Low Carbon Path for the Indian Economy

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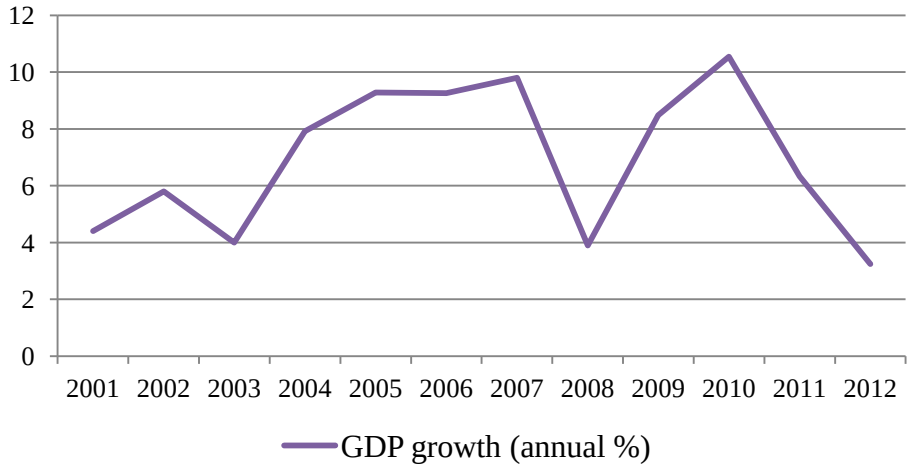
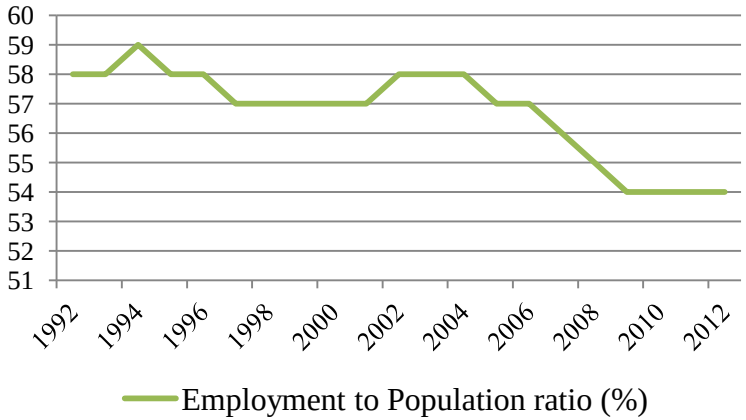
ICRIER, June 12, 2014

Macroeconomic Indicators

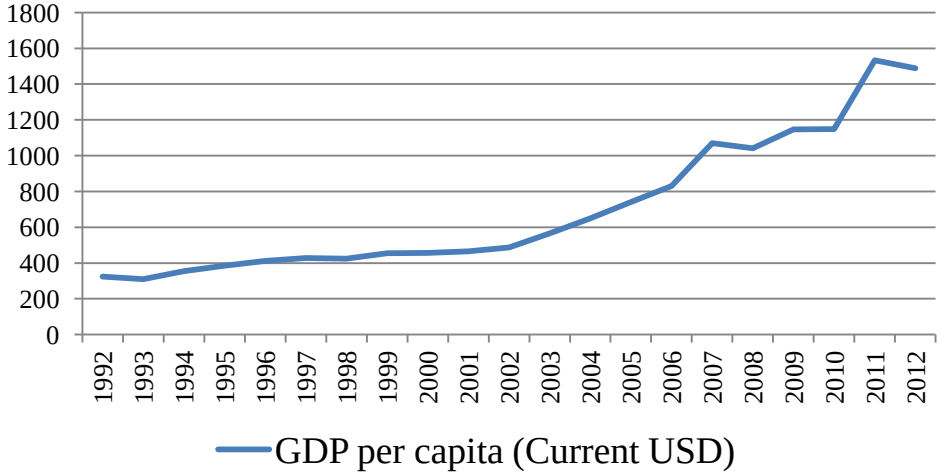
GDP growth (annual %)



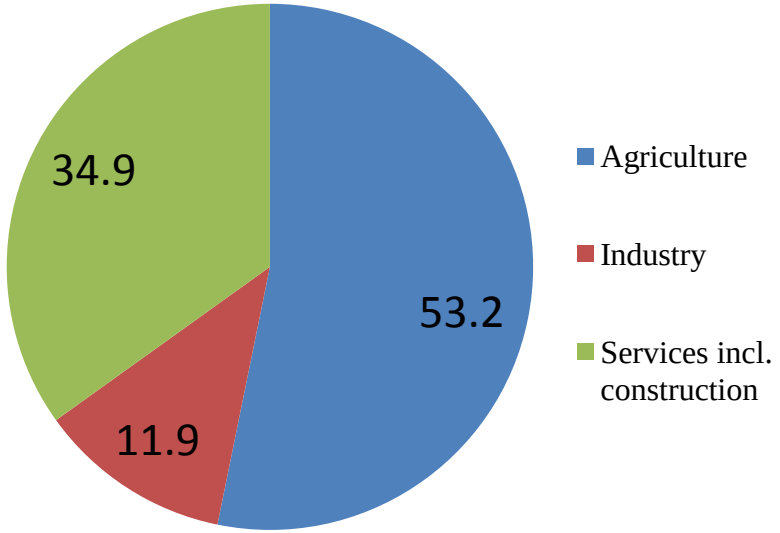
Employment to Population ratio (%)



GDP per capita (Current USD)

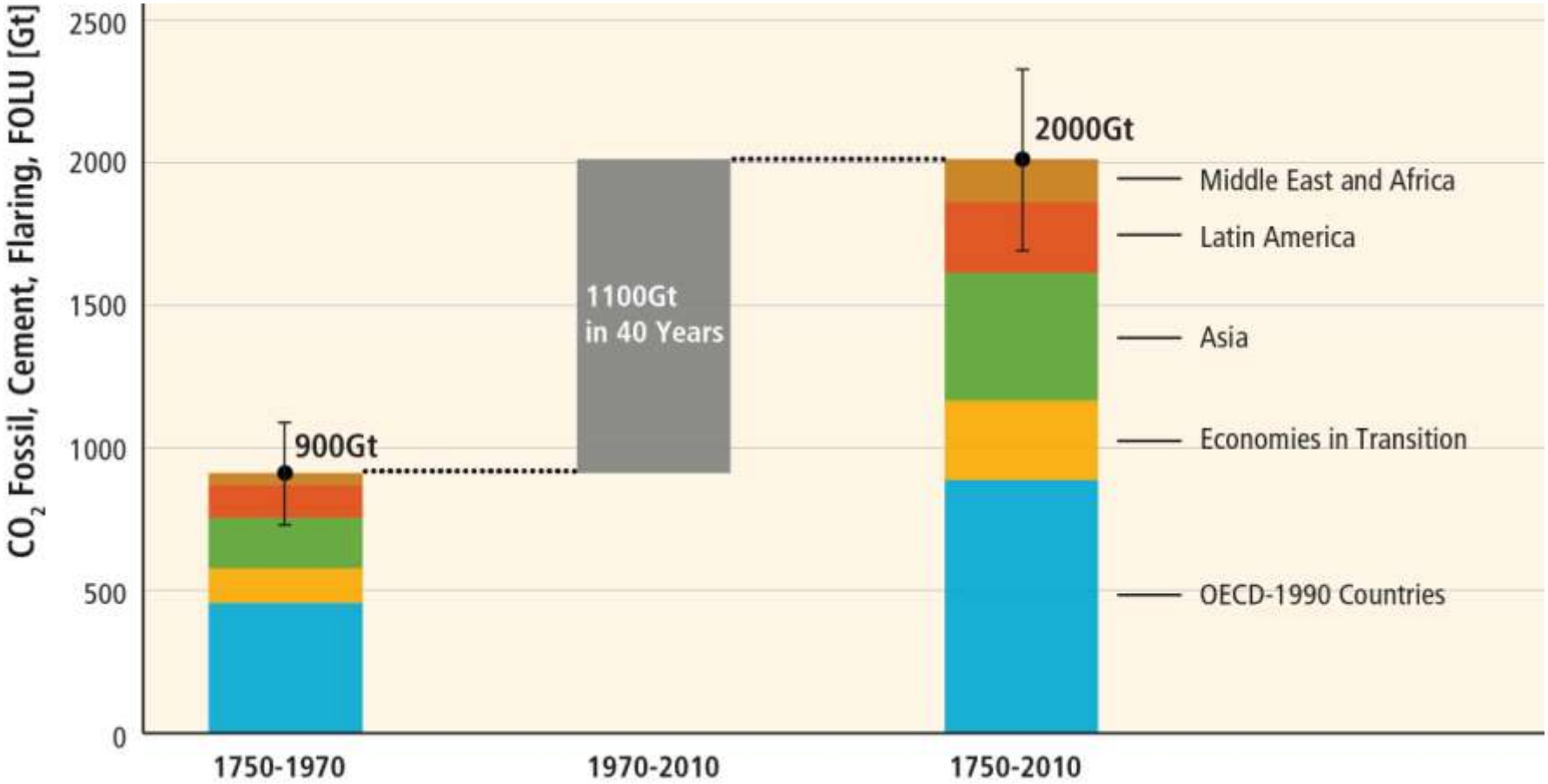


Share in Employment (%)

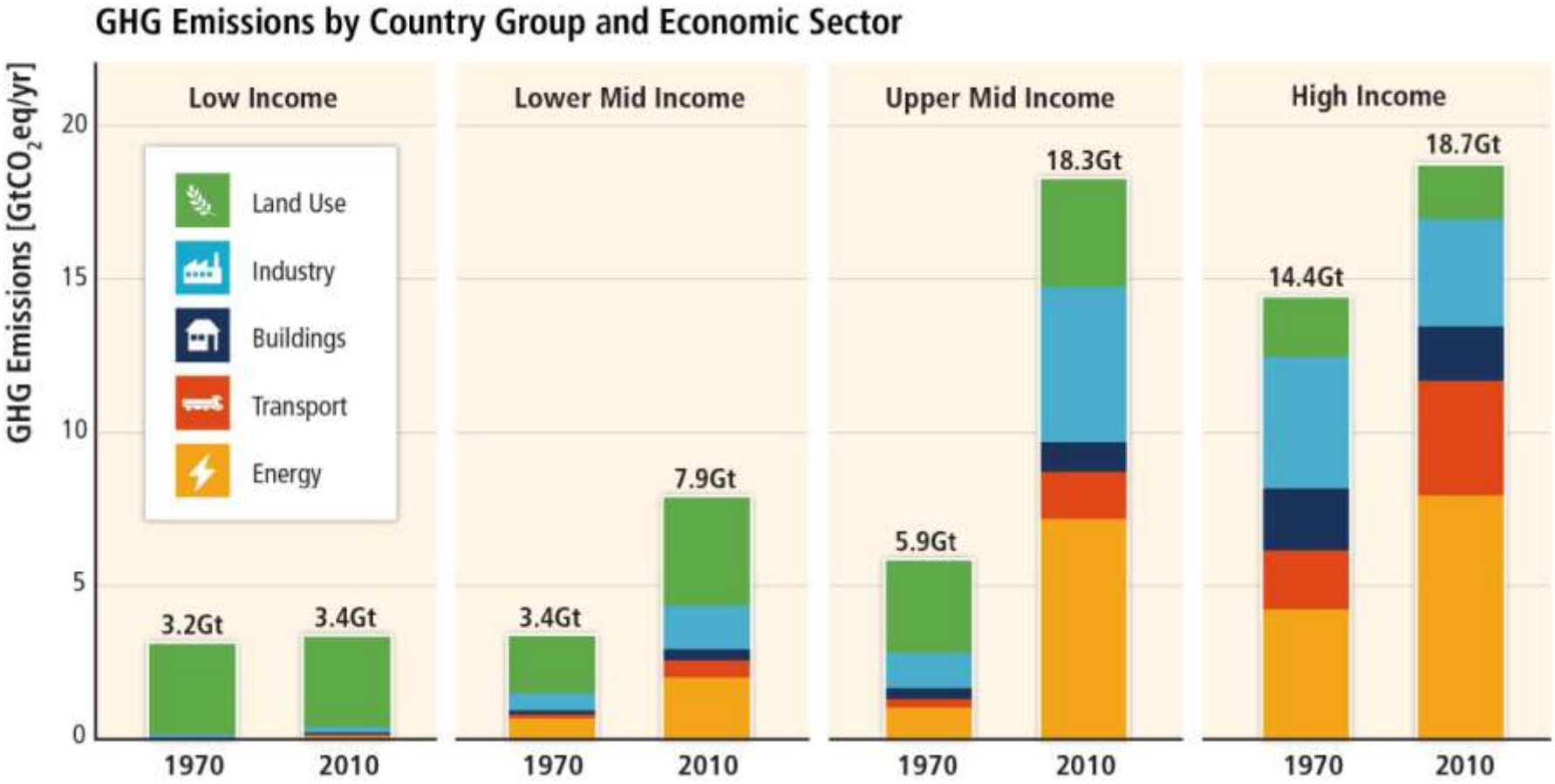


Economic Growth, Sustainability and Climate Change

- **Gains in the recent decade: GDP, per capita income, poverty alleviation, average real wage rates.**
- **An energy intensive growth phase**
- **Long term sustainability : resource availability, negative externalities , ethical concerns**
- Globally, GHG growth inspite of reduction efforts

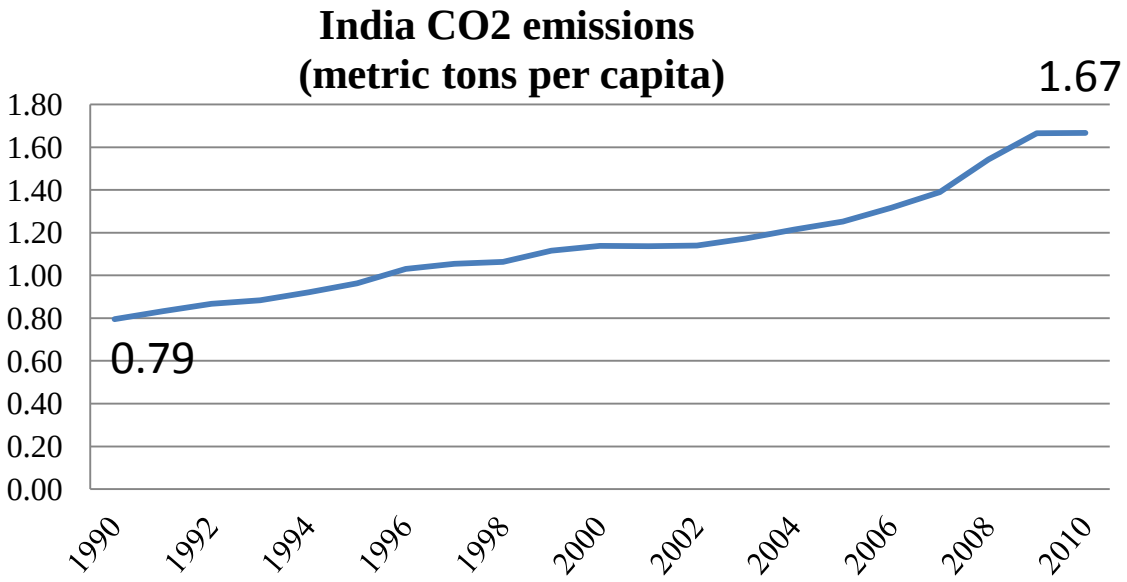


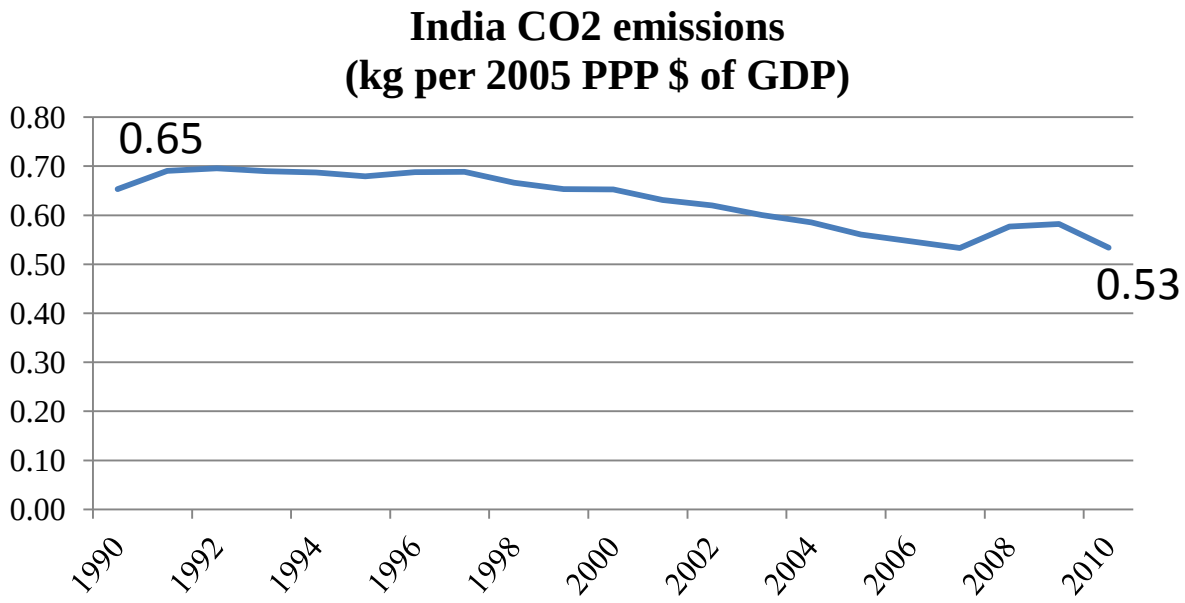
Source: Presentation to the SED 2014, WG III Contribution to IPCC, AR5.



Source: Presentation to the SED 2014, WG III Contribution to IPCC, AR5.

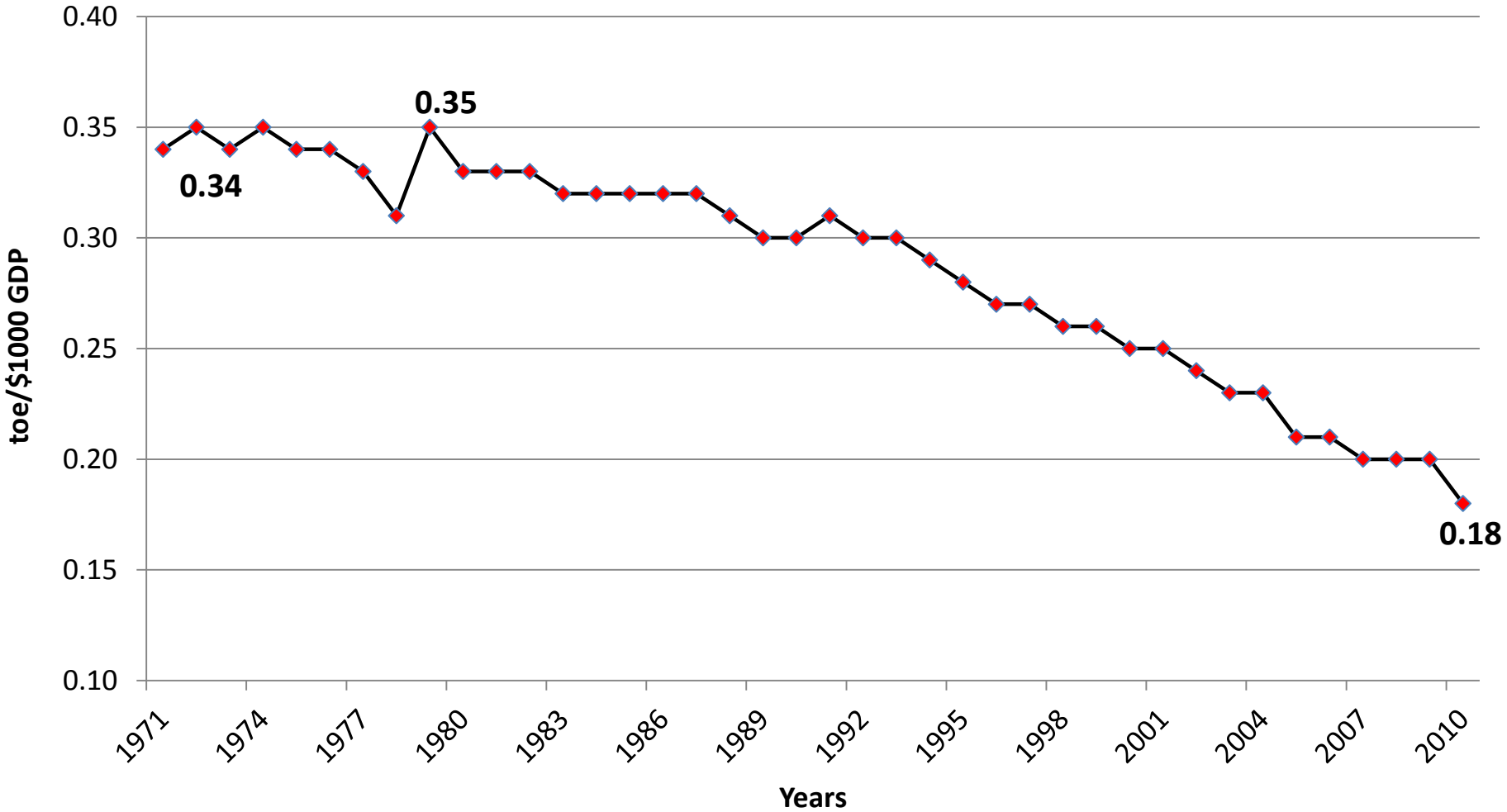
Emission Indicators





India's Energy Intensity (1971 – 2010)

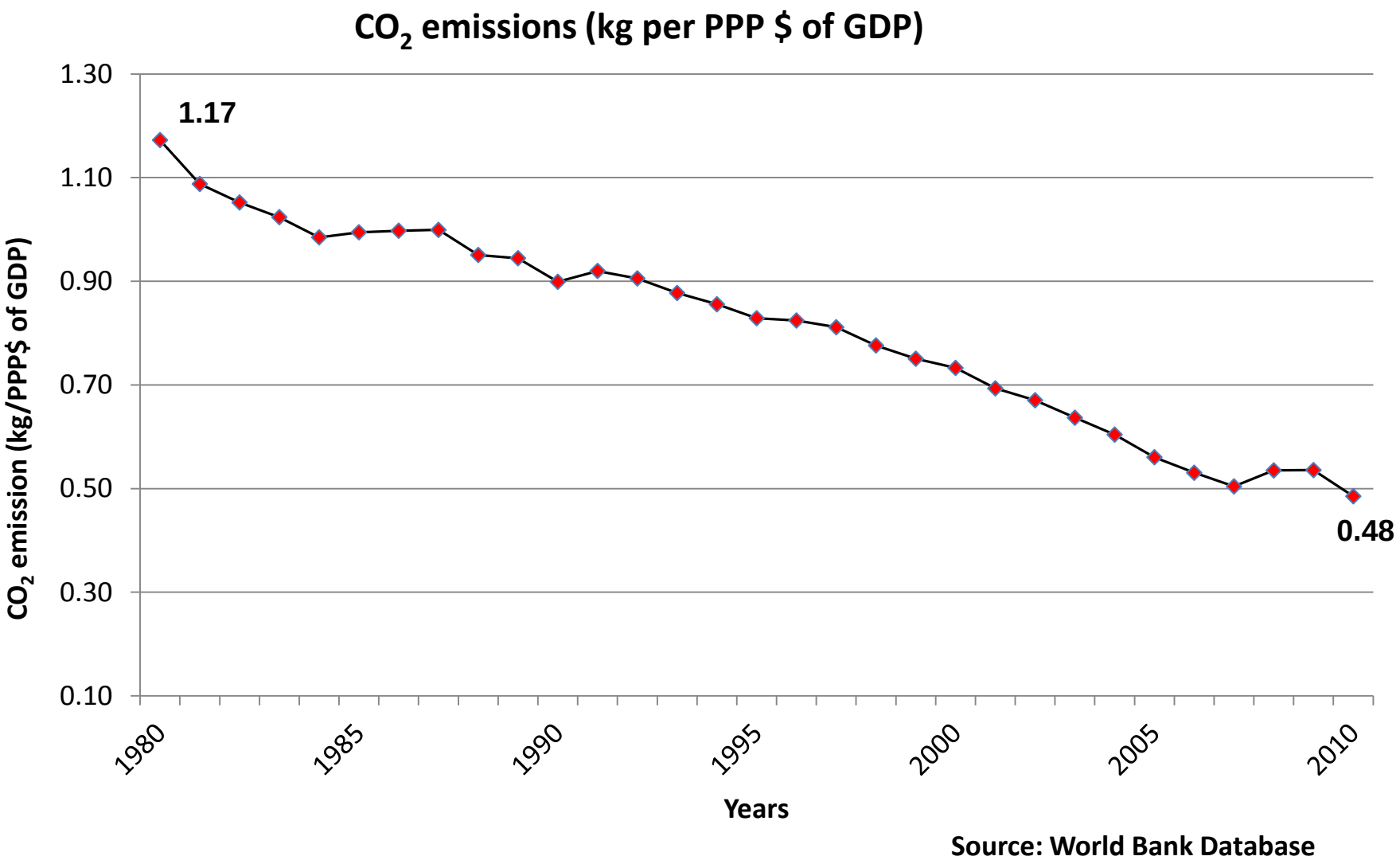
Tonnes of oil equivalent (toe) per thousand 2000 US dollars of GDP calculated using PPPs



The ratios are calculated by dividing each country's annual TPES by each country's annual GDP expressed in constant 2000 prices and converted to US dollars using purchasing power parities (PPPs) for the year 2000.

Source: OECD database; available through OECD's iLibrary

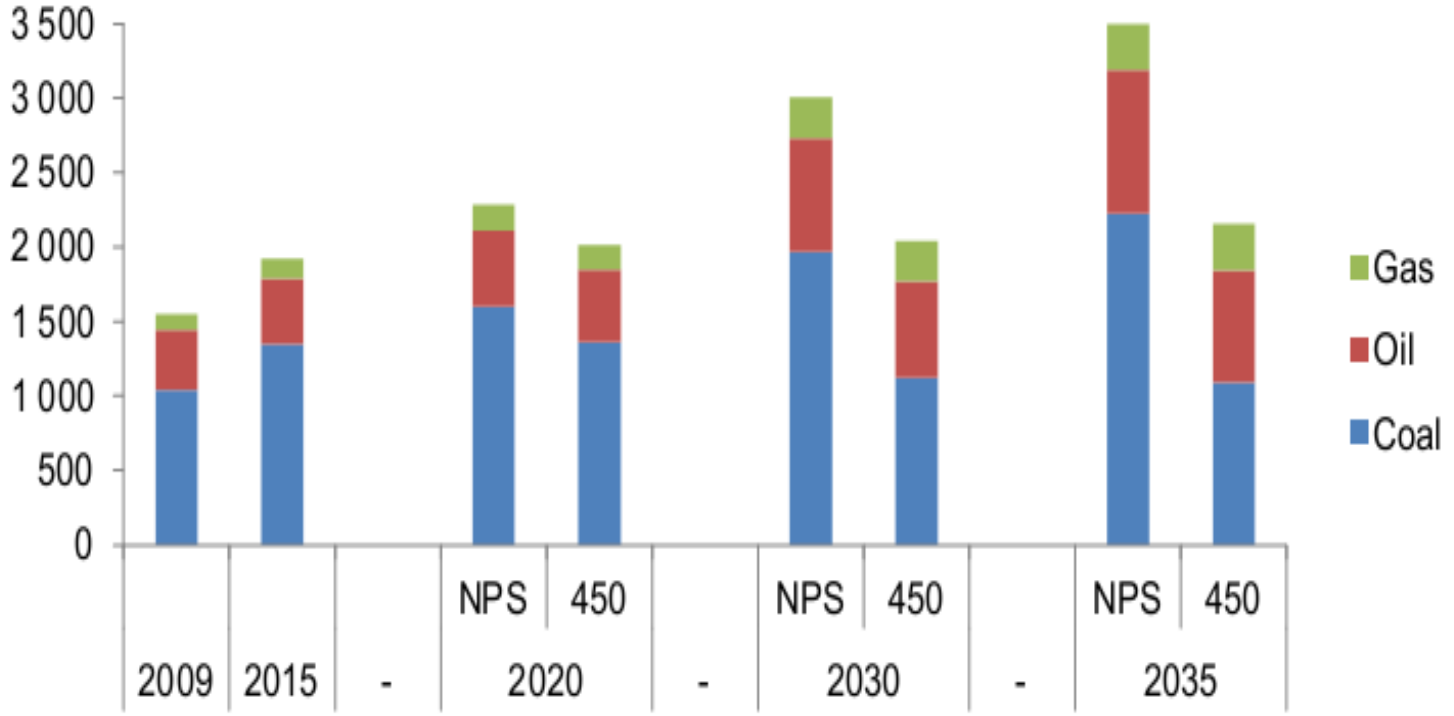
India's Carbon Intensity (1980 – 2010)



Source: World Bank Database

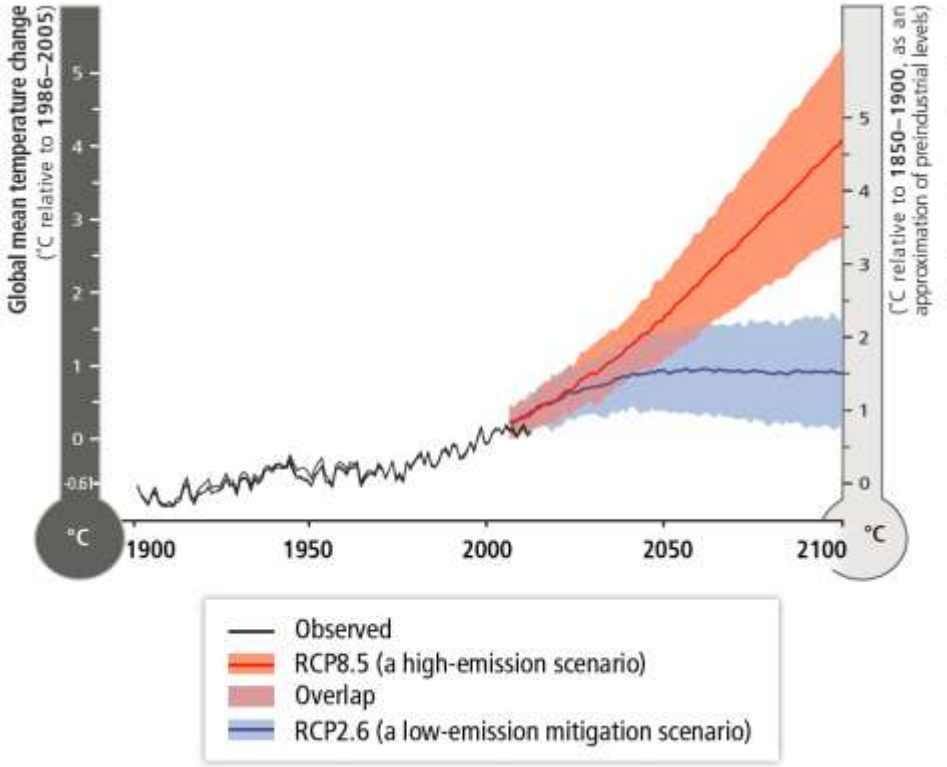
Carbon emissions in India 1990-2035 (MtCO2)

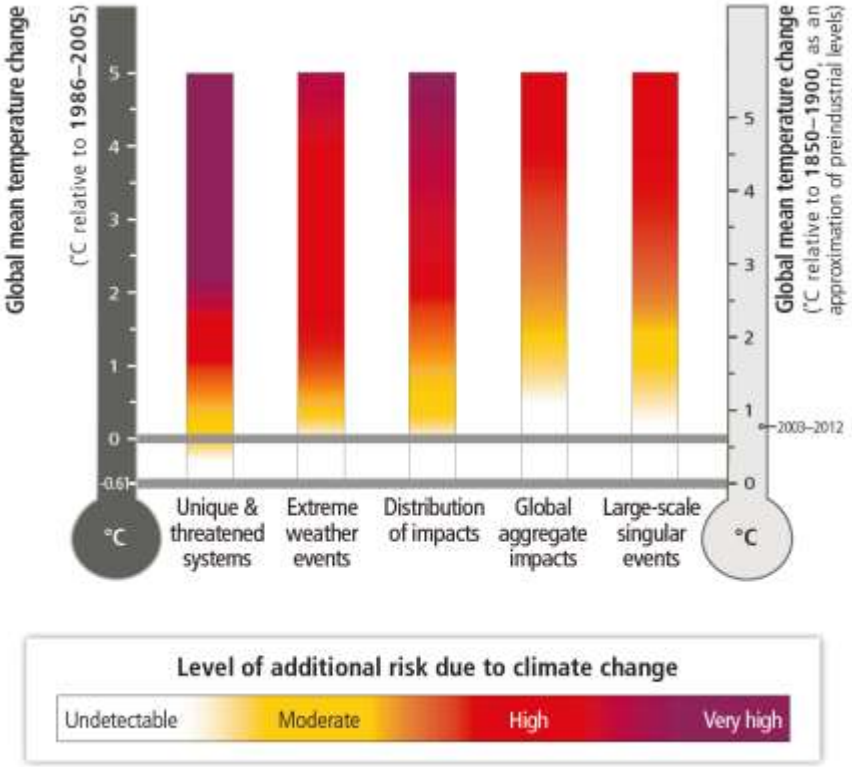
Figure 8 • Carbon emissions in India, 1990-2035 ($MtCO_2$)



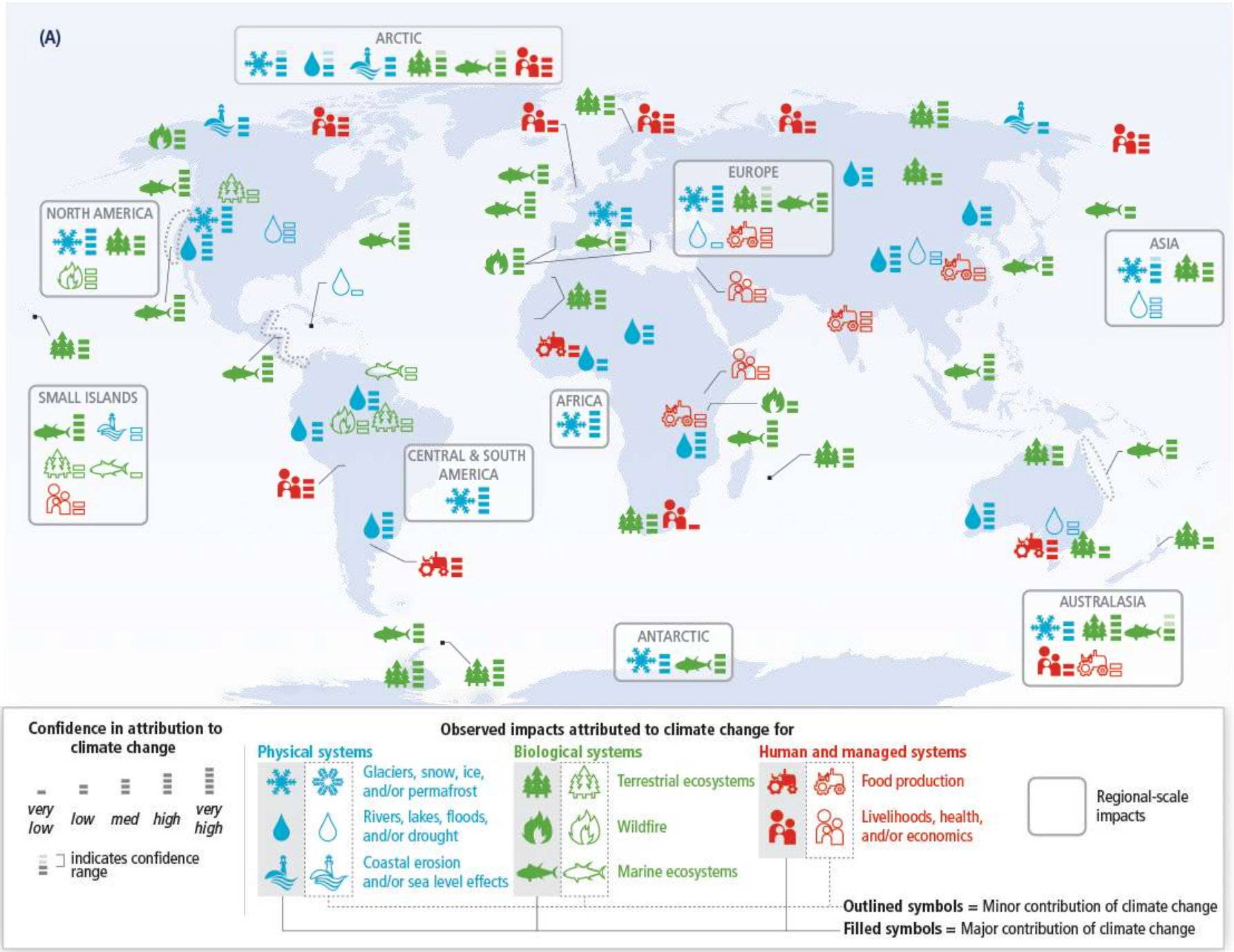
Source: IEA, 2011a.

Source: Understanding Energy Challenges in India Policy, Players and Issues. OECD/IEA, 2012



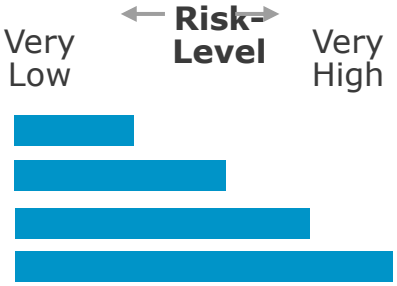


Source: Summary for Policy Makers, WG II Contribution to IPCC, AR5.

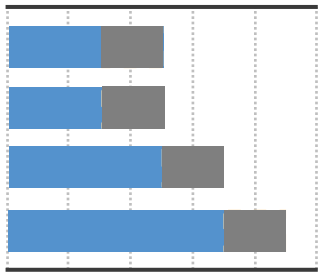

(A)
ARCTIC
NORTH AMERICA
EUROPE
ASIA
SMALL ISLANDS
AFRICA
CENTRAL & SOUTH AMERICA
AUSTRALASIA
ANTARCTIC
Confidence in attribution to climate change
very low
low
med
high
very high
indicates confidence range
Observed impacts attributed to climate change for
Physical systems
Glaciers, snow, ice, and/or permafrost
Rivers, lakes, floods, and/or drought
Coastal erosion and/or sea level effects
Biological systems
Terrestrial ecosystems
Wildfire
Marine ecosystems
Human and managed systems
Food production
Livelihoods, health, and/or economics
Regional-scale impacts
Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change

Projected Risks for Asia

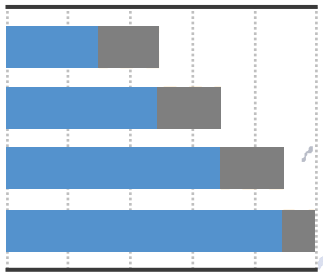
Present
Near Term (2030-2040
Long Term (2080-2100) **2°C** **4°C**



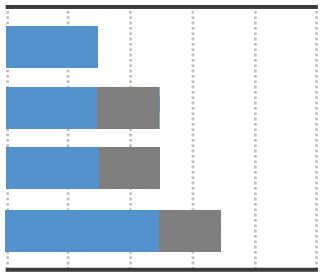
Increased Flood Damage to Infrastructure , Livelihoods, and Settlements



Heat-Related Human Mortality

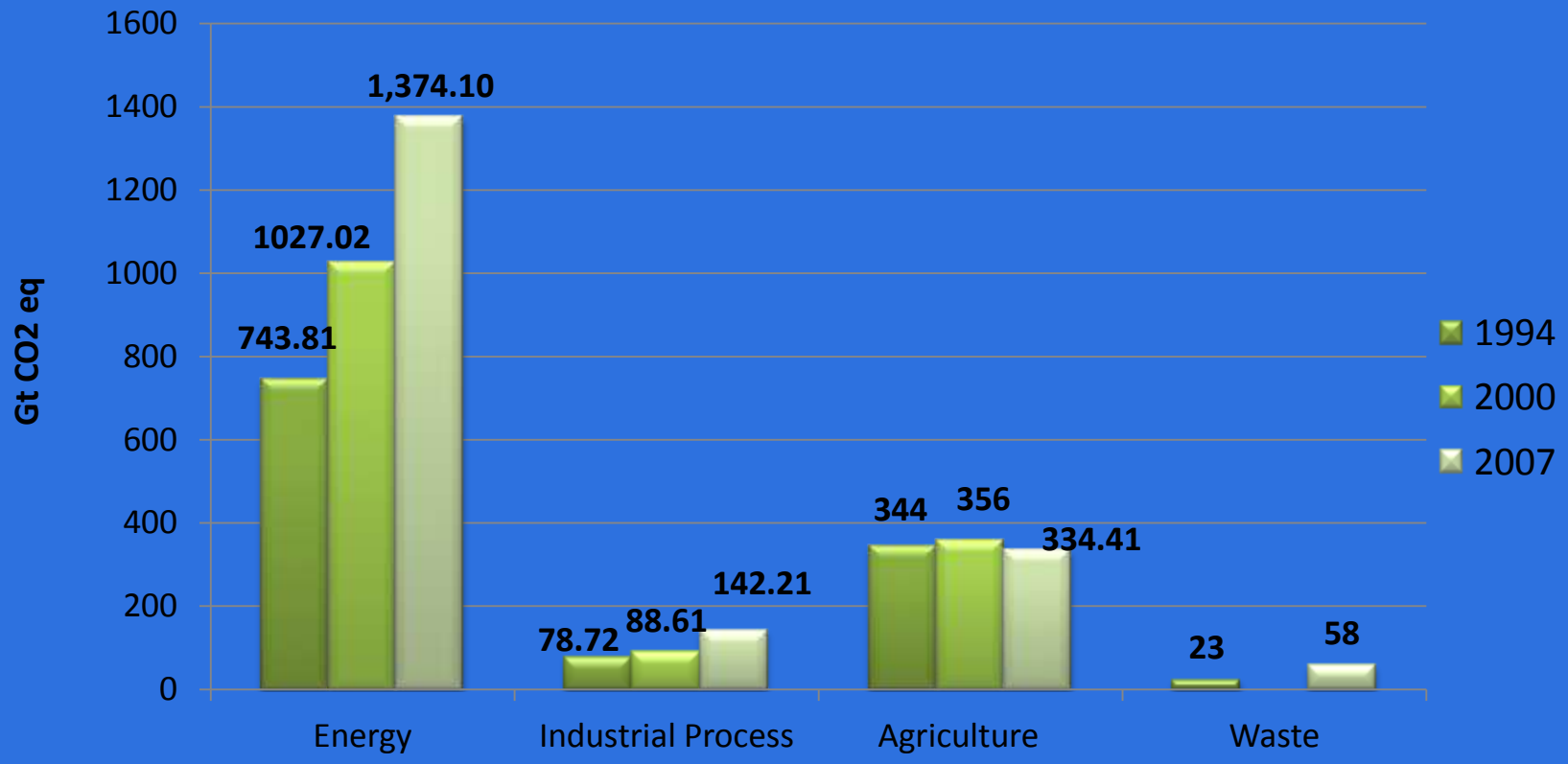


Increased Drought-Related Water and Food Shortage



India's Sectoral GHG Emission (1994, 2000 and 2007)

- **1994 - India's Ist National communication to UNFCC on GHG Emission**
- **2000 - India's 2nd National communication to UNFCC on GHG Emission**
- **2007 - INCCA* Prepared an inventory of GHG emission for the year2007**



Source: India's Second National Communication to UNFCC, 2012

***India : Greenhouse Gas Emission 2007, INCCA Indian Network for Climate Change Assessment, 2007**

Options for a Low Carbon Pathway:

Focus:

Maximise Synergies (multiple objectives, co-benefits, low regret strategies)

Reduce trade-offs (GDP, poverty)

Share of Low Carbon Energy in Low Carbon Path – renewables, nuclear, CCS

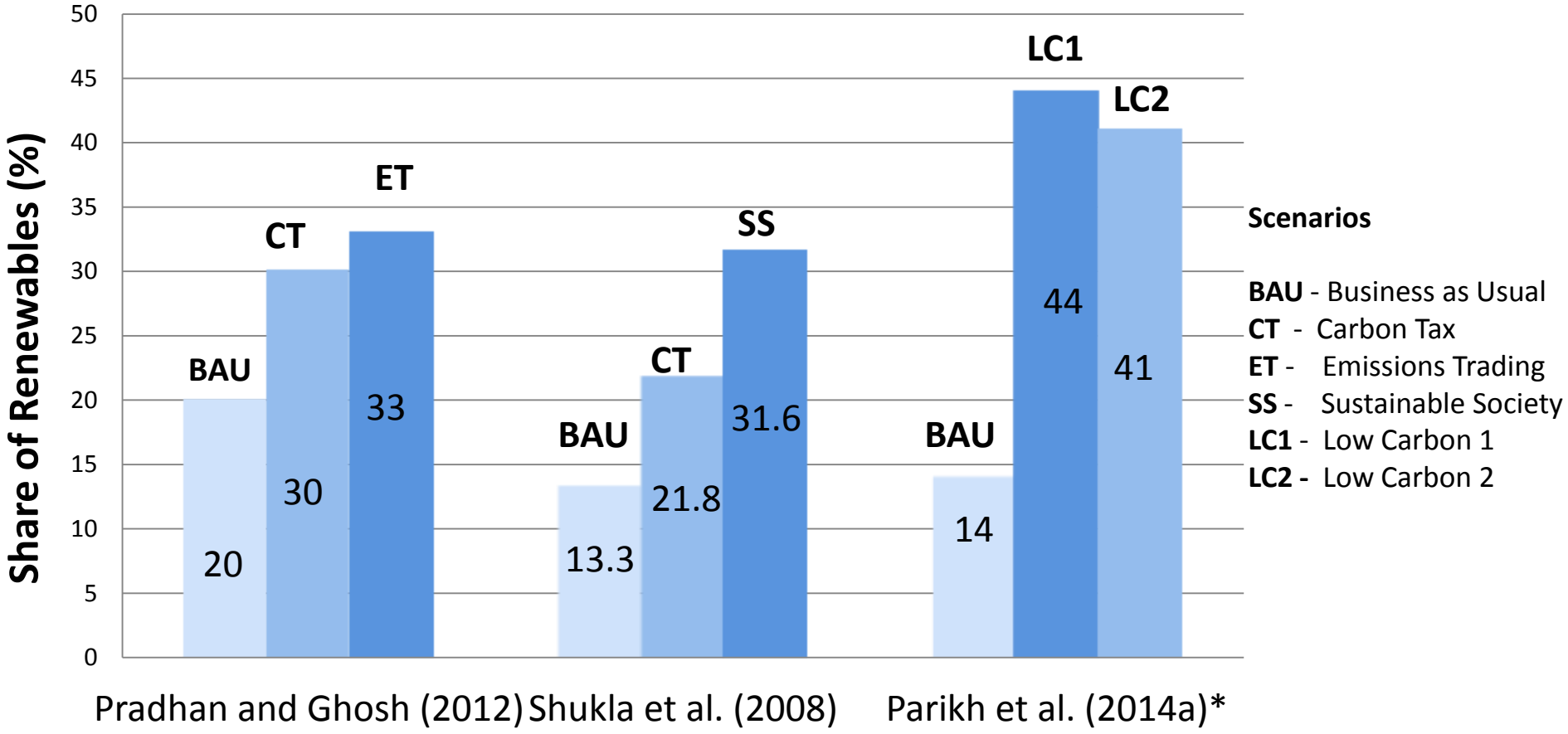
Energy Production, Consumption and *Efficiency*

- Across sectors, in industrial production technology and switching of fuels (transport, electricity)
- End use energy efficiency
- In particular, Low carbon technologies in electricity generation

  (additional: Fuel switching, T & D loss reduction)

- Regional Co-operation : Energy and electricity trade (hydro), and effective use of shared water resources.

% Share of renewable energy in total energy, with and without climate policy in 2050



** Parikh et al. (2014a) - share of renewables in total electricity generation*

Table 1 : Mitigation Options and Potential:

Emissions of selected electricity supply technologies (gCO2eq/kWh)

Options	Lifecycle emissions* (gCO2eq/kWh)
Currently Commercially Available Technologies	
Coal – PC	820
Gas - Combined Cycle	490
Biomass – CHP	230
Hydropower	24
Nuclear	12
Concentrated Solar Power	27
Solar PV - rooftop	41
Solar PV - utility	48
Pre-commercial Technologies	
CCS - Coal - PC	220
CCS - Coal	200
IGCC-CCS - Gas - Combined Cycle	170

*** Represents the median value**

Source: As reported in IPCC, AR5, WG III calculations

Is a low carbon transition pathway consistent with attaining the goals set for the economy?

- 25% emission intensity reduction over 2005 levels possible by 2020 with GDP growth rate of 8-9% in short term (Interim report, Expert Committee, Planning Commission) , 29% (WB 2011), 24-25% (Parikh 2014)
- Climate change a threat multiplier, adding to constraints, and competition over resources
- Low carbon path offers potential economic gains, apart from climate mitigation benefits
- Energy security : EE improvements, share of renewables
- Health Co-benefits: Air pollution major issue already in cities
- Technological innovation and its attendant implications for investment gains; impacts on quality of life (varying extent in most models)