.7

Energy and Development



Source: Dr. Steve Chu, Department of Energy, US

Energy and Development

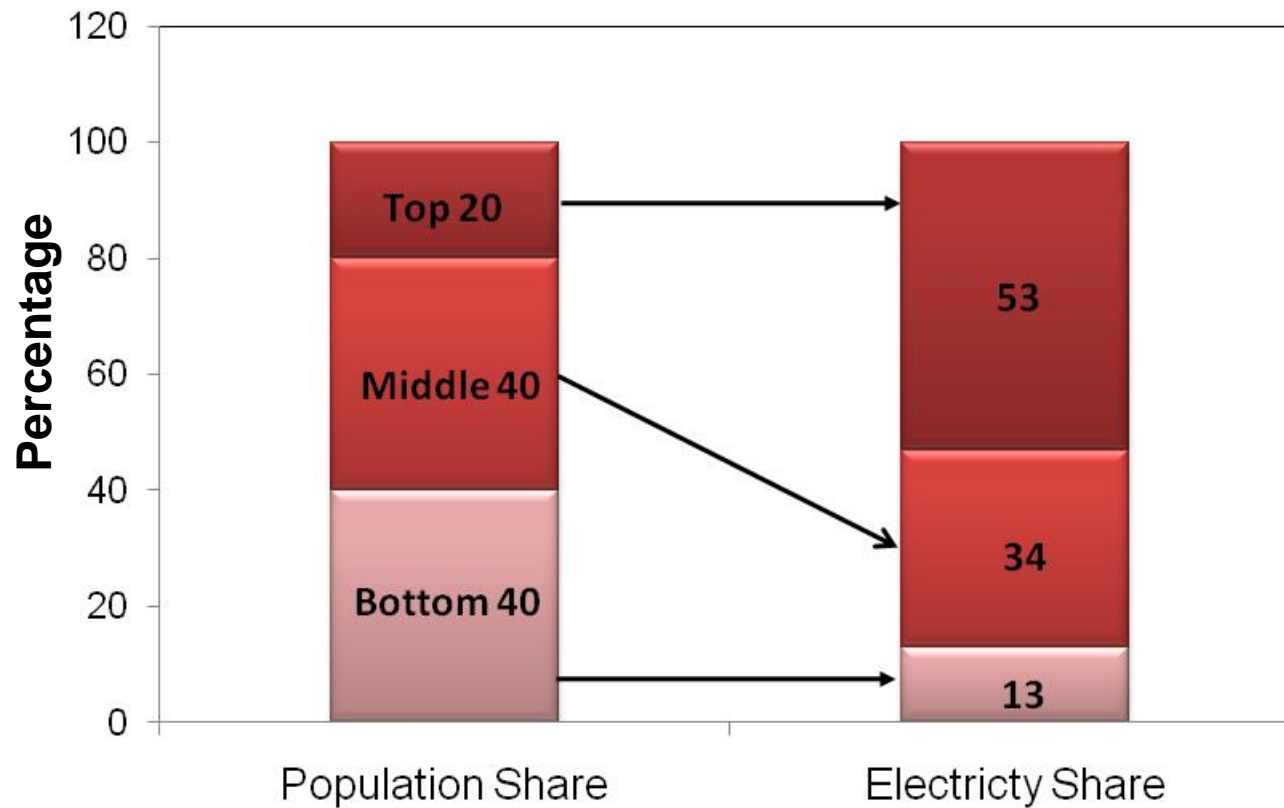
According to the IEA, India's share would increase to 7 percent of global emissions by 2020.

	Emissions Share	Population Share
2005	4%	17%
2020	7%	18%

Source: International Energy Agency, Reference Scenario

Energy and Development - Equity

Distribution of Electricity Consumption by Income Class

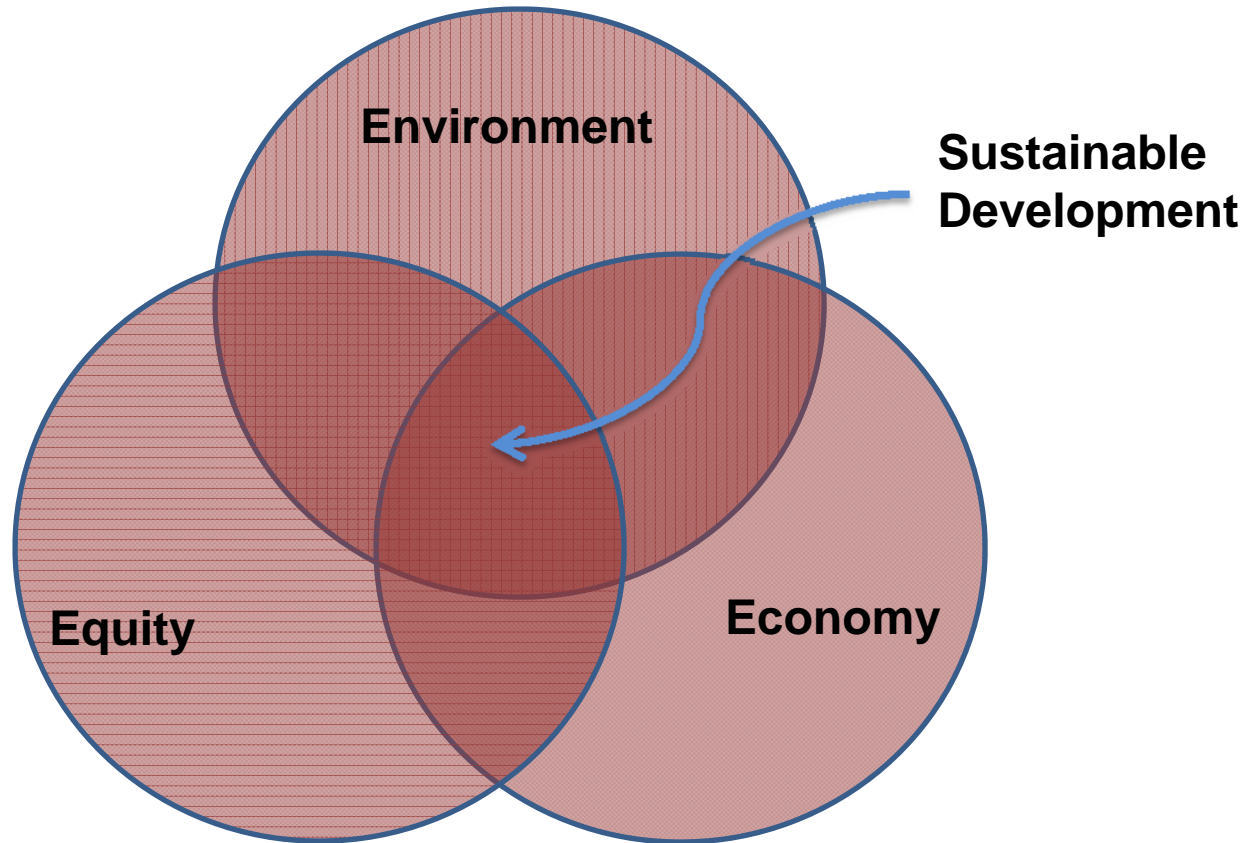


Source: National Sample Survey Data, 2004-05

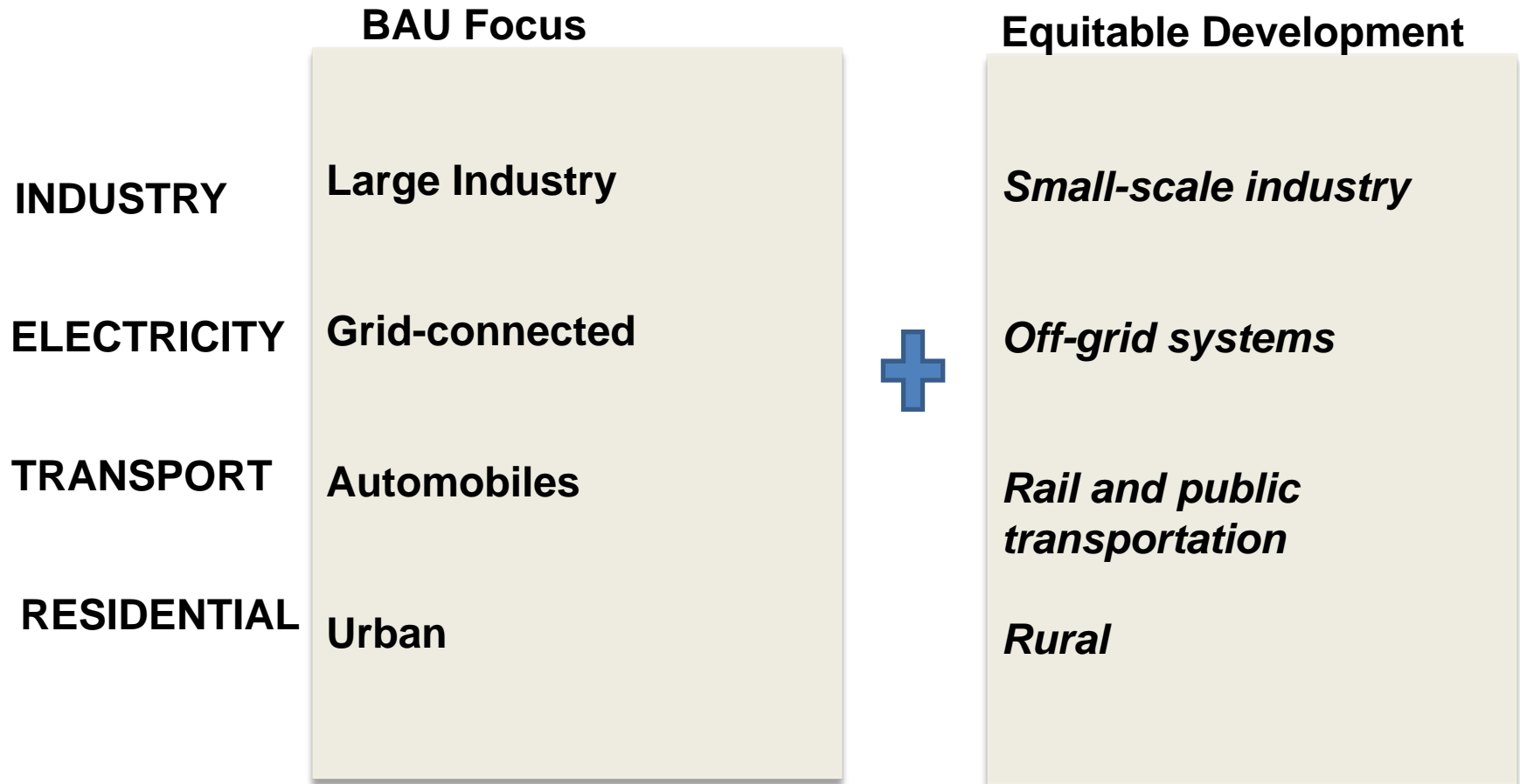
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Aligning Clean Growth with Development



Aligning Clean Growth with Development



Aligning Clean Growth with Development

- **Some Examples**
 - Solar home lighting for un-electrified houses
 - Modern biomass stoves for rural areas
 - Public Transport
 - Gas-based vehicles

THANK YOU

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