

Emission Scenarios Primer

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Energy Options & Paths to Climate Stabilization

Aspen Global Change Institute, Aspen, United States – 7 July 2003

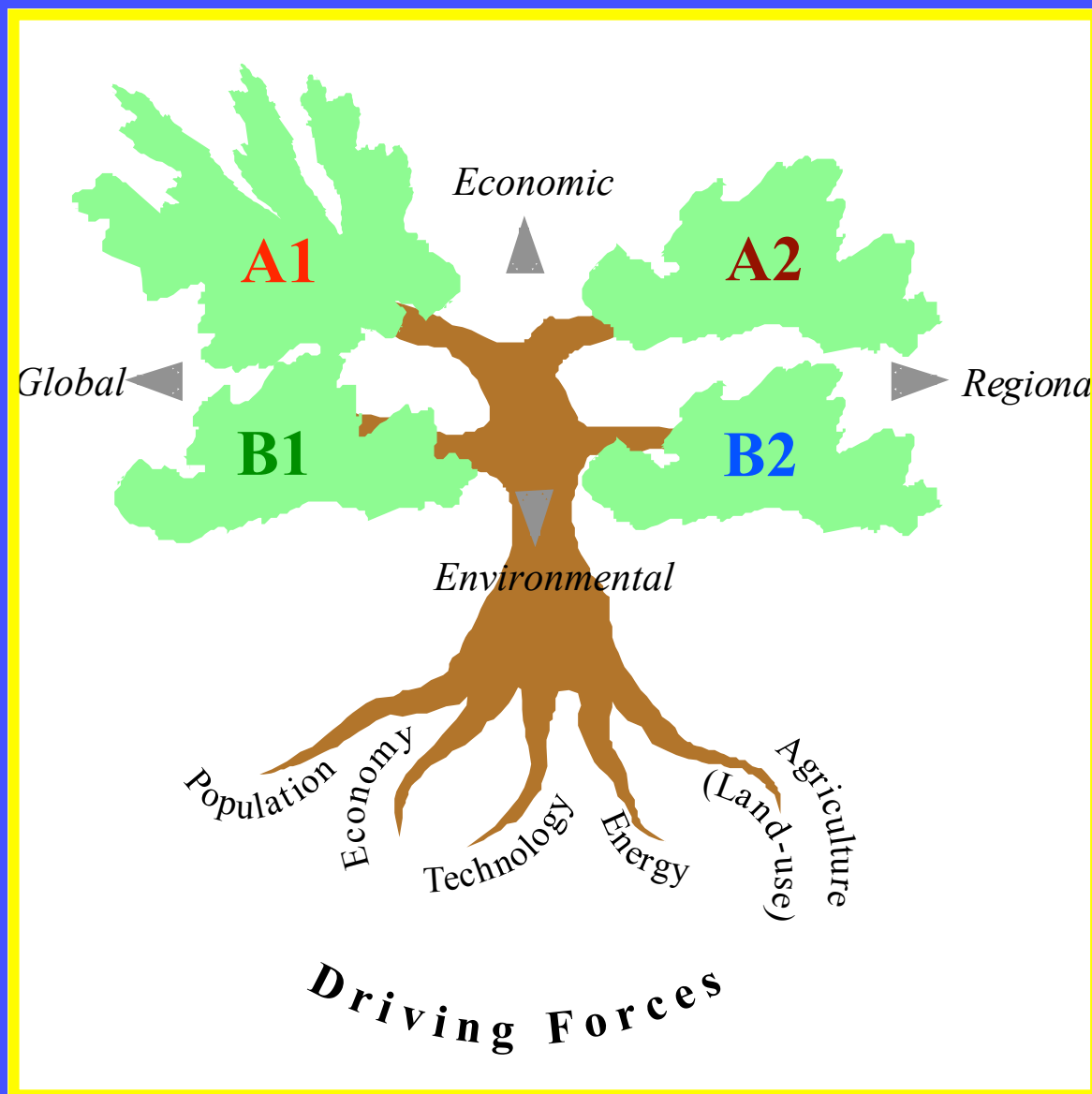
Definition of a Long-Term Scenario II

A scenario is a plausible description of how the future may develop, based on a coherent and internally consistent set of assumptions (“scenario logic”) about key relationships and driving forces (e.g., rate of technology changes, prices). Note that scenarios are neither predictions nor forecasts.

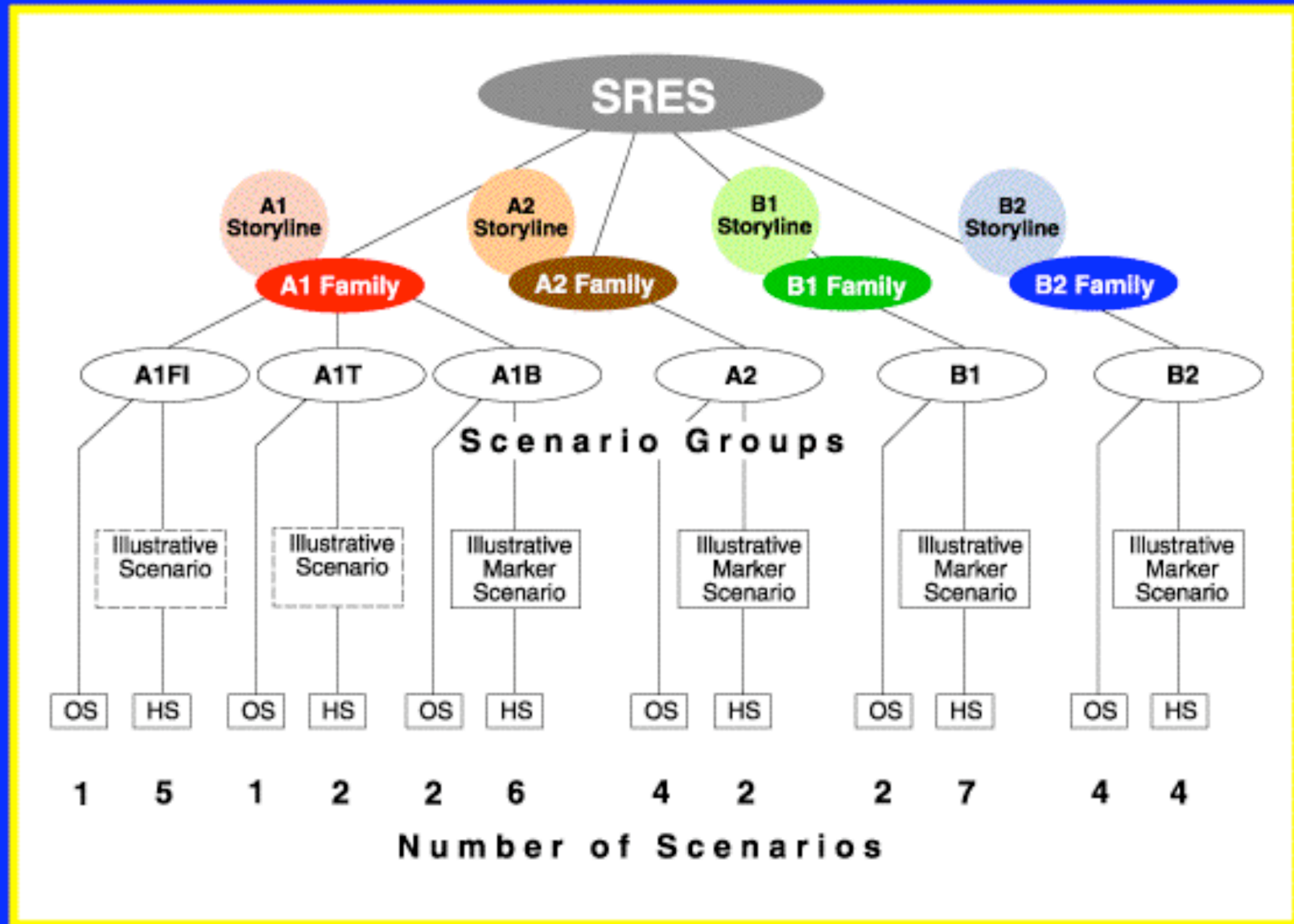
SRES SCENARIOS

- Extensive literature review
- Six modeling frameworks
-
- Full range of driving forces
- Full range of GHG emissions

SRES Scenarios



SRES SCENARIOS

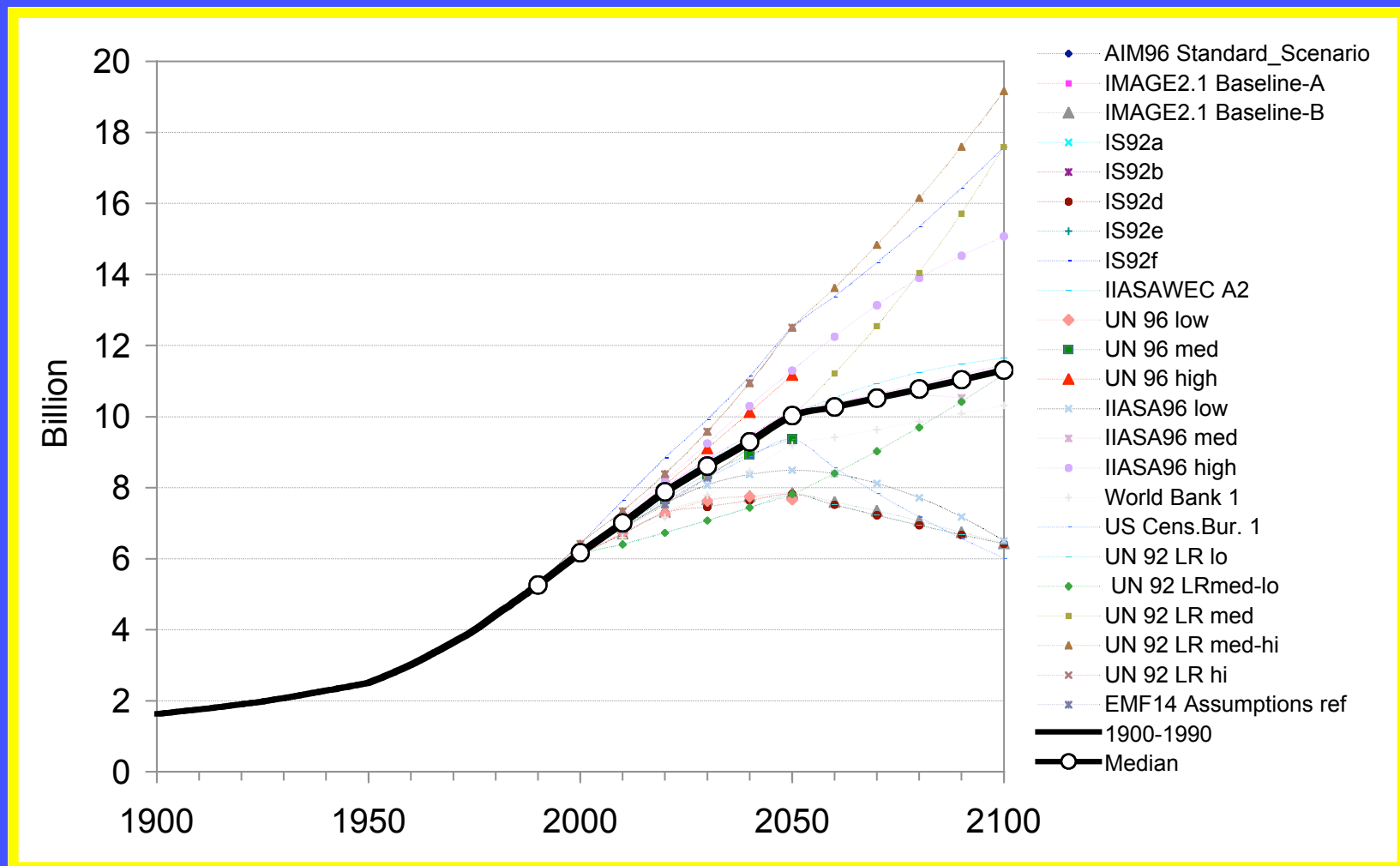


Factors of Growth: The Last 200 Years

	1800	2000	factor
World population, billion	1	6	x 6
Life expectancy, years*	35	75	x 2
Work hours per year*	3,000	1,500	÷ 2
Free time over life*	70,000	300,000	x 4
Mobility, km/day* (excl. walk)	0.04	40	x 1000
World income, trillion \$	0.5	36	x 70
Global energy use, Gtoe	0.3	10	x 35
Carbon, energy, GtC	0.3	6	x 22
Carbon, all sources, GtC	0.8	8	x 10

Population Projections

Range Across Emissions Scenarios

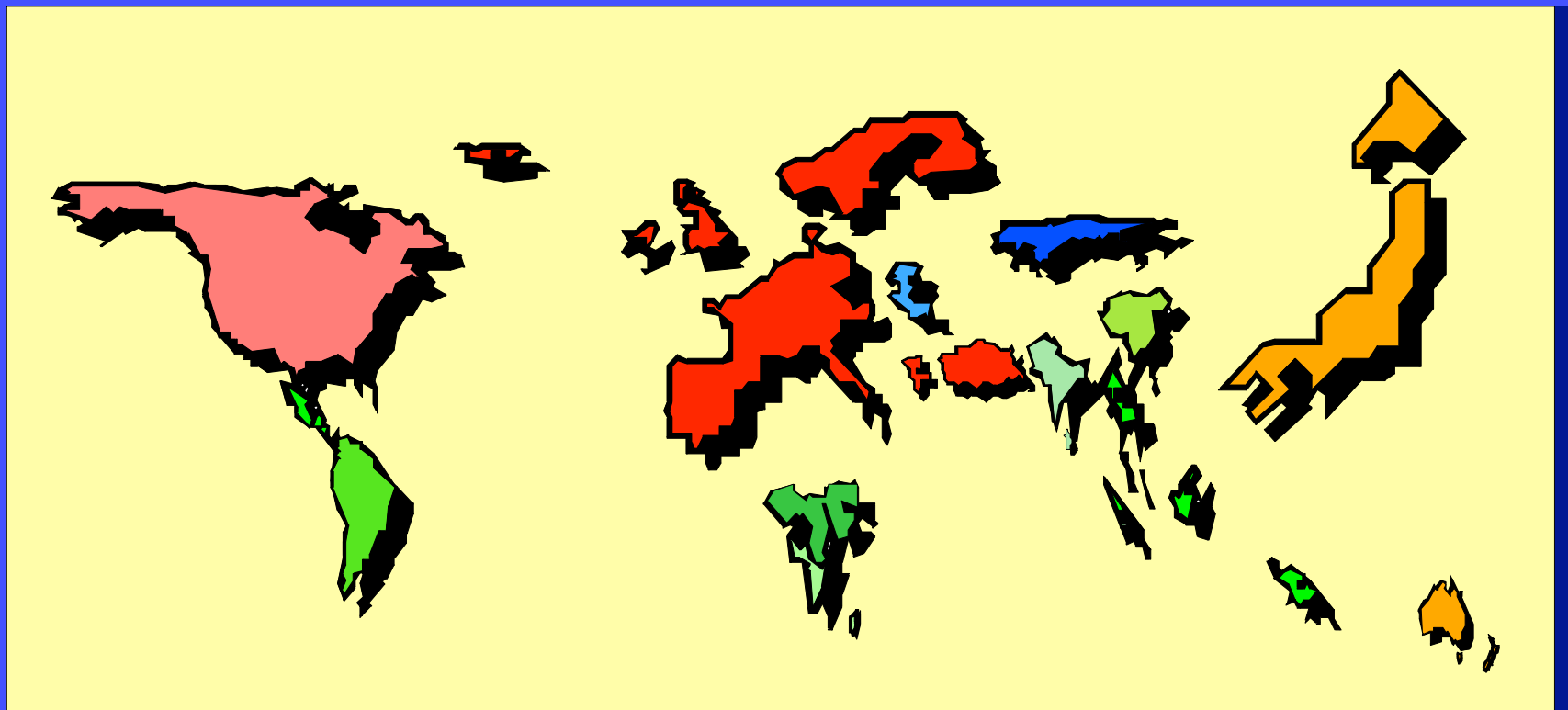


Nakicenovic *et al.*

IIASA 1998

World Economic Map

Areas of Regions Proportional to 1990 GDP
(mer)



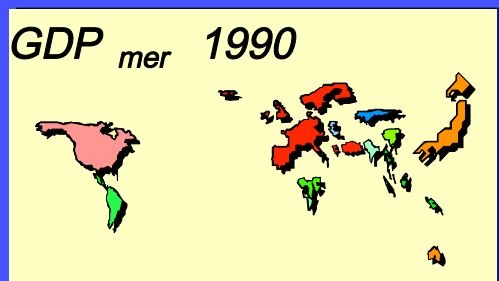
DCs = 16% of world GDP(mer); 35% of world GDP (ppp)

Nakicenovic

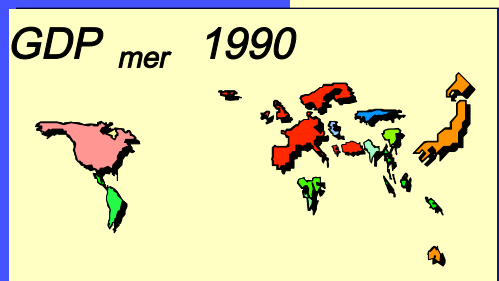
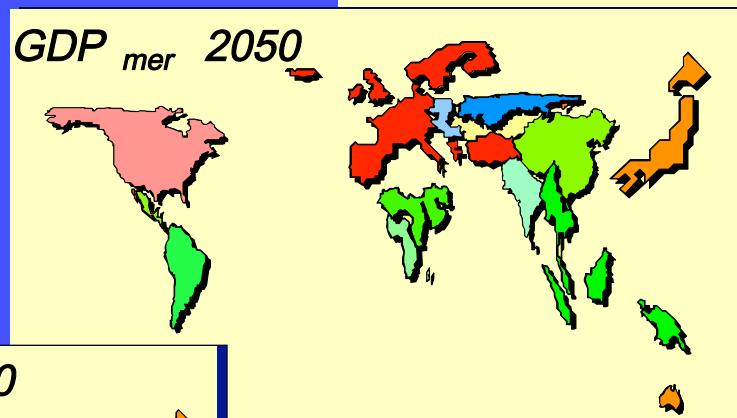
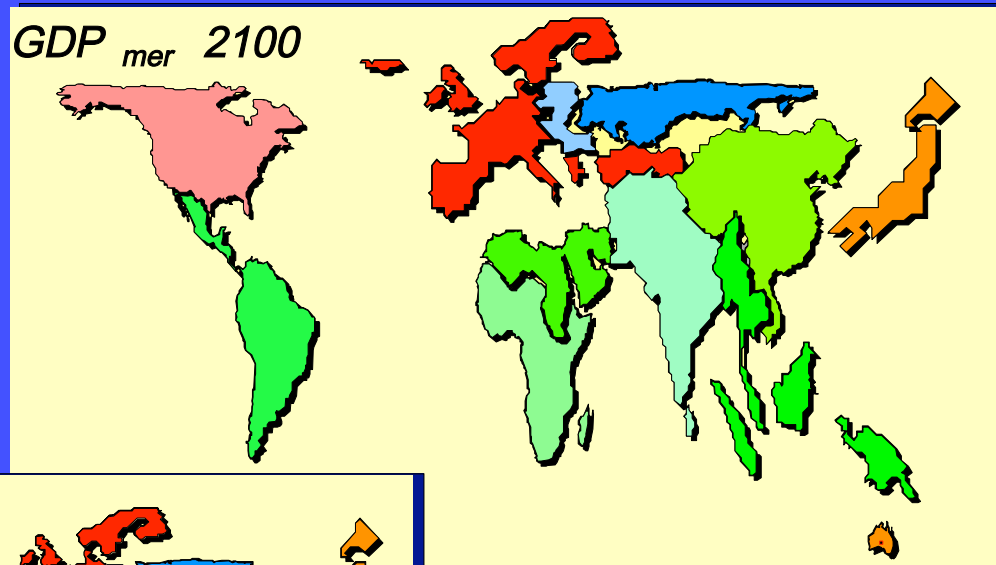
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World Economic Map

Areas of Regions Proportional to 1990 GDP
(mer)



Area of Regions
Proportional
to 1990 GDP_{mer}

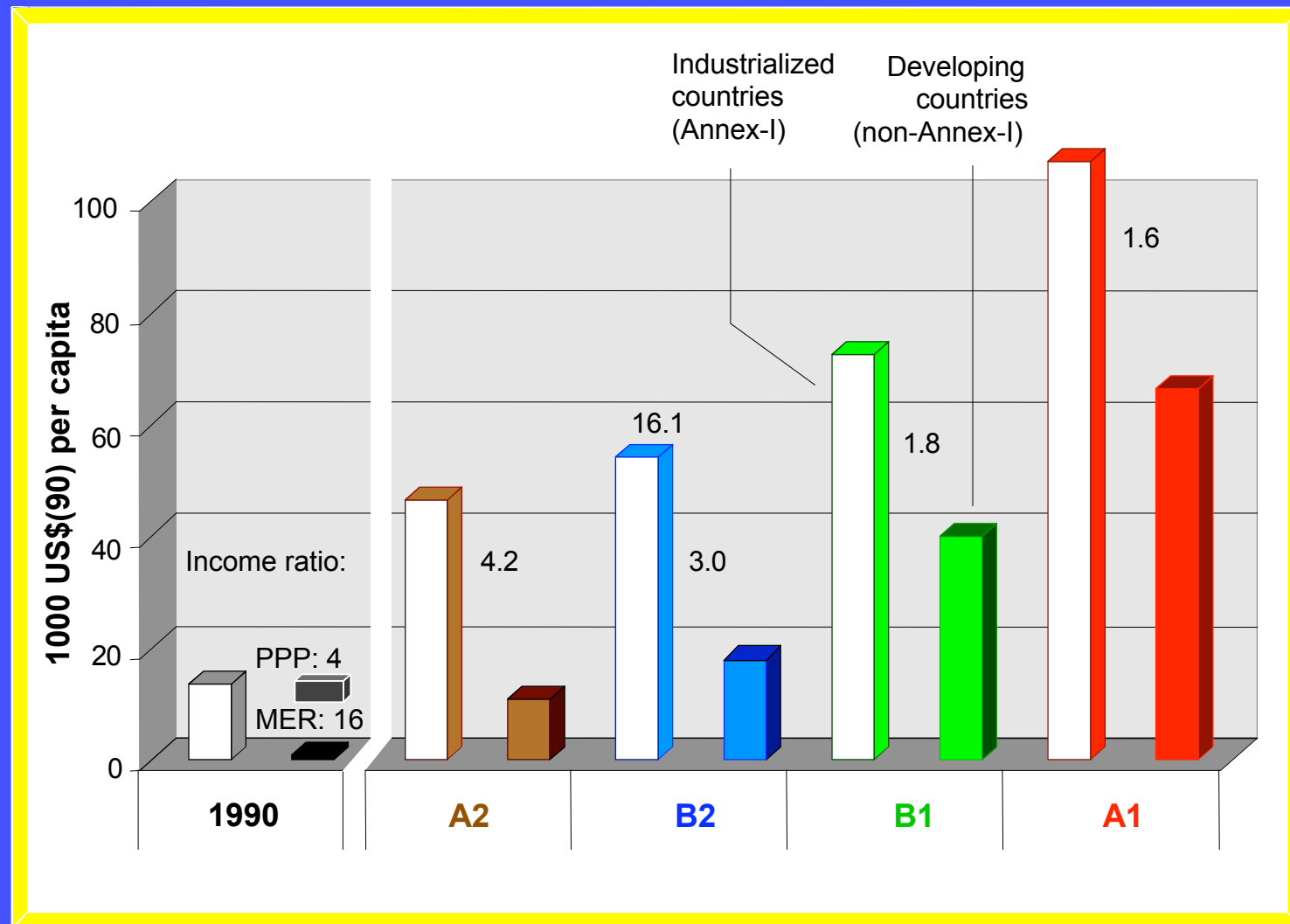


World Economic Map

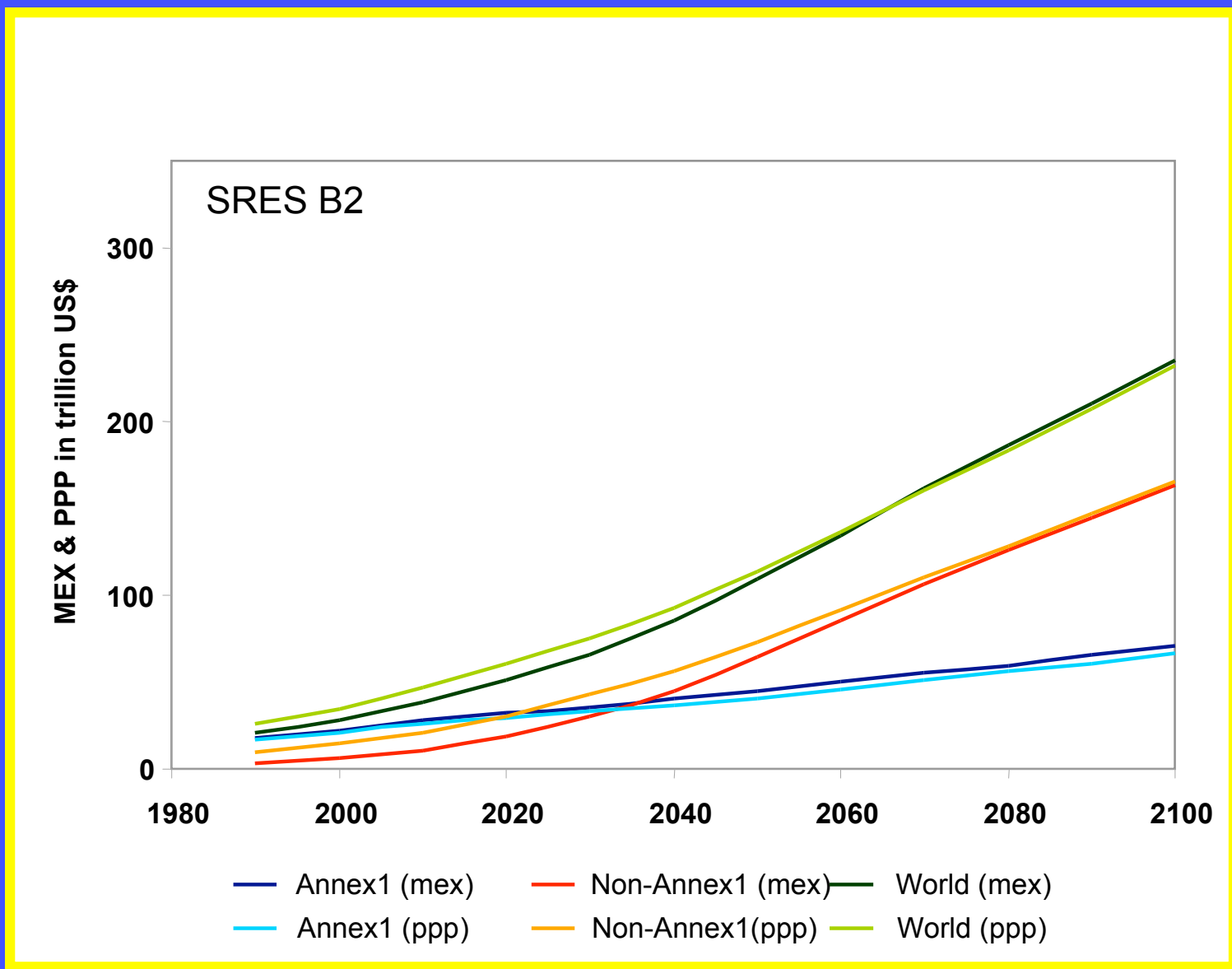
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Per Capita Income Across SRES Scenarios

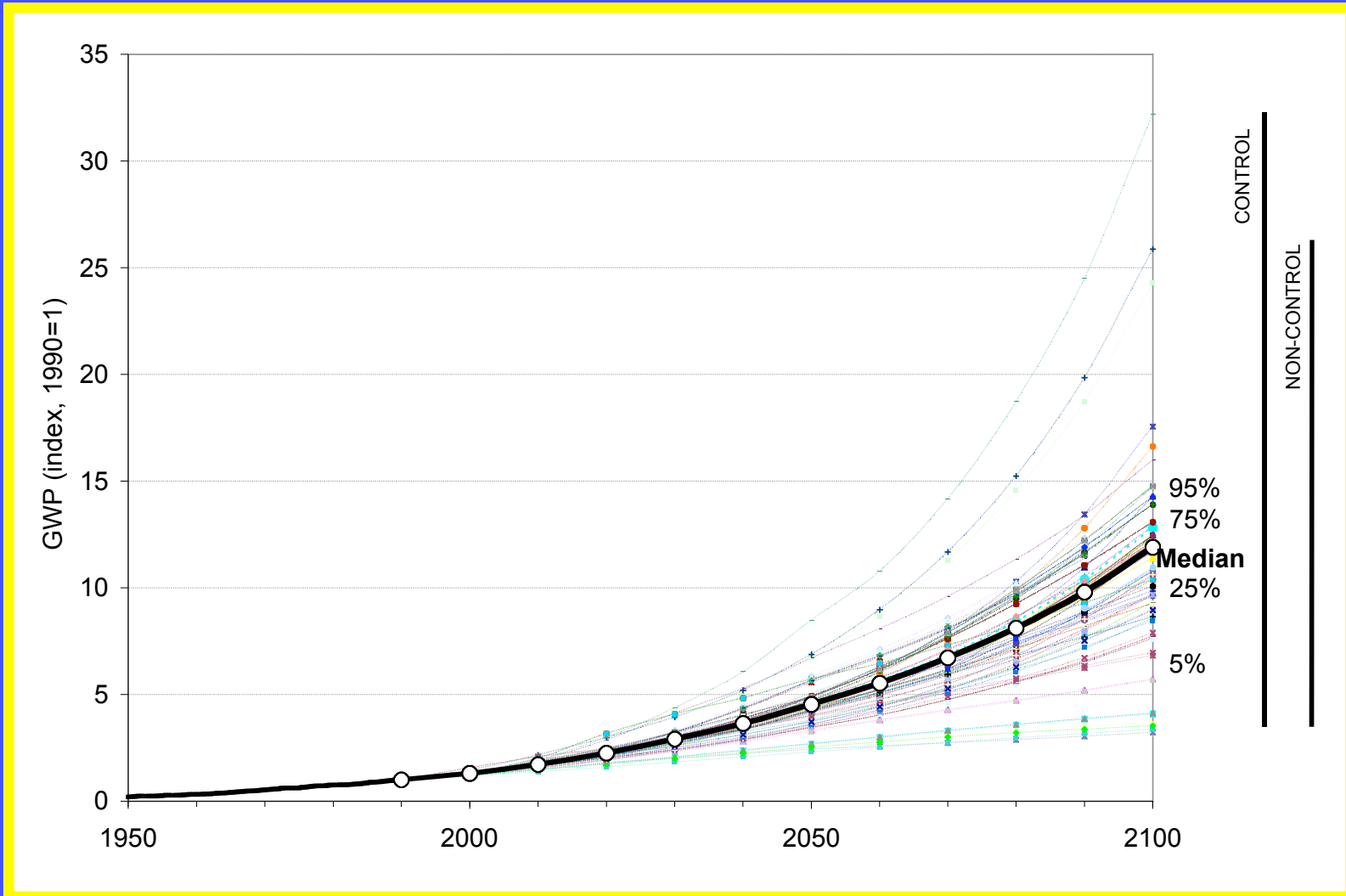


Gross World Product in MEX and PPP



Gross World Product

Range Across Emissions Scenarios



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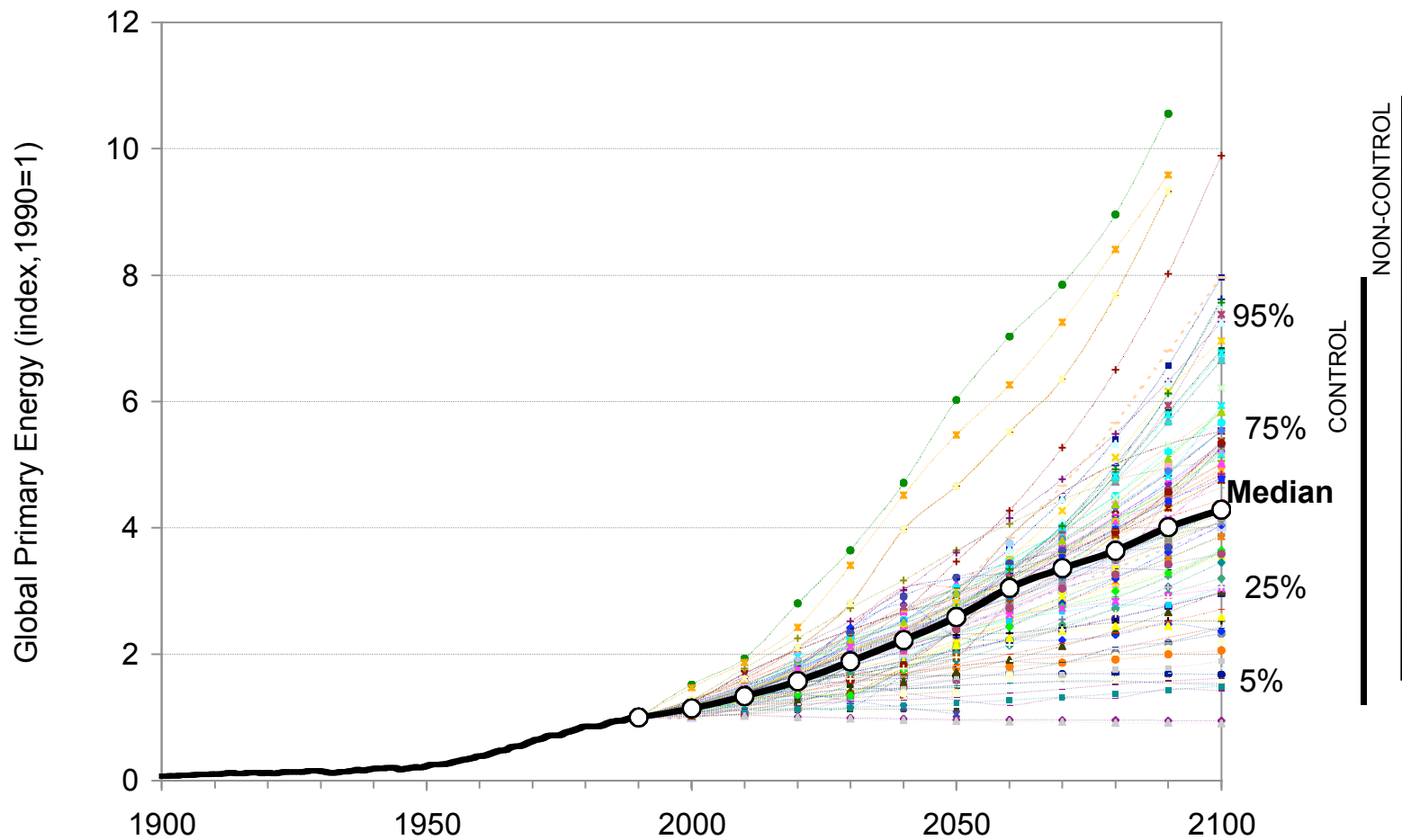
PPP Growth

10^9 PPP\$ ₁₉₈₀	1870	1985	Factor	%/yr
UK	59.0	510.9	8.7	1.9
USA	61.7	2947.1	47.8	3.4
Canada	4.9	306.8	62.1	3.7
Japan	17.2	1202.2	69.8	3.8
SRES range (B2, B1, A1-MESSAGE) 1990-2100				
OECD90			3.6 -- 7.6	1.2--1.9
REF			6.2--13.2	1.7--2.4
ASIA			18.9--39.1	2.7--3.4
ALM			17.1--43.7	2.6--3.5

Source: Historical data: Kausel, 1985; SRES: Nakicenovic *et al.*, 2000.

Global Primary Energy

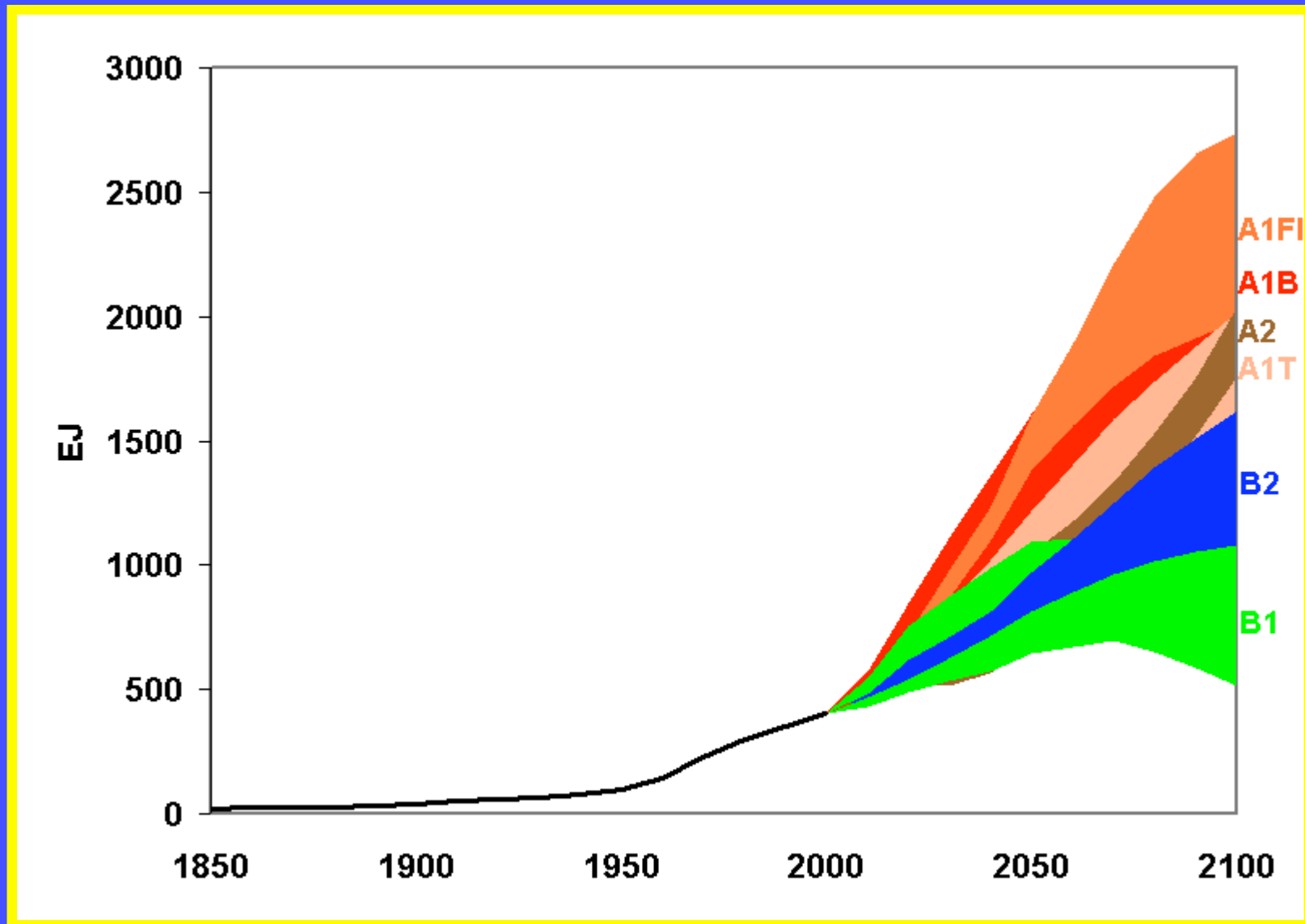
Range Across Emissions Scenarios



Nakicenovic *et al.*

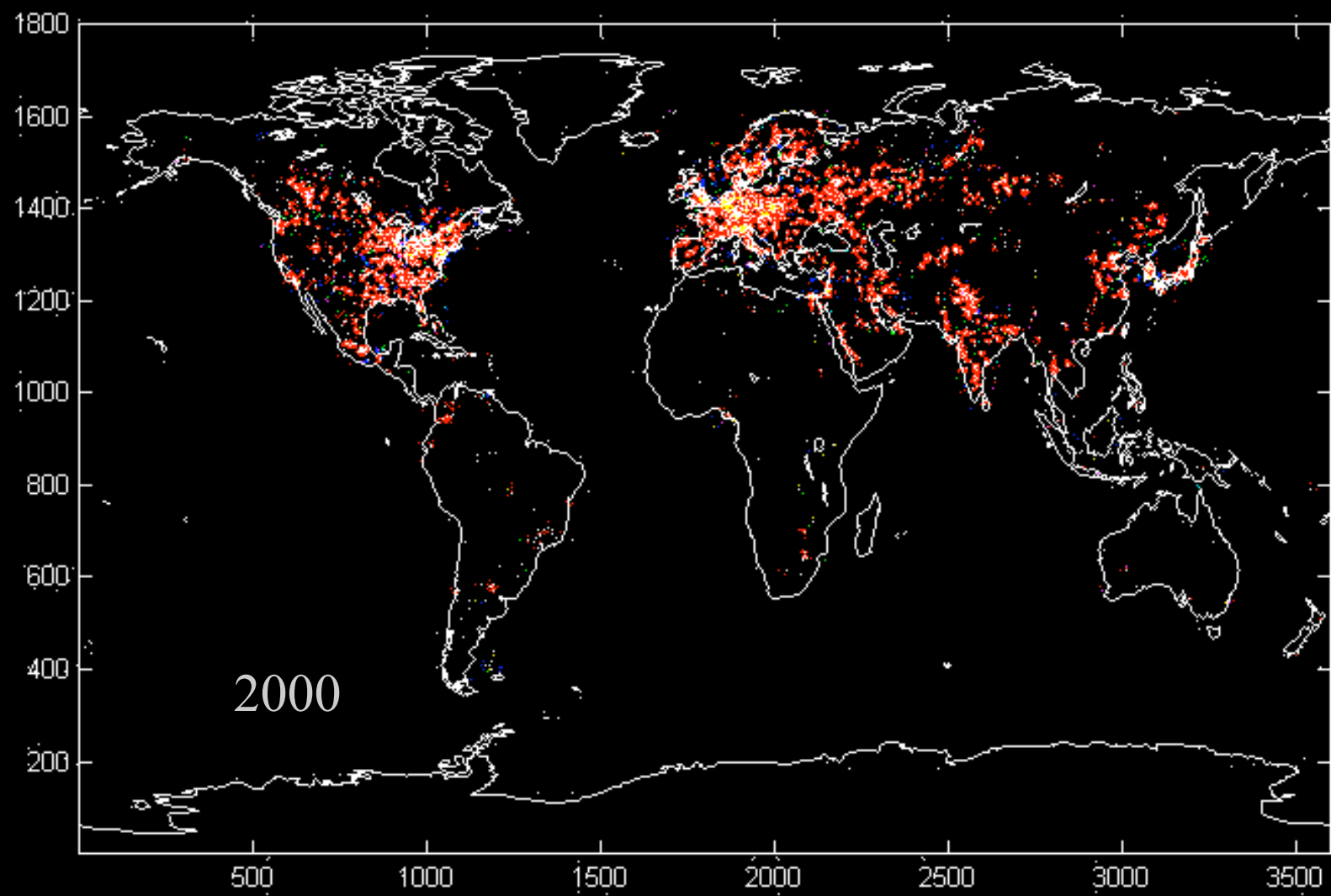
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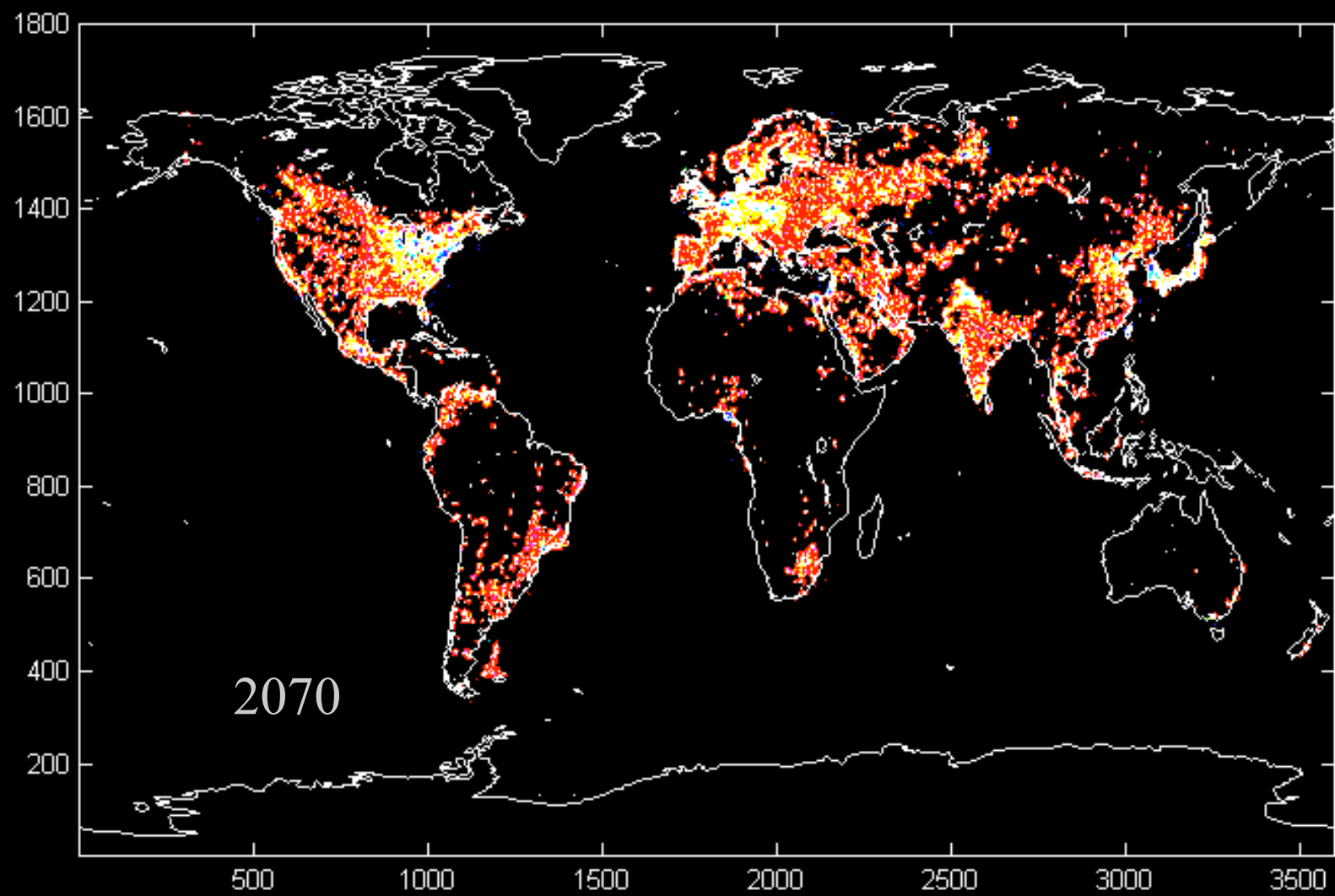
Global Primary Energy Scenarios



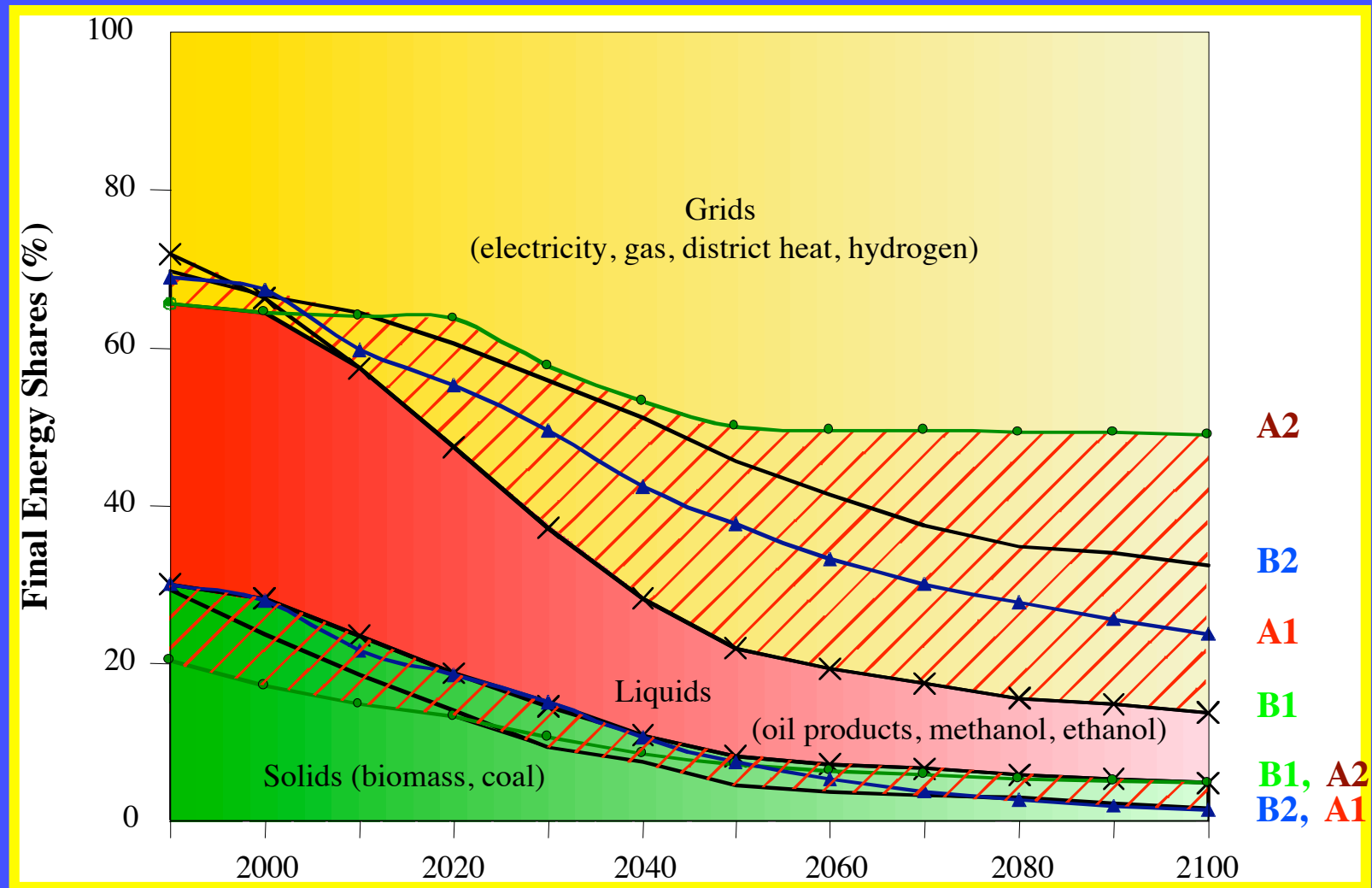
Nakicenovic

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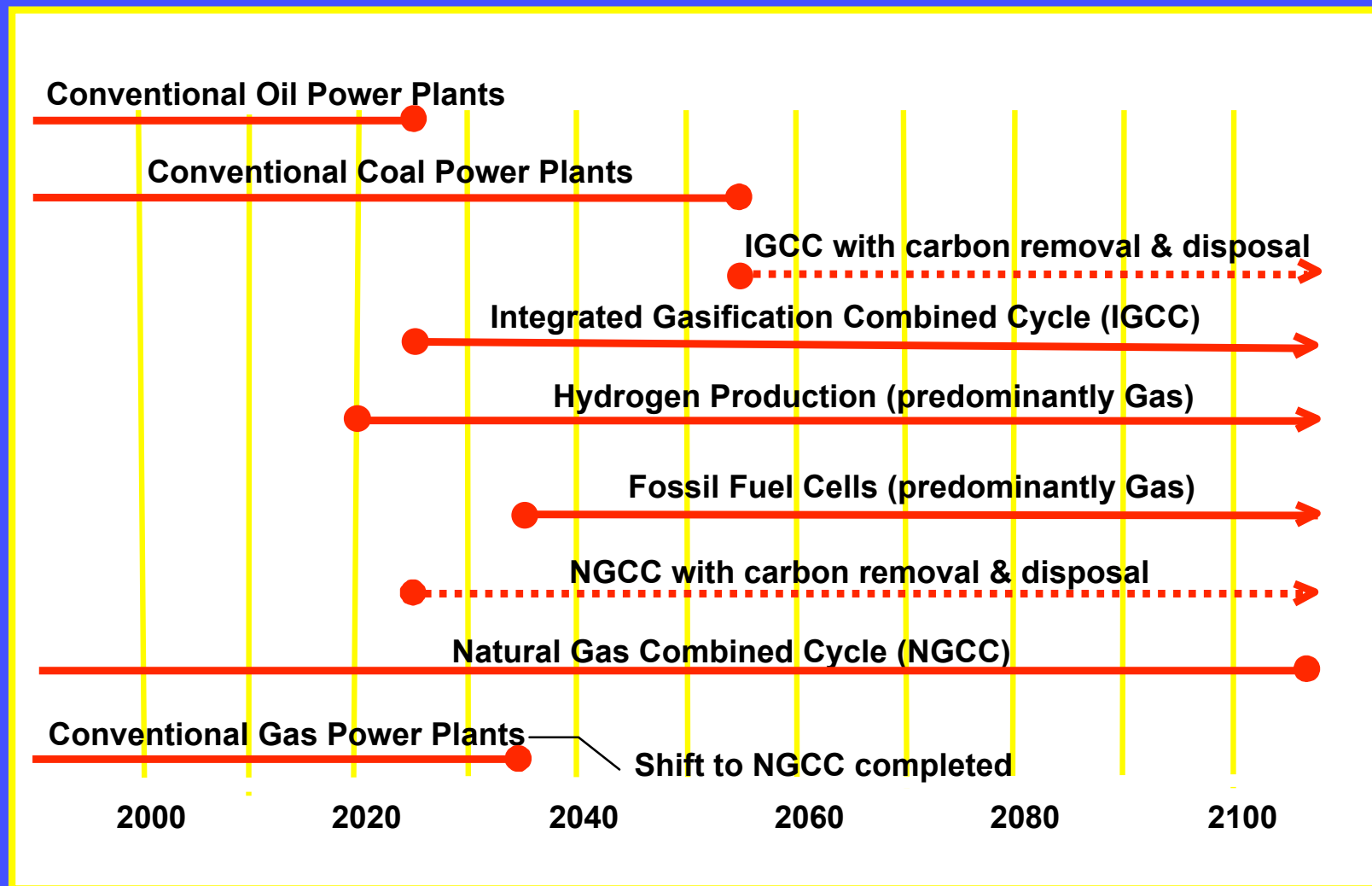


Global Final Energy by Form

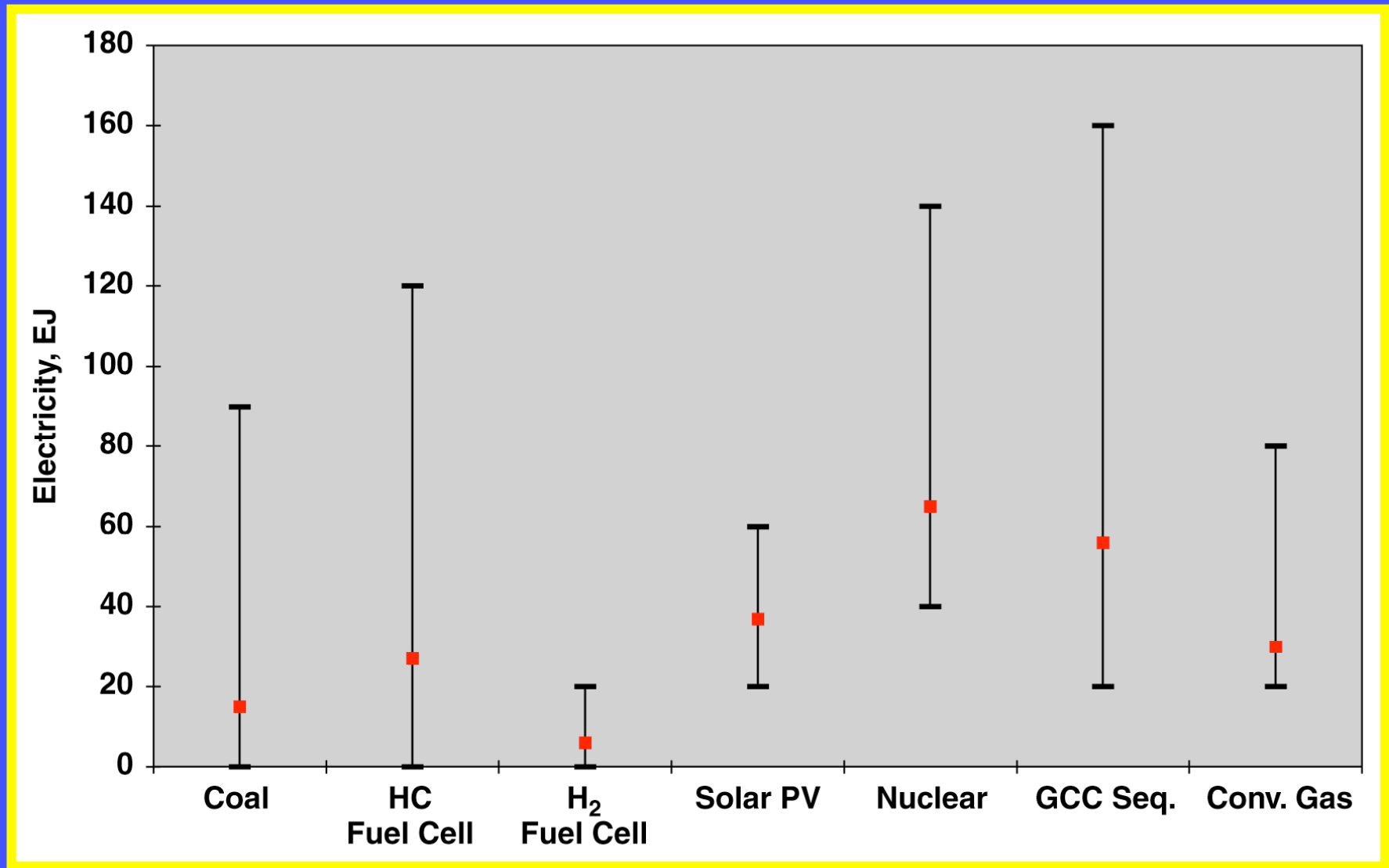


Diffusion of Fossil Technologies

IIASA IPCC SRES and Post-SRES Scenarios



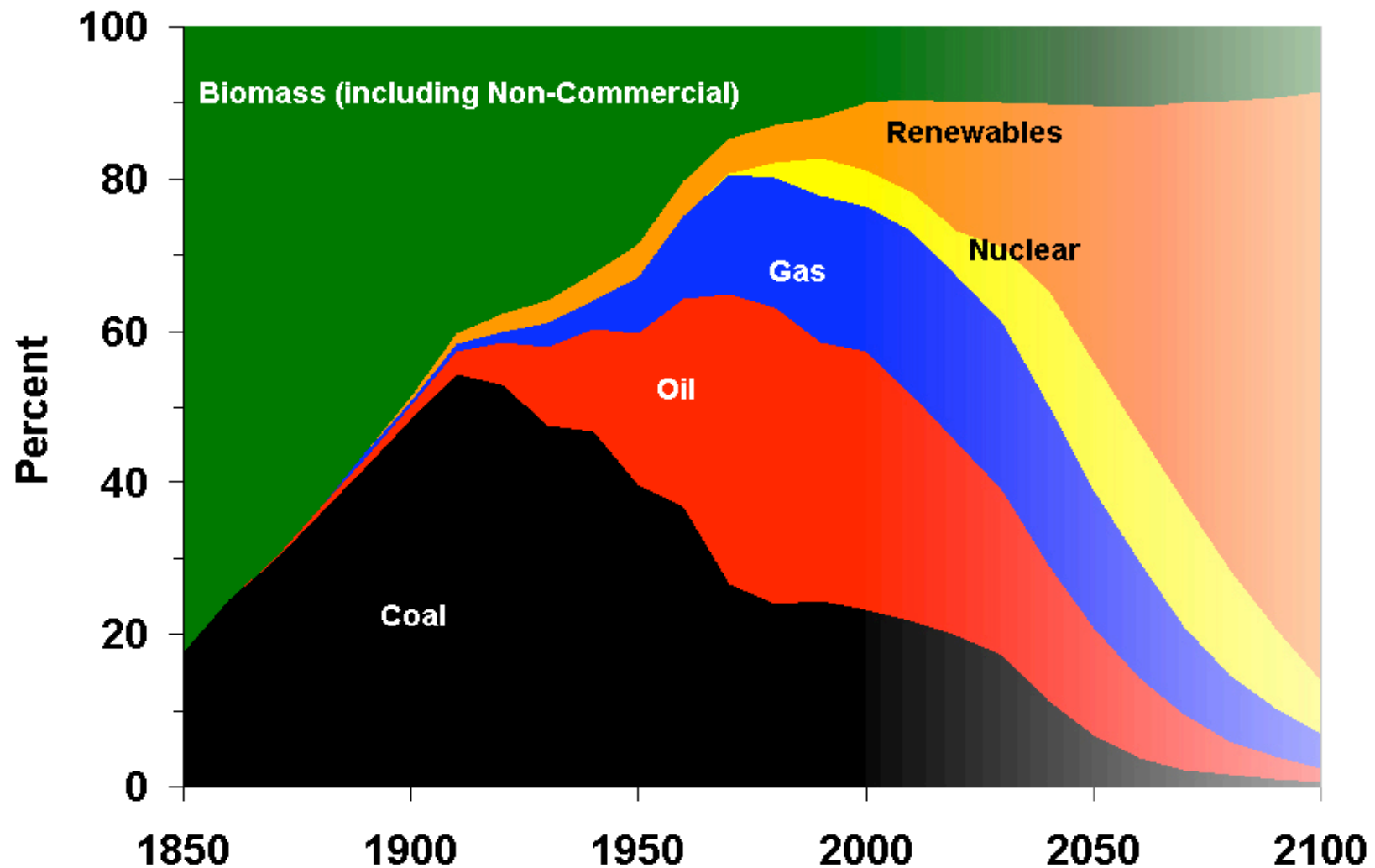
Power Generation in 2050



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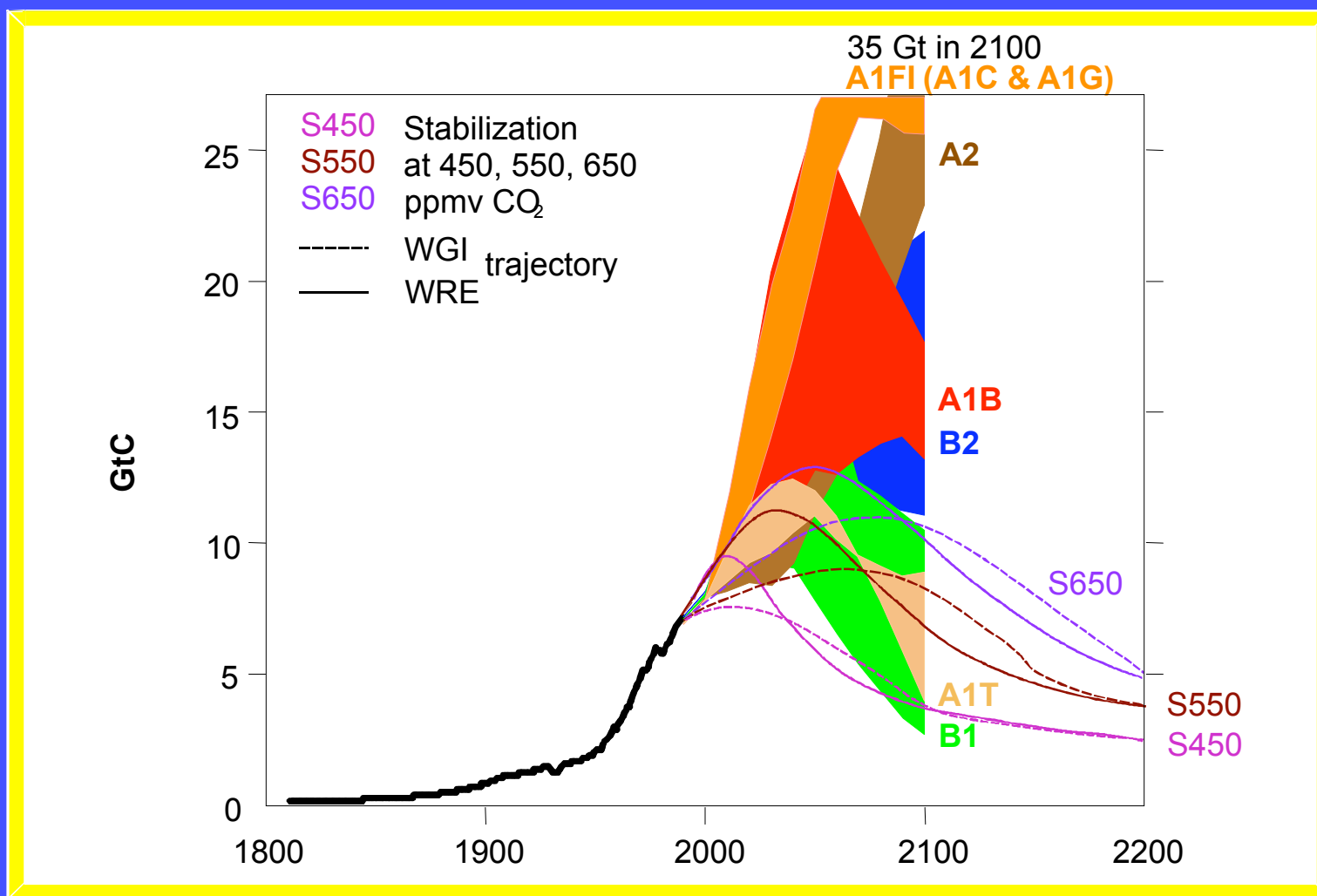
Evolution of Global Primary Energy



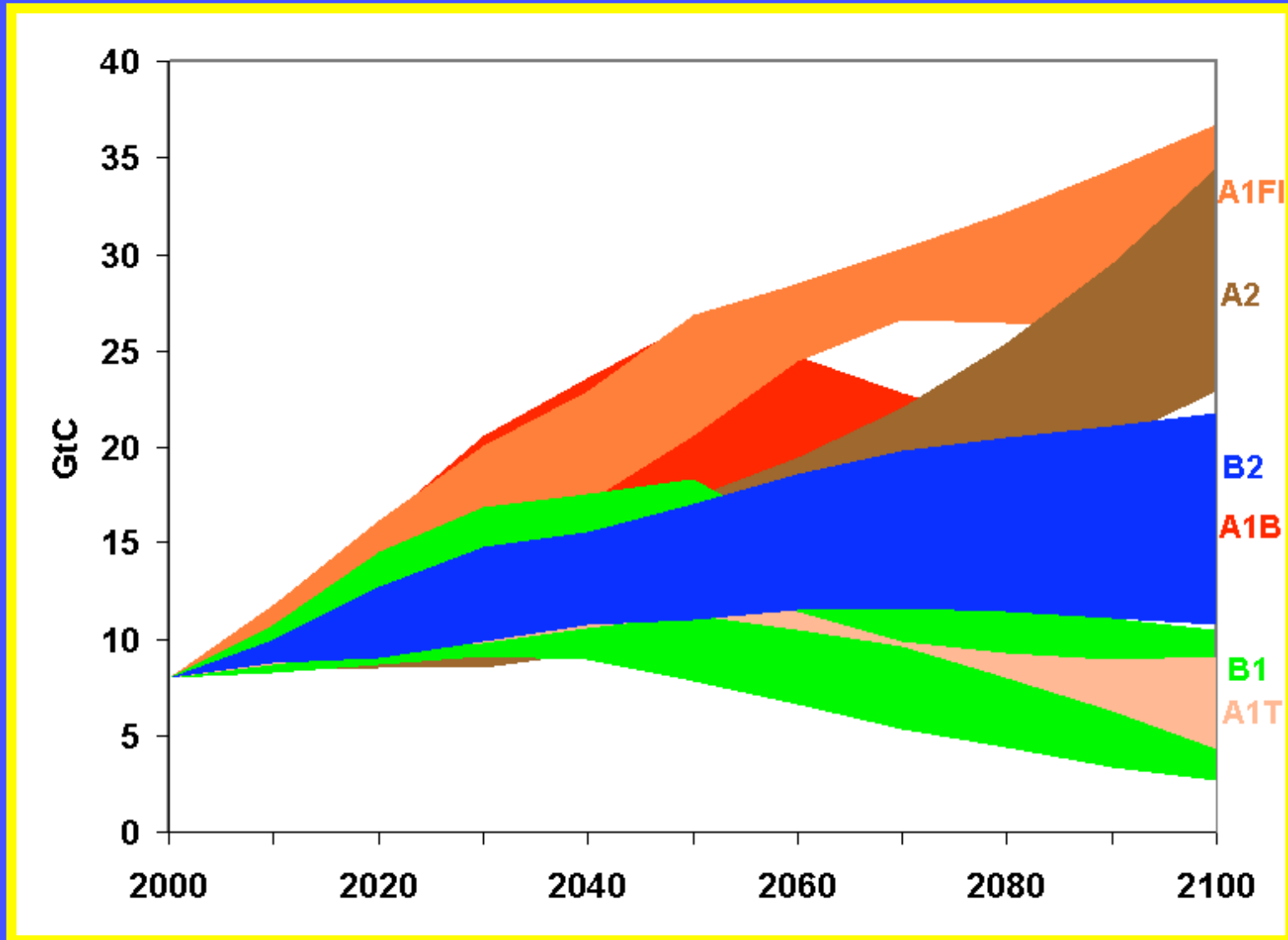
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Carbon Emissions: Scenarios and Stabilization Profiles



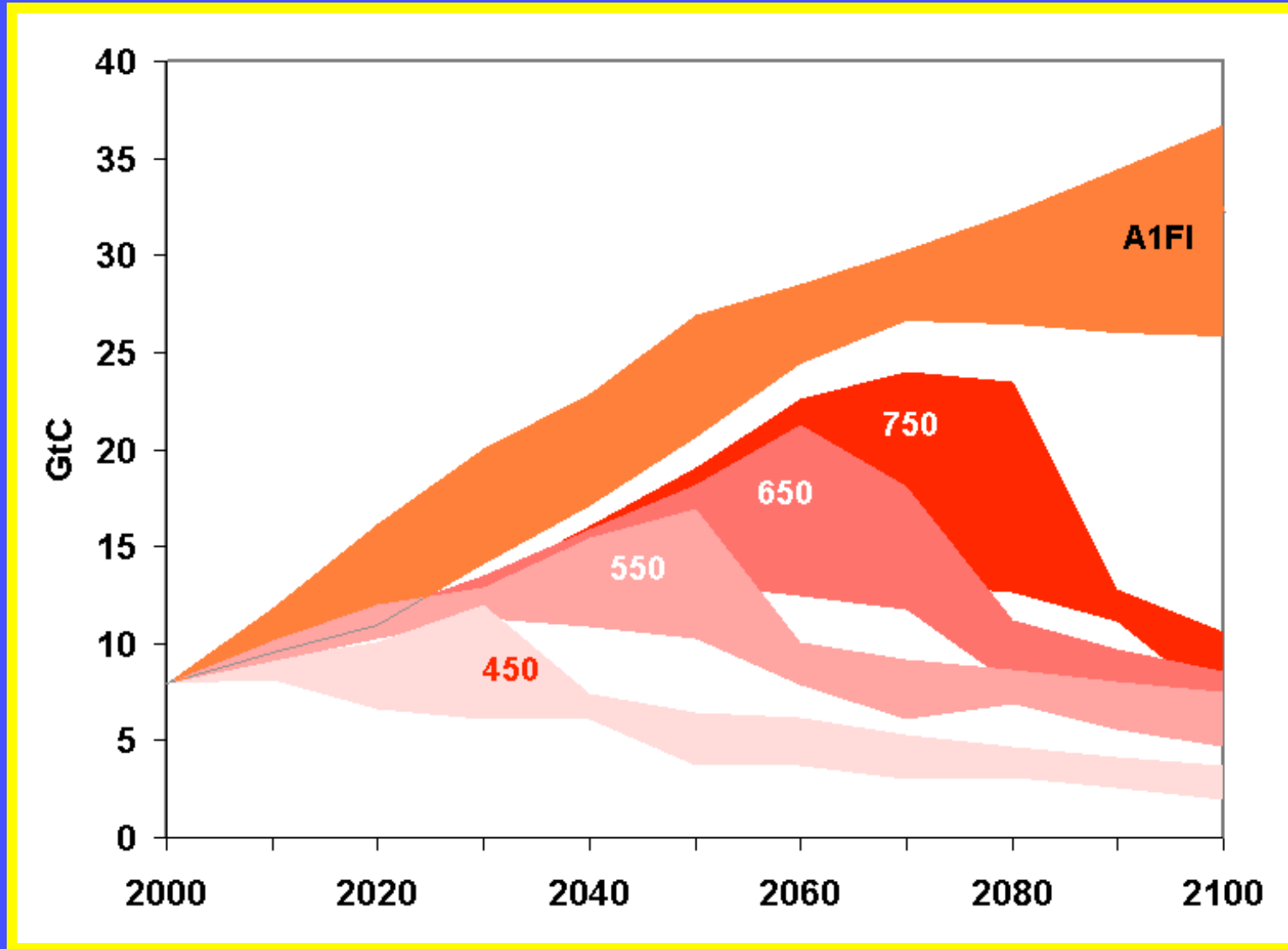
Global Carbon Dioxide Emissions



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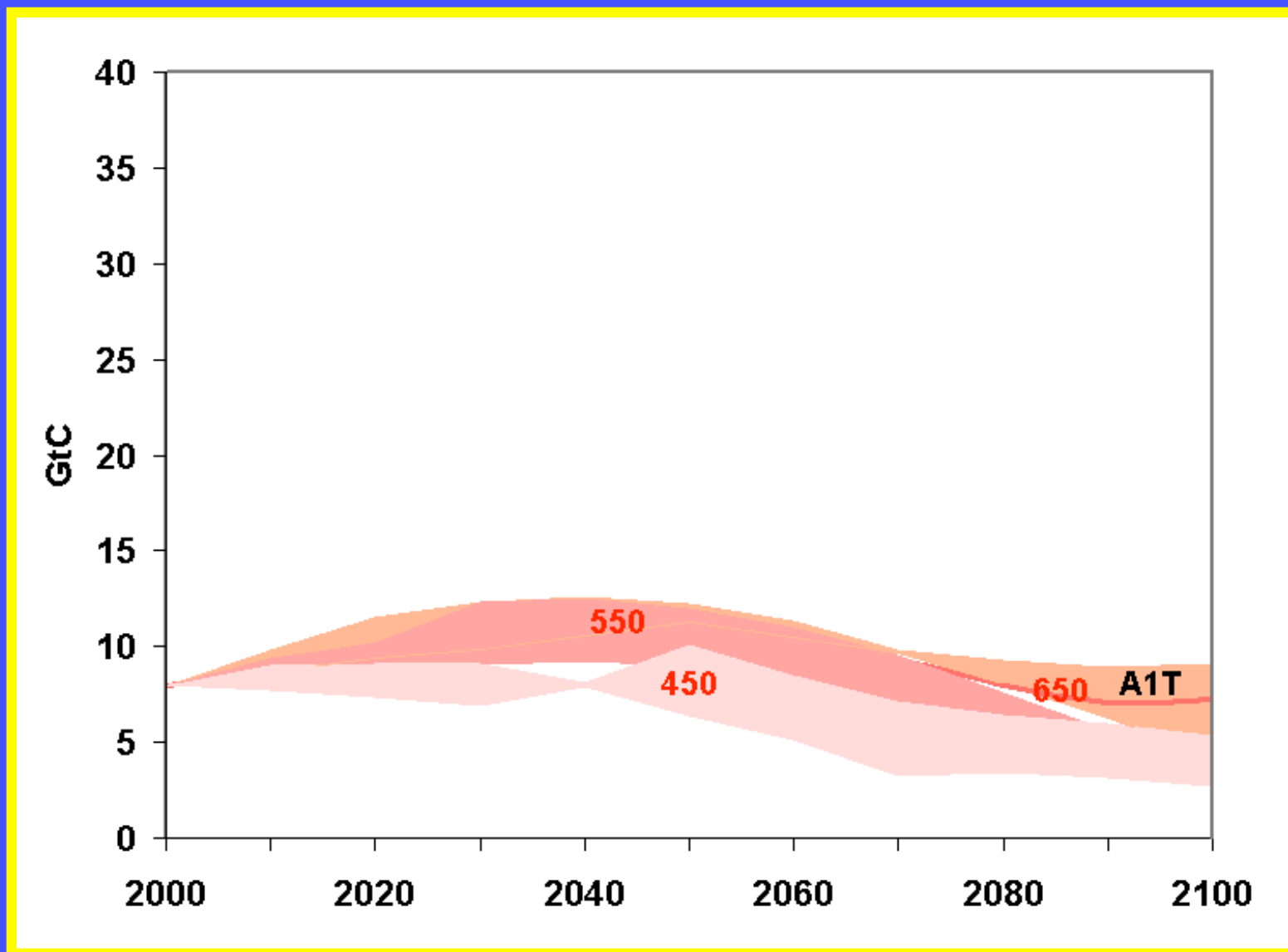
Global Carbon Dioxide Emissions



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Global Carbon Dioxide Emissions

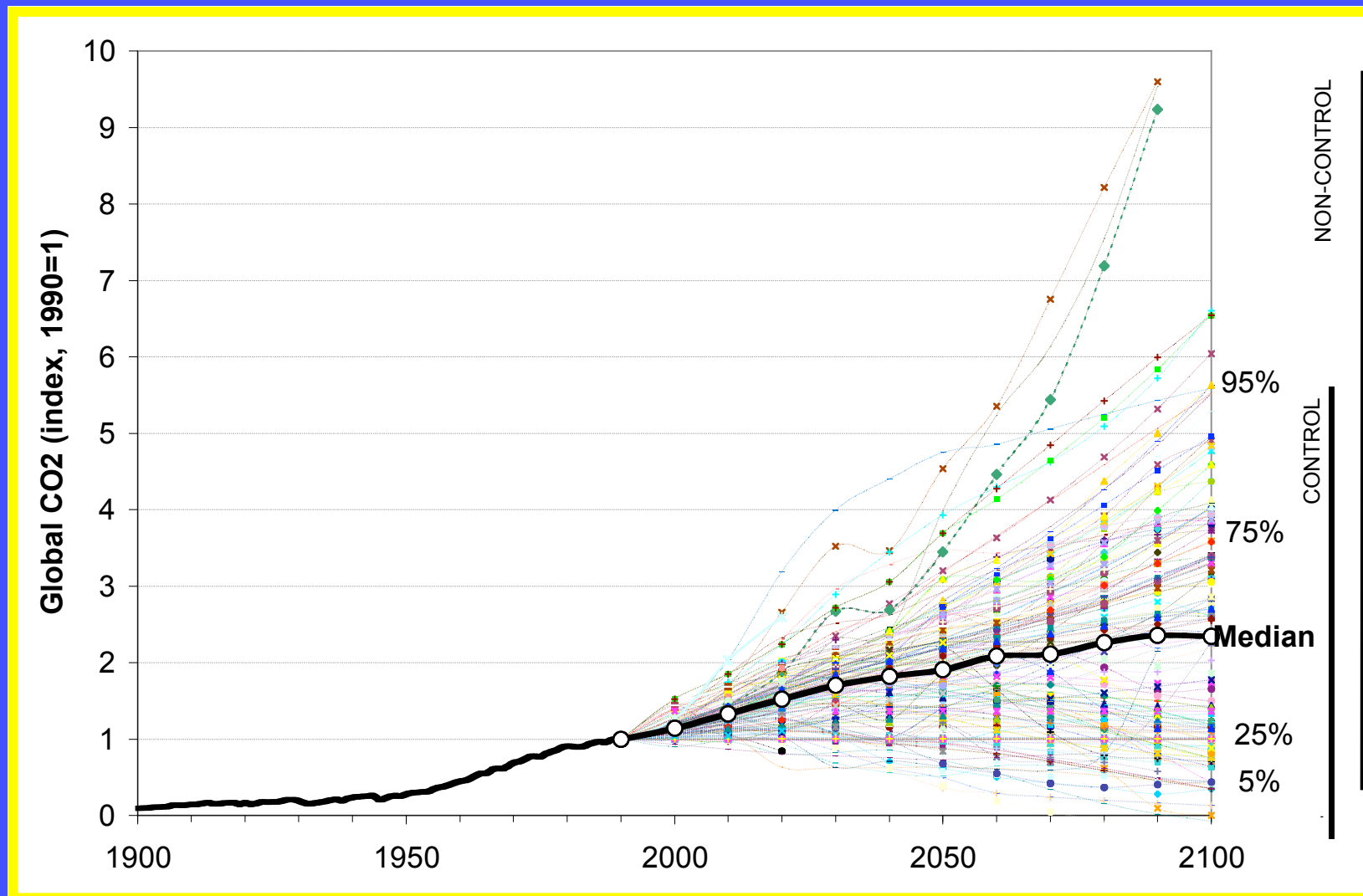


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Carbon Dioxide Emissions

Total All Sources

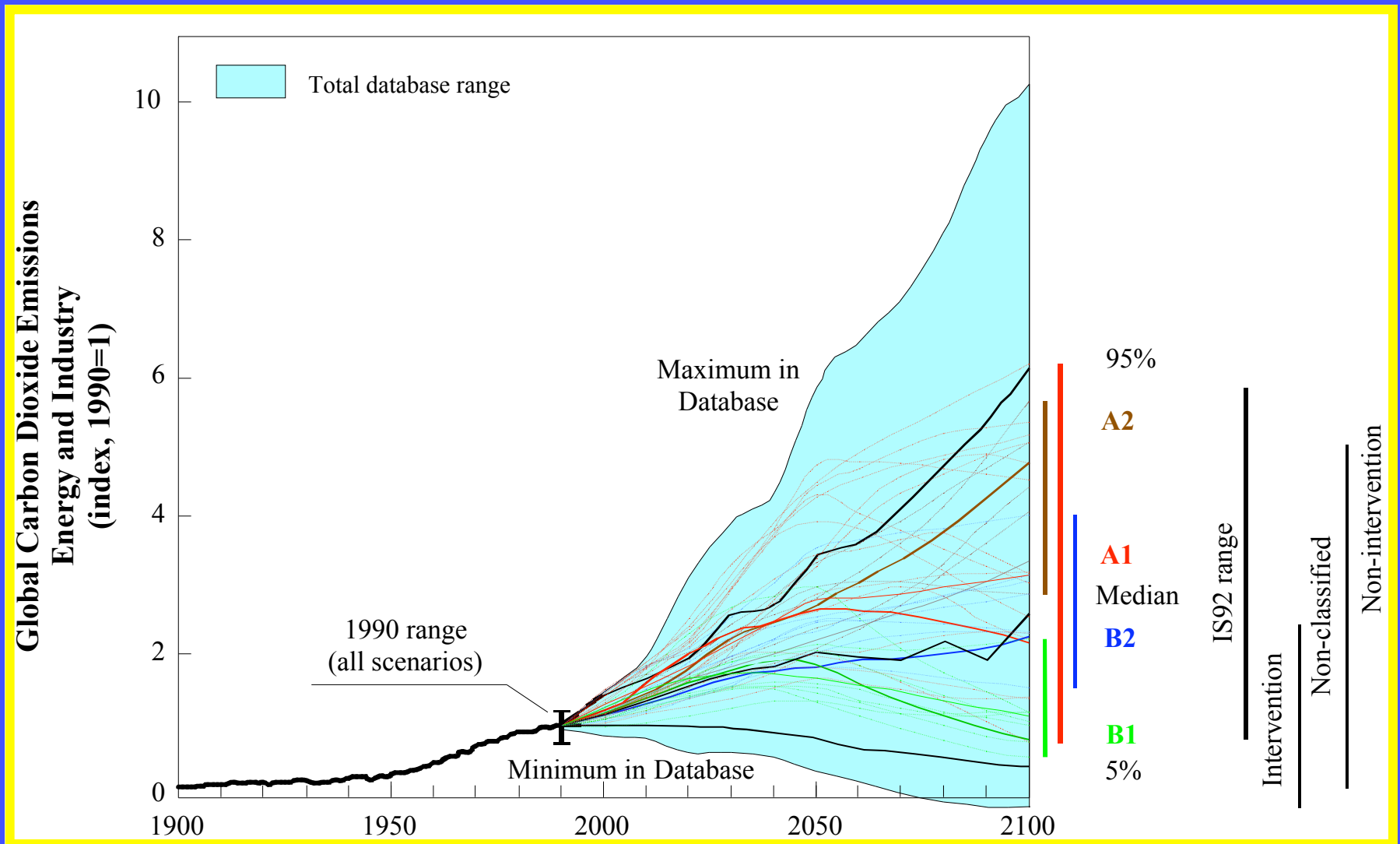


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Global Carbon Dioxide Emissions

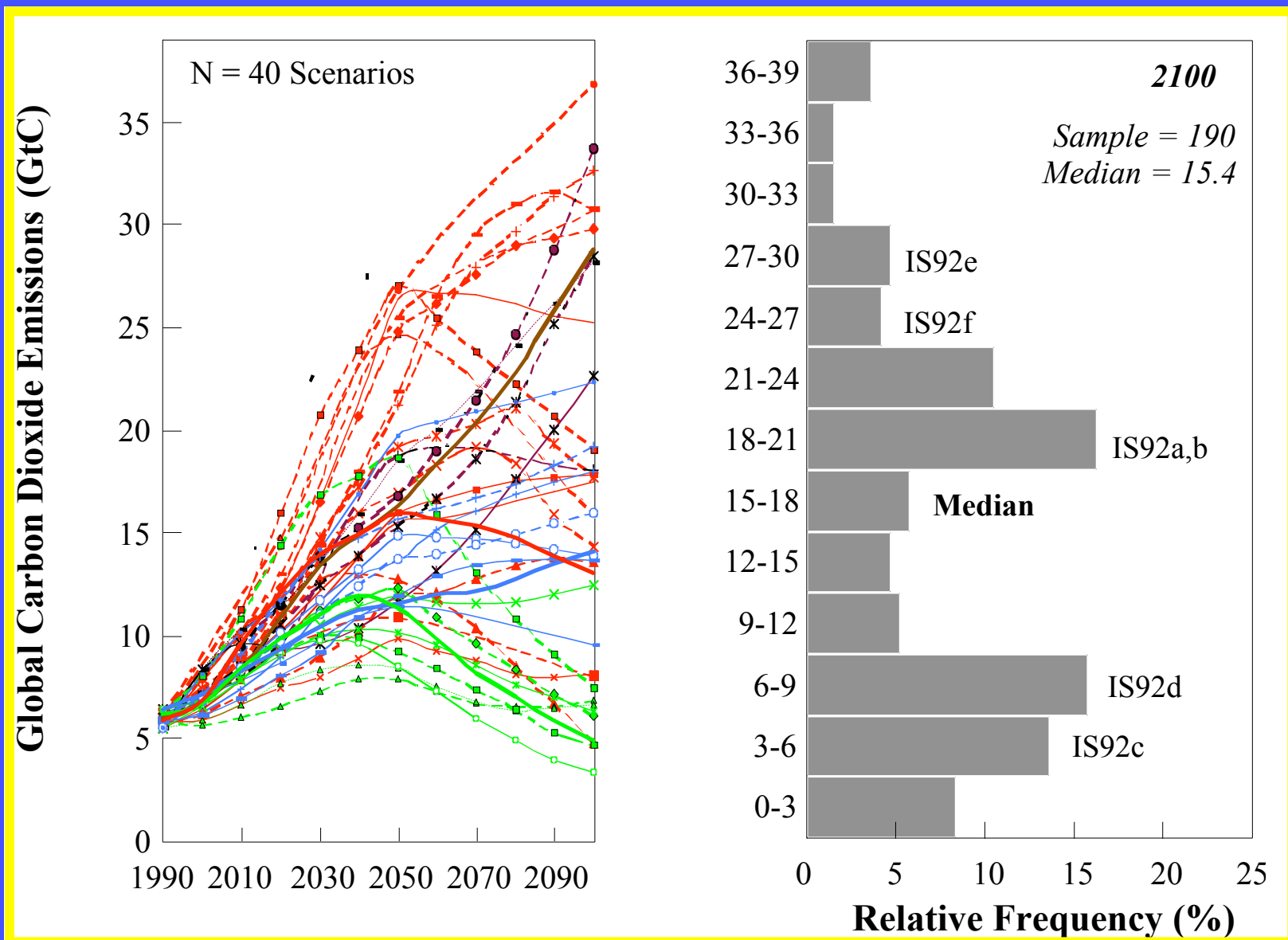
40 SRES Scenarios and Literature Range



et al.

SRES 2000

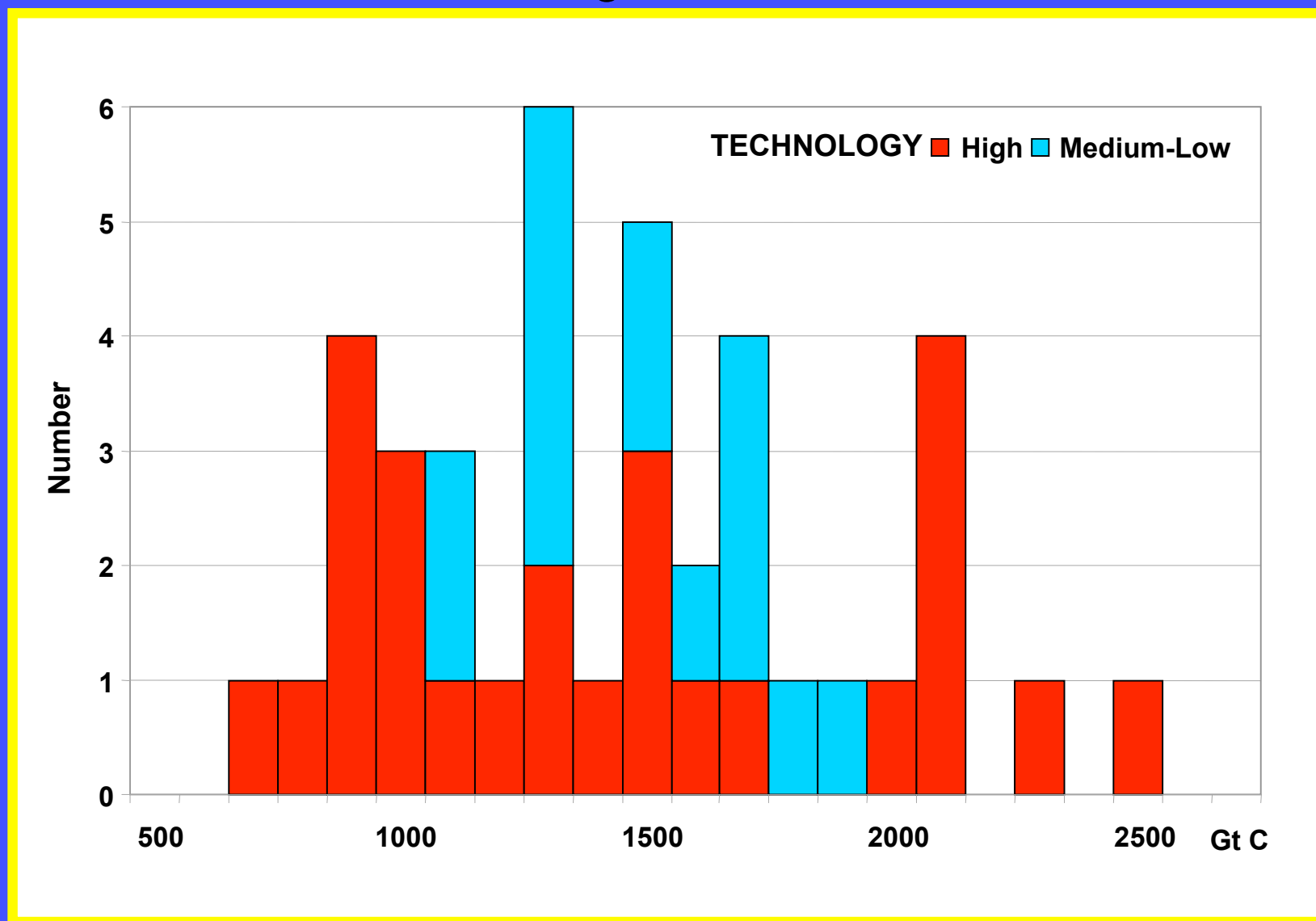
Energy-Related Carbon Dioxide Emissions



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SRES 2000

Distribution of Cumulative Carbon Emissions Across the Range of SRES Scenarios

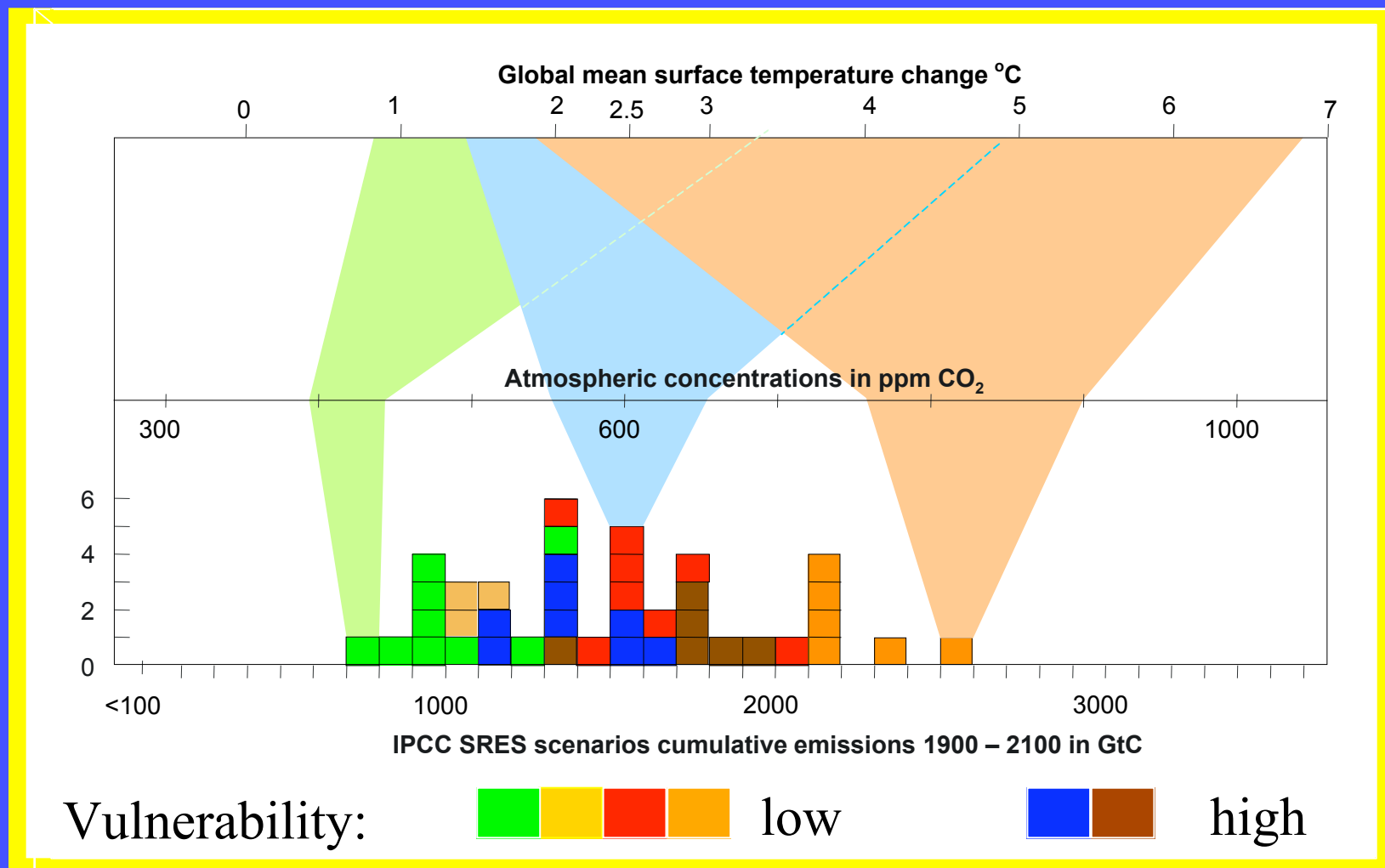


Nakicenovic & Slentoe

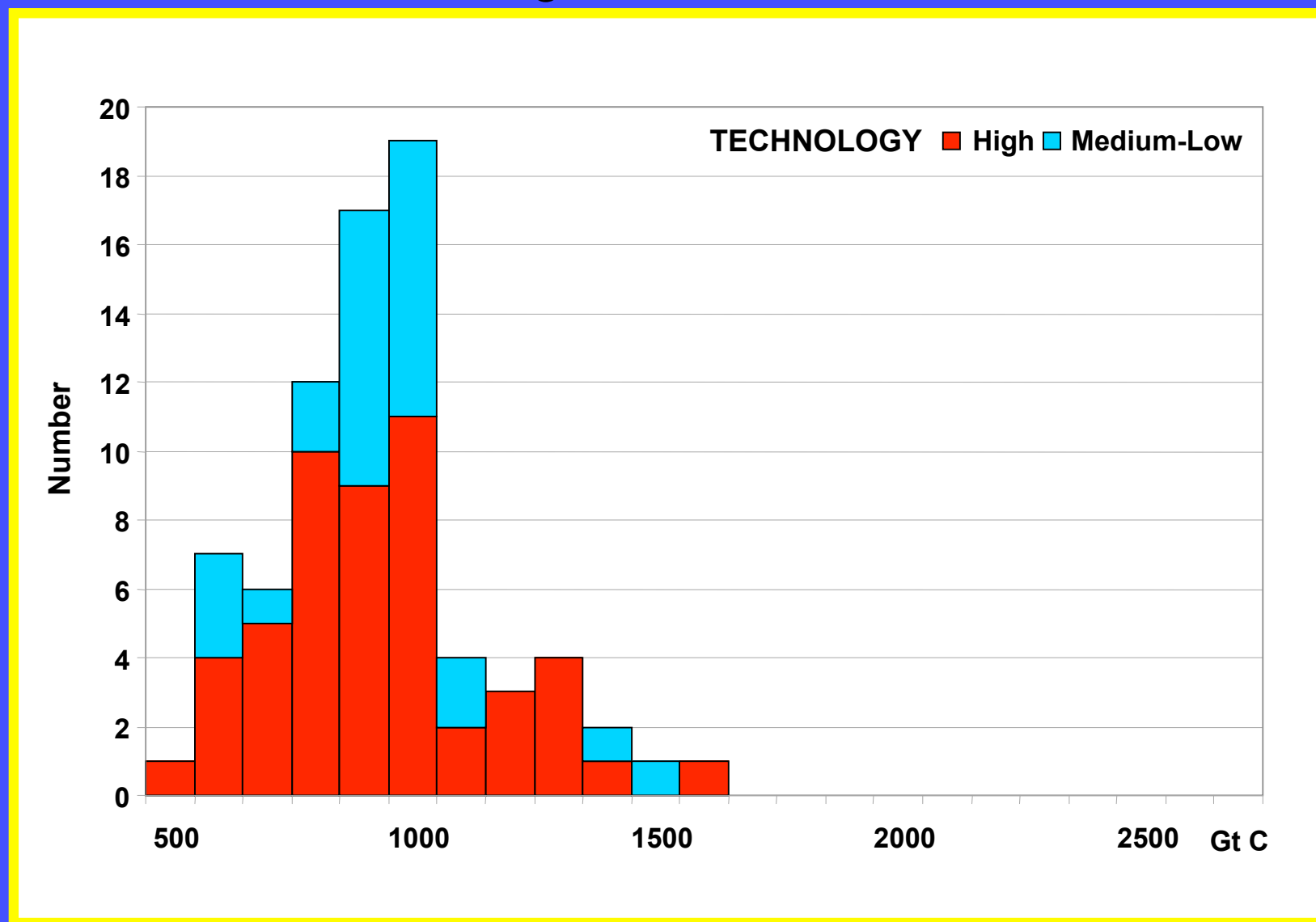
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MAJOR CLIMATE CHANGE UNCERTAINTIES

Cumulative CO₂ of IPCC SRES scenarios and resulting CO₂ concentrations and climate sensitivity in °C temperature change based on MAGICC model

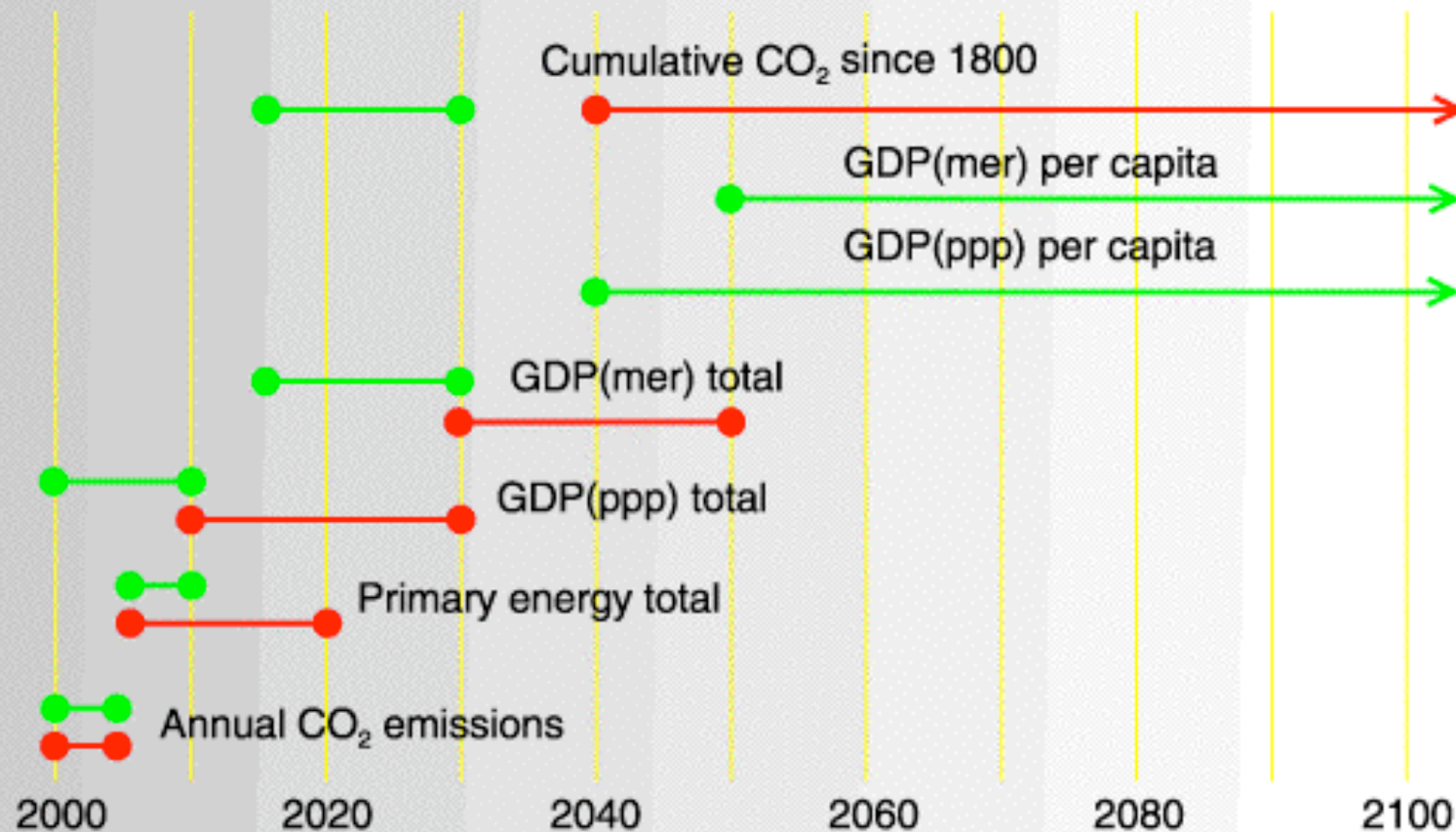


Distribution of Cumulative Carbon Emissions Across the Range of Post-SRES Scenarios

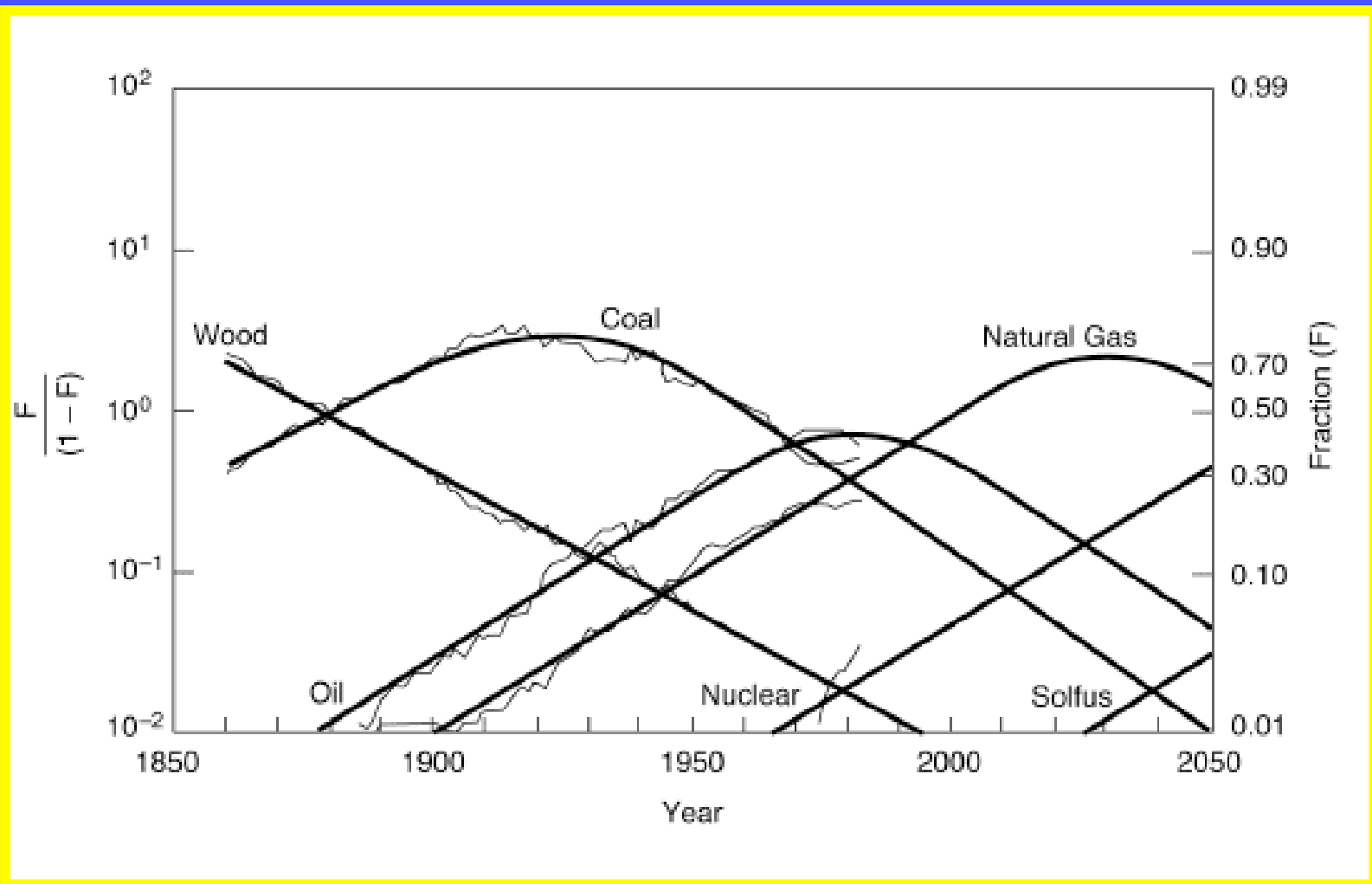


SRES DEVELOPMENT CATCH-UP

Dates when non-Annex-I countries **reach 1990 Annex-I levels**, and **surpass Annex-I values**. Range of 4 SRES marker scenarios



World - Primary Energy Substitution



<http://www.iiasa.ac.at/Research/TNT/index.html>

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