

Emissions Intensity and Climate Change

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Two Approaches to Mitigation

- First Approach
 - Focus on physical constraints – availability of carbon space – carbon budget approach
 - Techno-economic considerations follow (energy intensity, carbon intensity etc.)
 - Mitigation benchmarks – actual emission reductions
- Focus on economic feasibility
 - Grandfathering existing inequities
 - Ignoring possibilities of technological failures
 - Primary focus on efficiency considerations
 - e.g. Japanese Proposals, IEA Outlook on Energy, Arvind Subramaniam et al, Stern Proposal

Focus on Global Constraints

- Carbon budgets
 - 1000 GtCO₂ between 2000 and 2050 – 25% probability of 2 deg C increase
 - 1440 GtCO₂ between 2000 and 2050 – 50% probability of 2 deg C increase

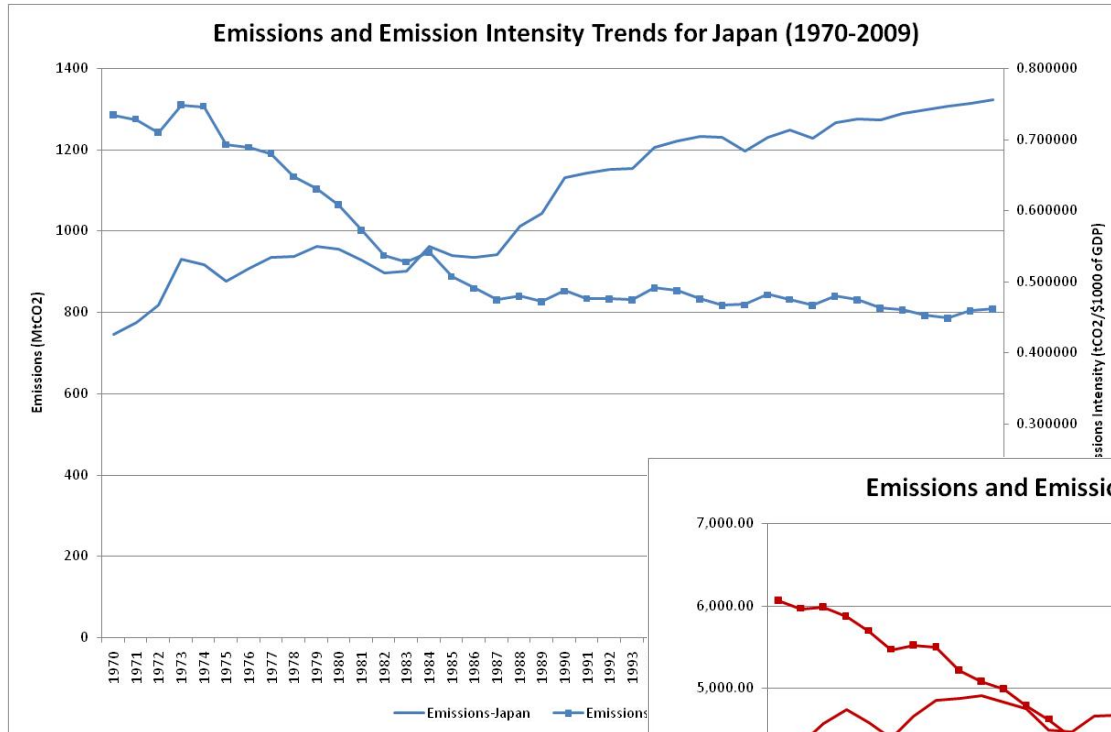
(Source: Meinshausen et al)

- Mitigation burden sharing
 - Equity – historical responsibility, current capability (GDR, TISS-DSF Model)

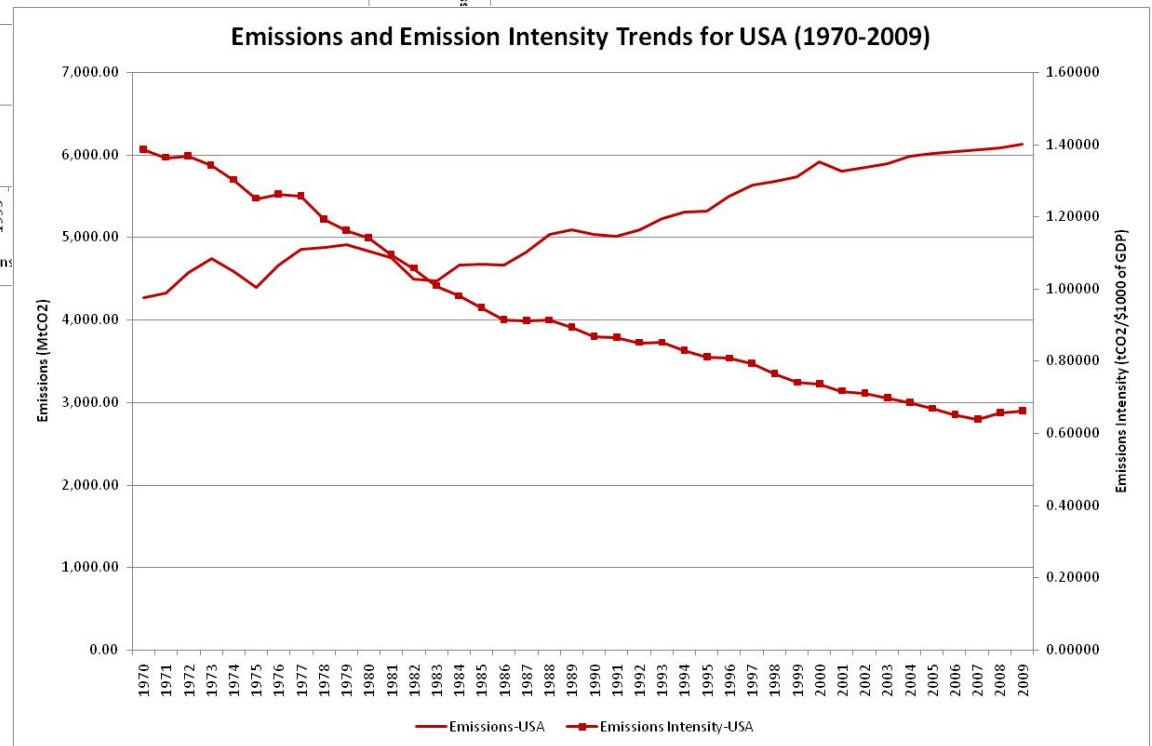
Why Energy/Emissions Intensity?

- Need to extract maximum output from investment in a carbon constrained world whether measured in physical or fiscal terms
- In developing countries where emissions will continue to rise for a certain time period, it is important to accelerate increase in energy efficiency and reduction on emissions intensity
- It is NOT mitigation per se and not an end in itself especially for developed countries

Energy and Emissions Intensity



Reduction in Energy and/or Emissions Intensity does not guarantee reduction in absolute quantum of emissions



“Carbon Efficiency”

- *Not only* “direct-energy related services”
But also energy necessary to ensure all services required for material well-being of the population (Contra Arvind Subramaniam et al)
- Difference between 1st and 3rd World
 - Stock of infrastructure
 - Higher incomes and access to services
- Separation of production and consumption emissions in recent proposals – plan for de-industrialization?

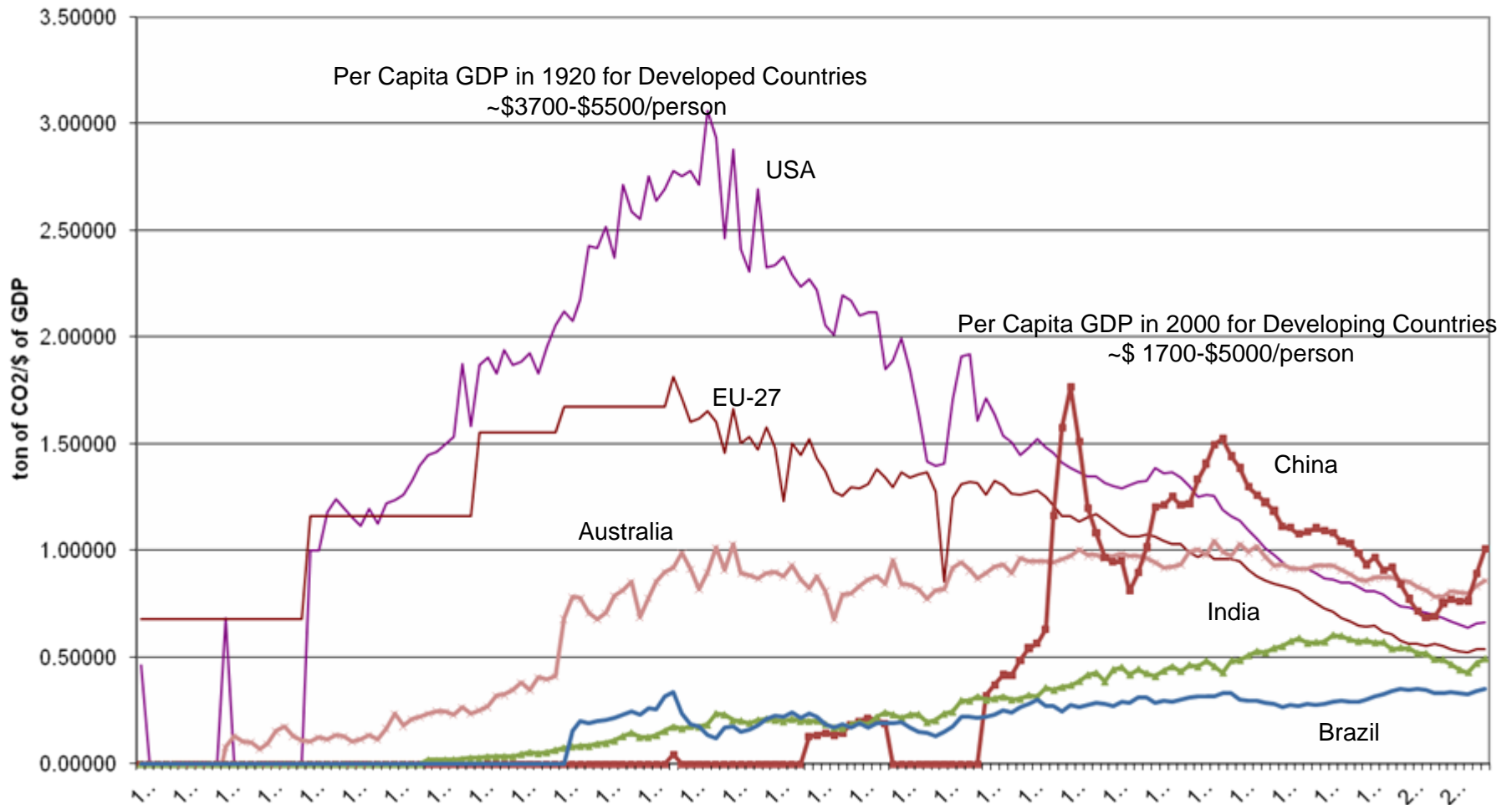
Emissions Intensity

- Carbon dioxide emitted to produce one unit of GDP – tCO₂/\$ of GDP
- Emissions Elasticity of GDP – Percentage increase in emissions for 1% increase in GDP
 - Depend on
 - Structure of economy
 - Stage of development
 - Fuel Mix
 - Availability of Technology
 - Cost

(Cross-correlation between variables)

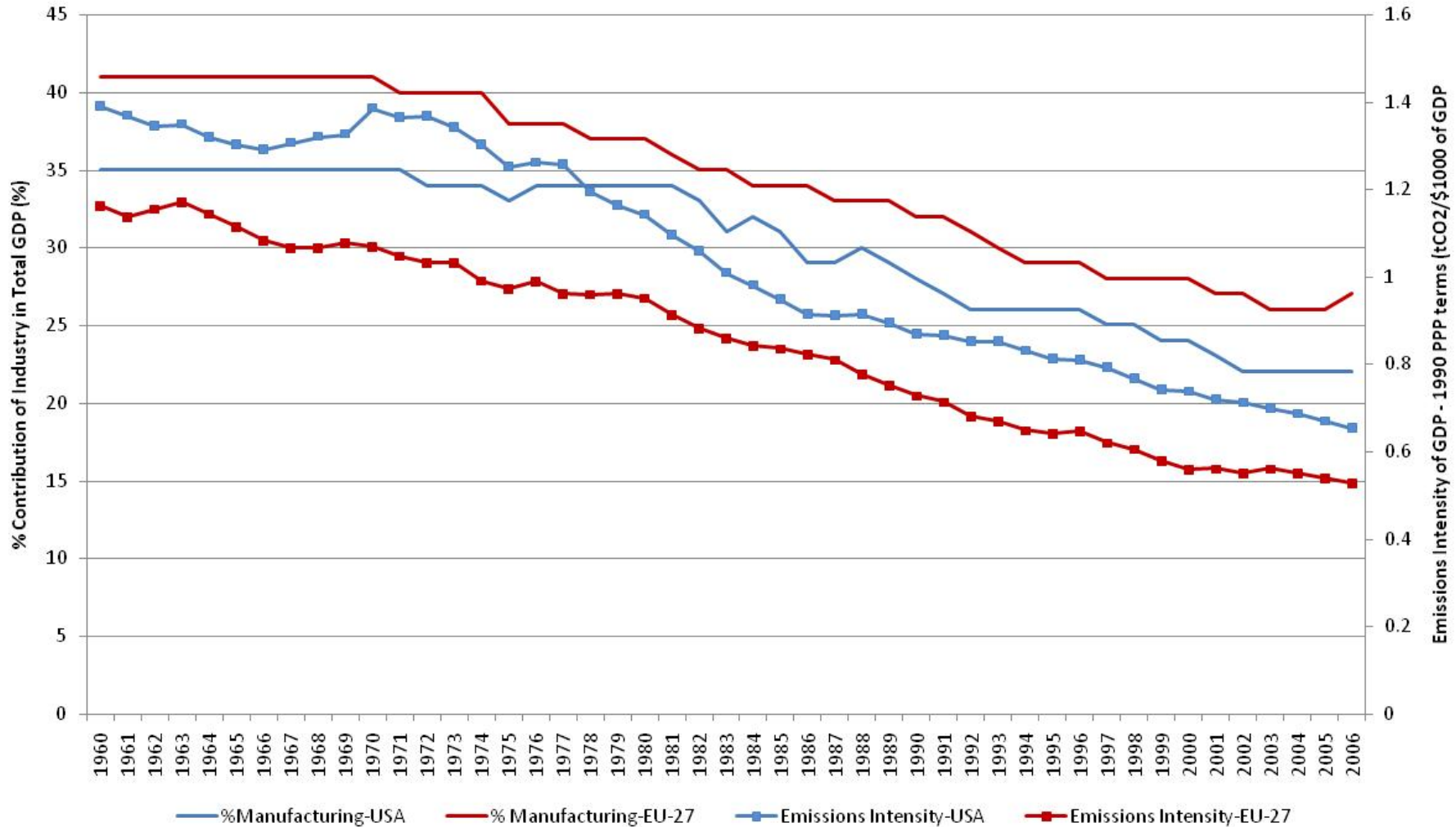
Stage of Development

Emissions Intensity of GDP



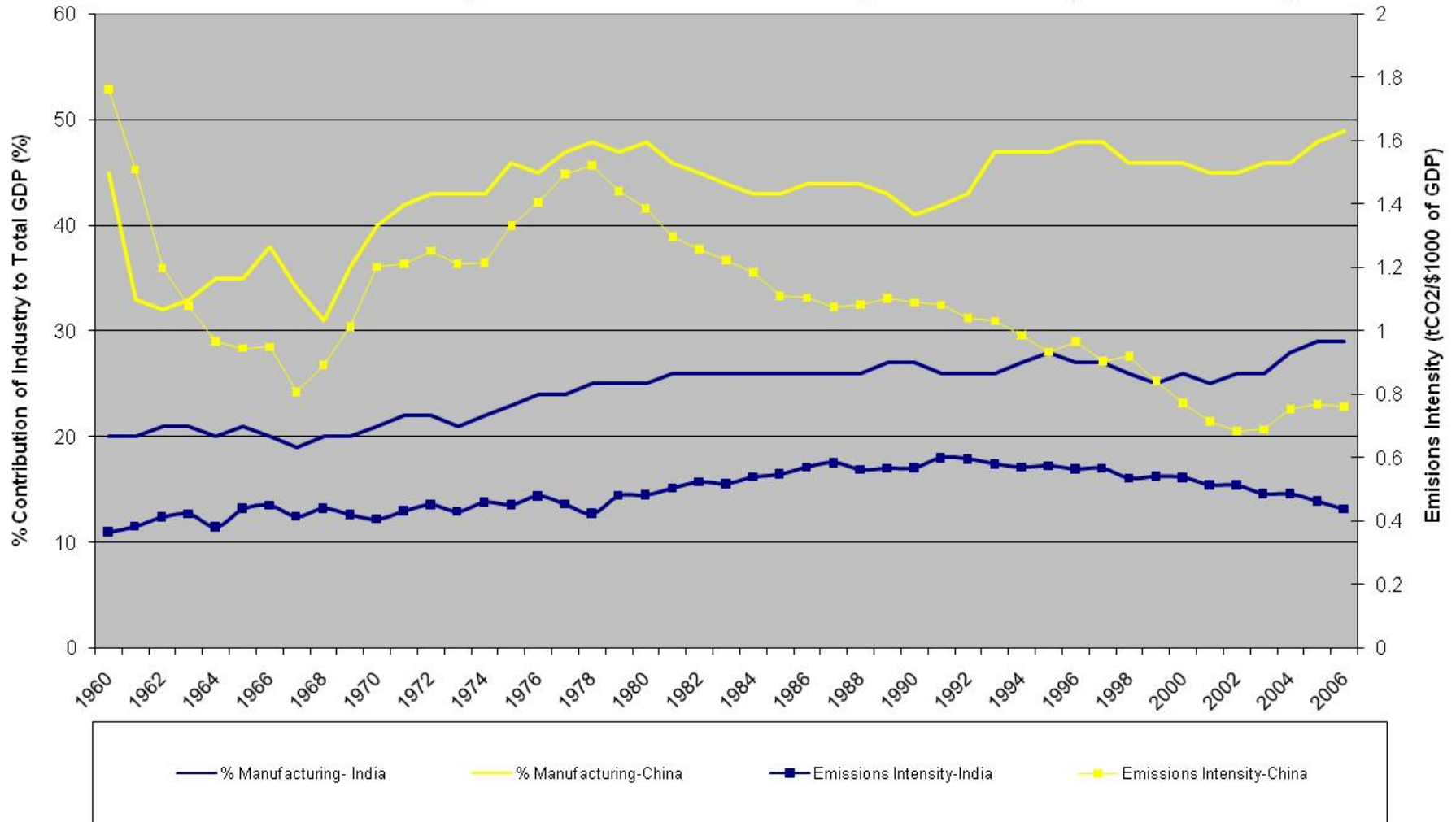
Structure of the Economy - I

Emissions Intensity and Contribution of Industry to Total GDP (USA and EU-27)



Structure of the Economy -II

Emissions Intensity and Contribution of Industry to Total GDP (India and China)



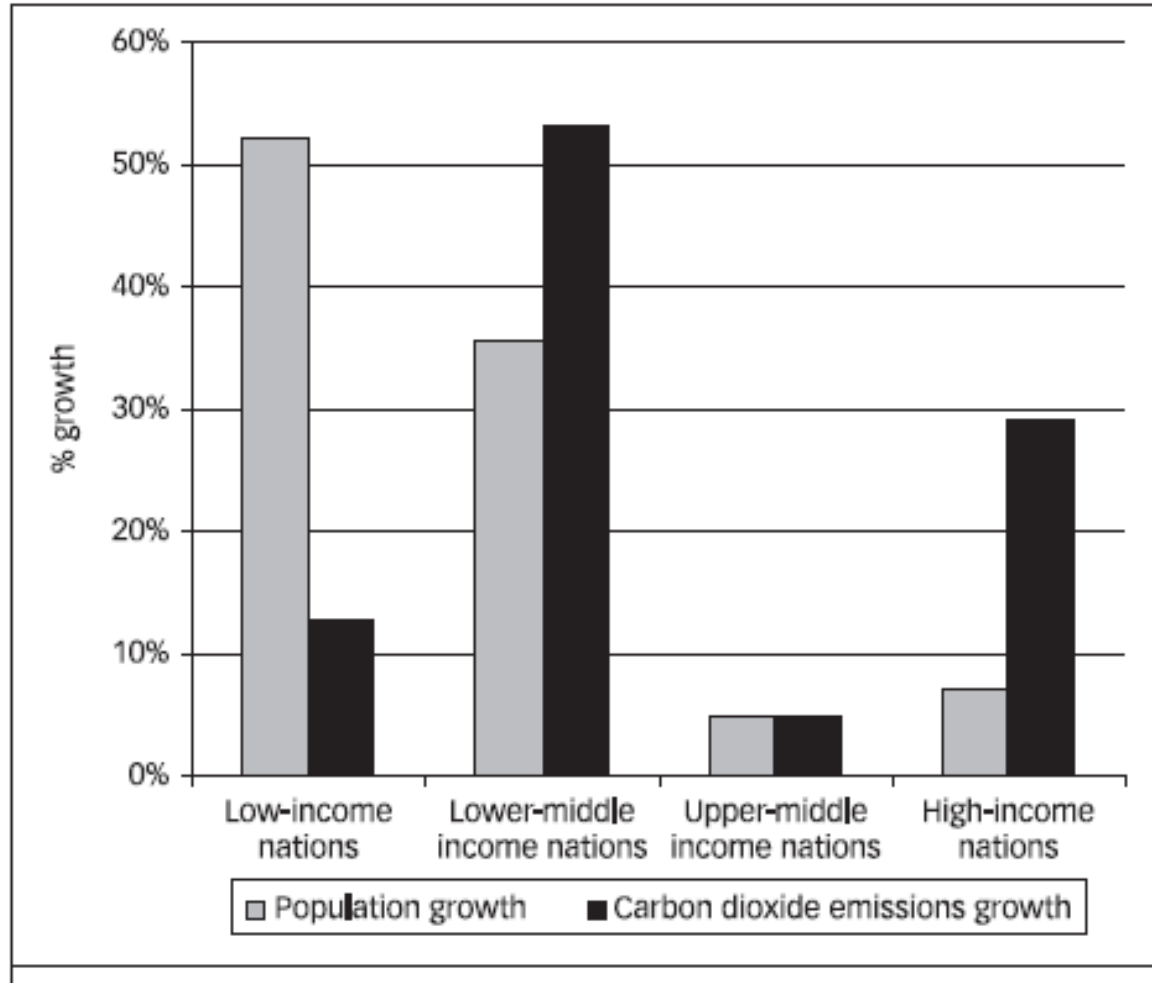
Emissions Elasticity of GDP

	1850-1950	1950-2009	1990-2009
USA	1.32	0.50	0.39
UK	0.82	0.03	0.03
Germany	1.58	0.23	-0.54
India	No Data	1.18	0.72
China	No Data	1.02	0.76
Brazil	No Data	1.09	1.41

The emissions elasticity of GDP of developing countries is lower than the emissions elasticity of GDP of developed countries in comparable stages of development

Debunking the Malthusian Argument - IPAT

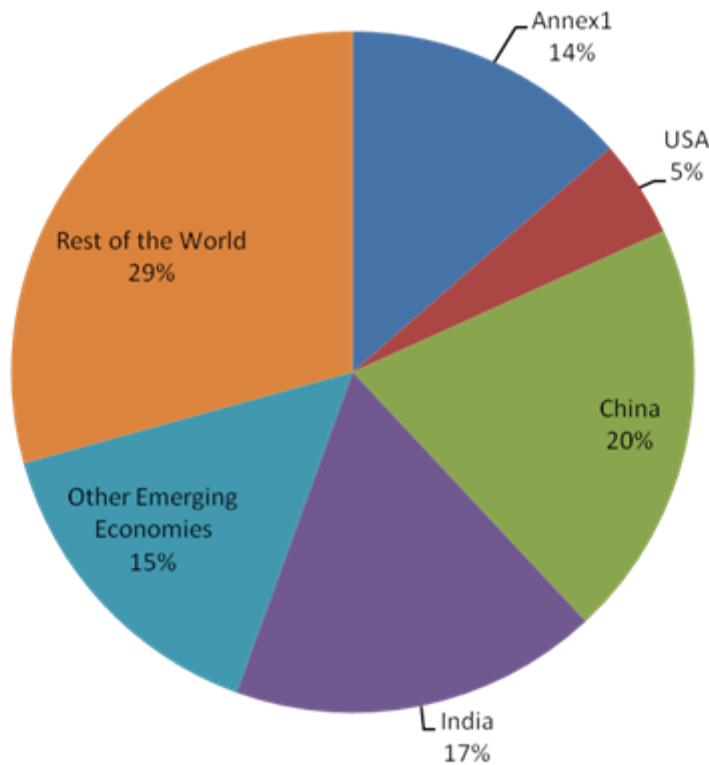
Contribution to the growth in world population and CO₂ emissions by groups of nations classified according to their average per capita income levels, 1980-2005



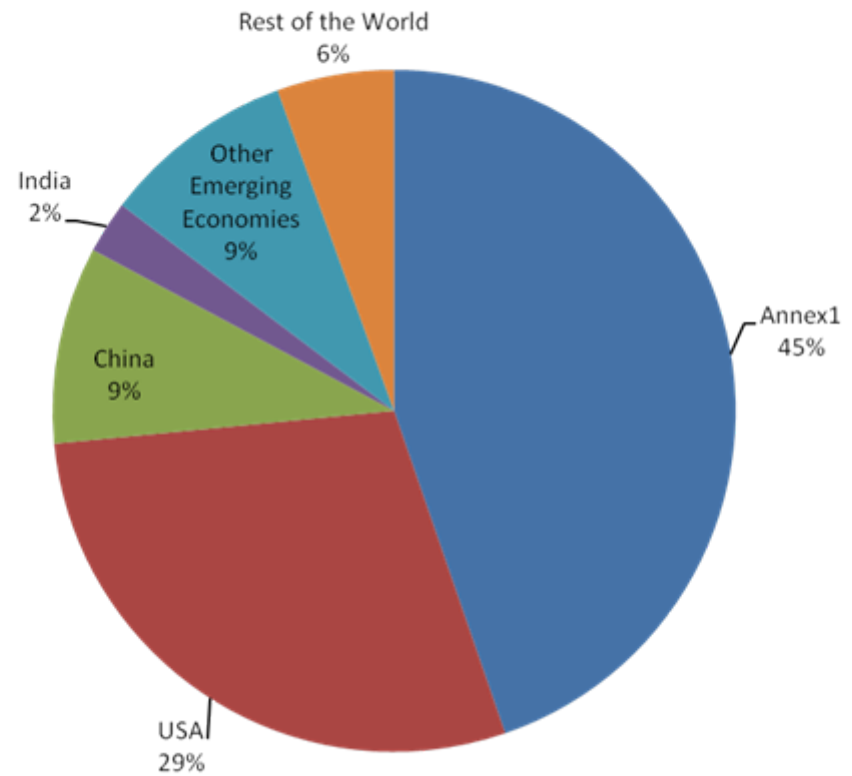
Source: *The implications of population growth and urbanization for climate change*
David Satterthwaite, *Environment and Urbanization*, 2009;21;554

Historical Fair and Actual Share of Atmospheric Carbon Space

Fair Share



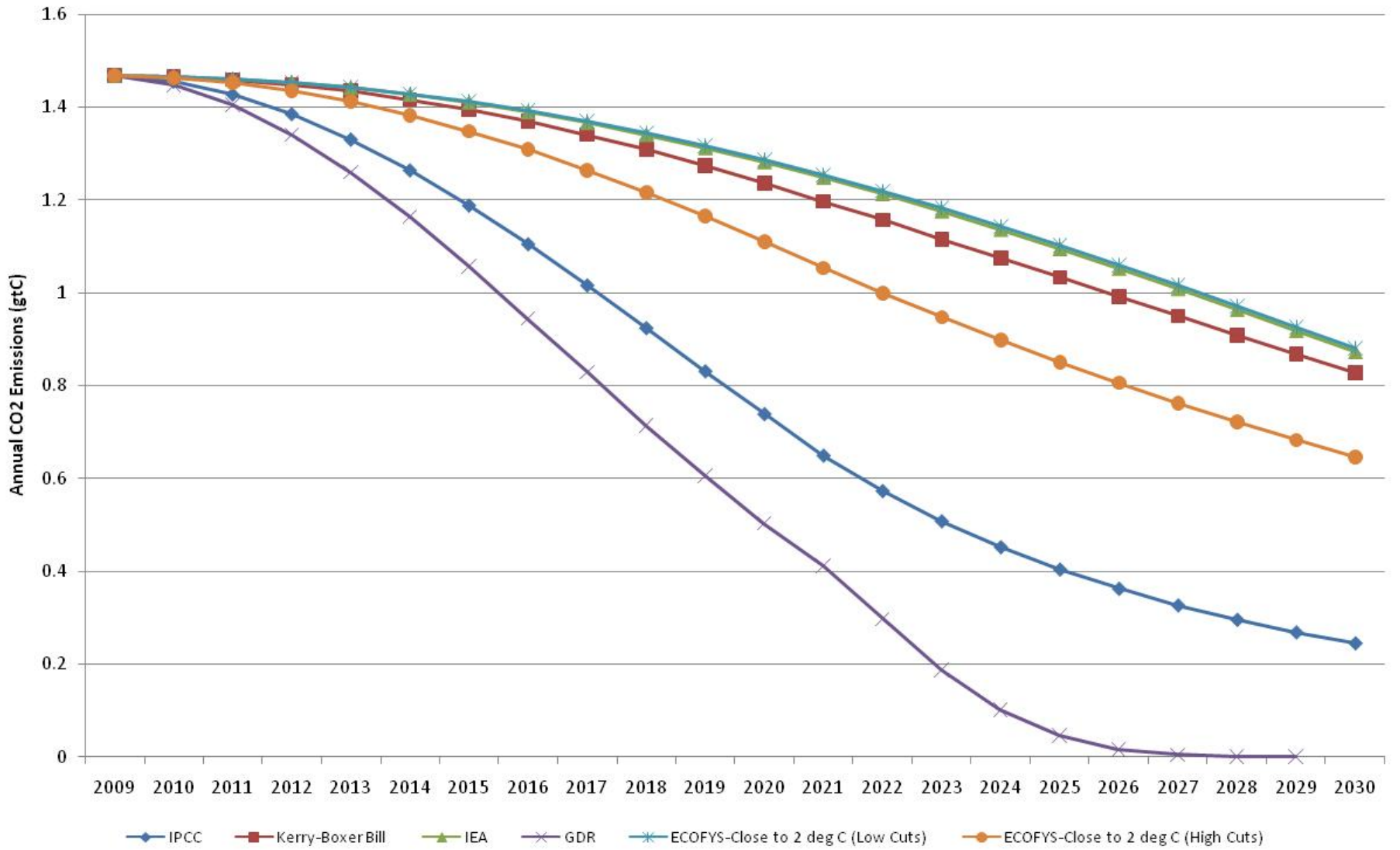
Actual share



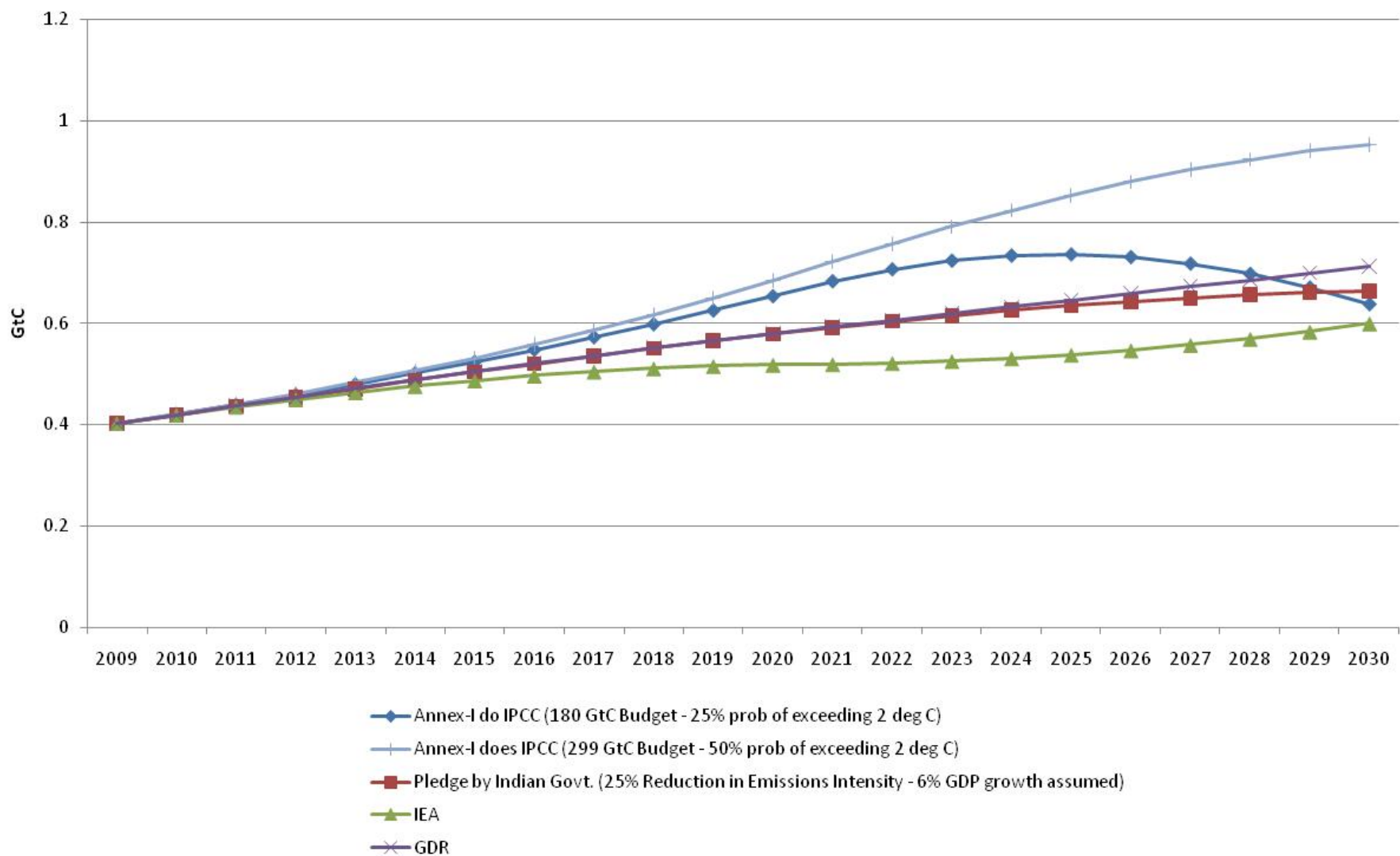
What is needed?

- Reduction in total quantum of emissions
- Mitigation burden to be shared on the principle of “common but differentiated responsibility”
 - Every person has an equal right to the global atmospheric commons
 - Burden sharing on responsibility and capability basis
 - Technology transfer to facilitate a low carbon pathway in developing nations (not without low carbon first world economies!)

Annual Emissions till 2030 for the USA - Comparison of Various Proposals



Annual Emissions till 2030 for India - Comparison of Various Proposals



Annual Emissions till 2030 for China - Comparison of various proposals

