Global Challenge of Climate Change

Keywan Riahi
International Institute for Applied Systems Analysis
Graz University of Technology
riahi@iiasa.ac.at

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Vienna, 3 December 2007

Overview

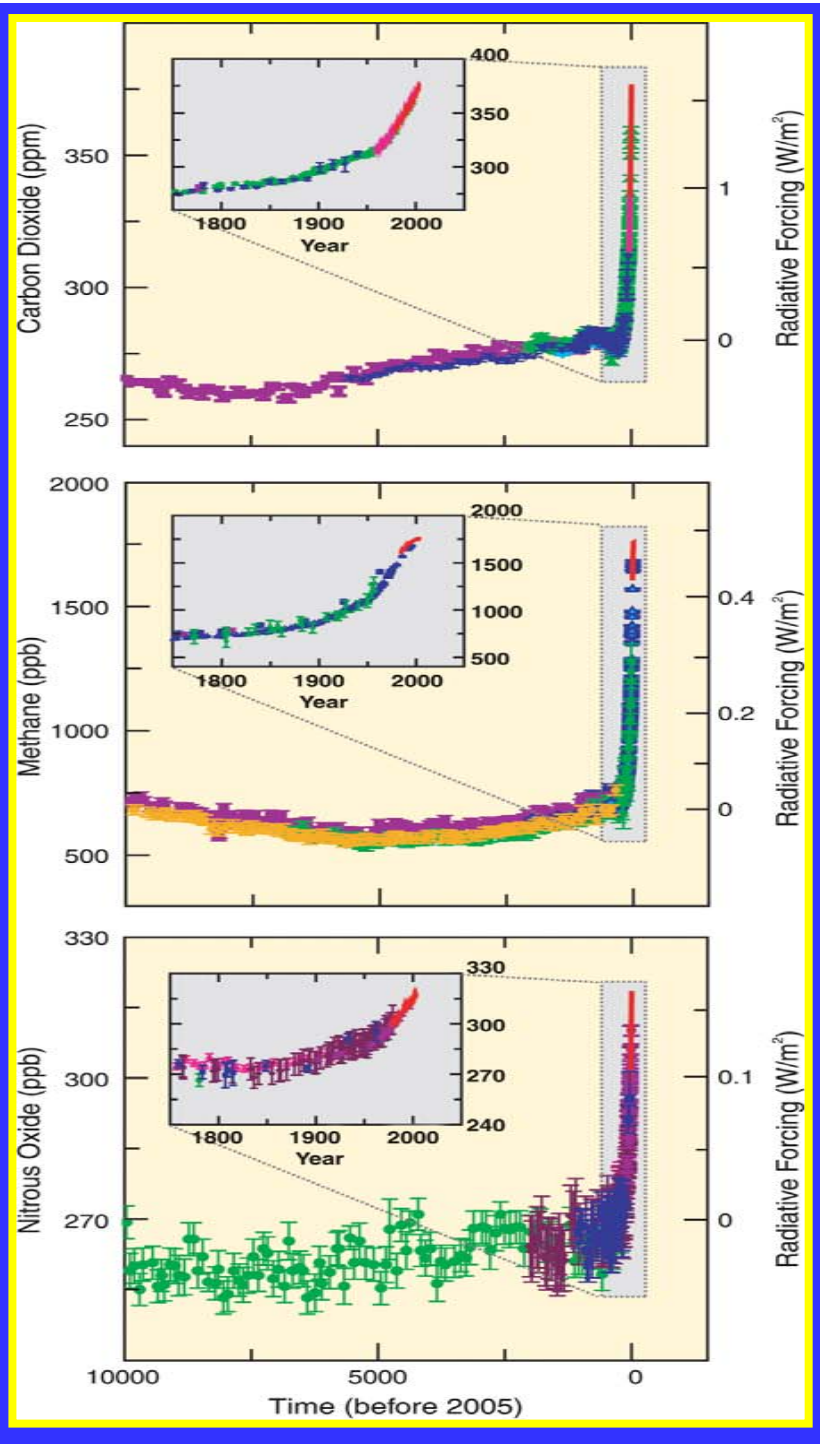
- Global Perspective
- Observed Climate Change (briefly)
- Future Projections (and uncertainties)
  - Climate
  - Impacts and risks
  - Response strategies (mitigation/adaptation)

The IPCC

- Scientific body set up by WMO and UNEP
- Periodic Assessment Reports (AR4 in 2007)
- Hundreds of Scientists involved as Authors and Reviewers
- Does not conduct own research, but assess the latest scientific, technical and socio-economic literature
- Elaborate Expert and Government Review
- Main findings summarized in “Summary for Policy Makers”
- Nobel Peace Price 2007 together with A. Gore

The last 200 Years

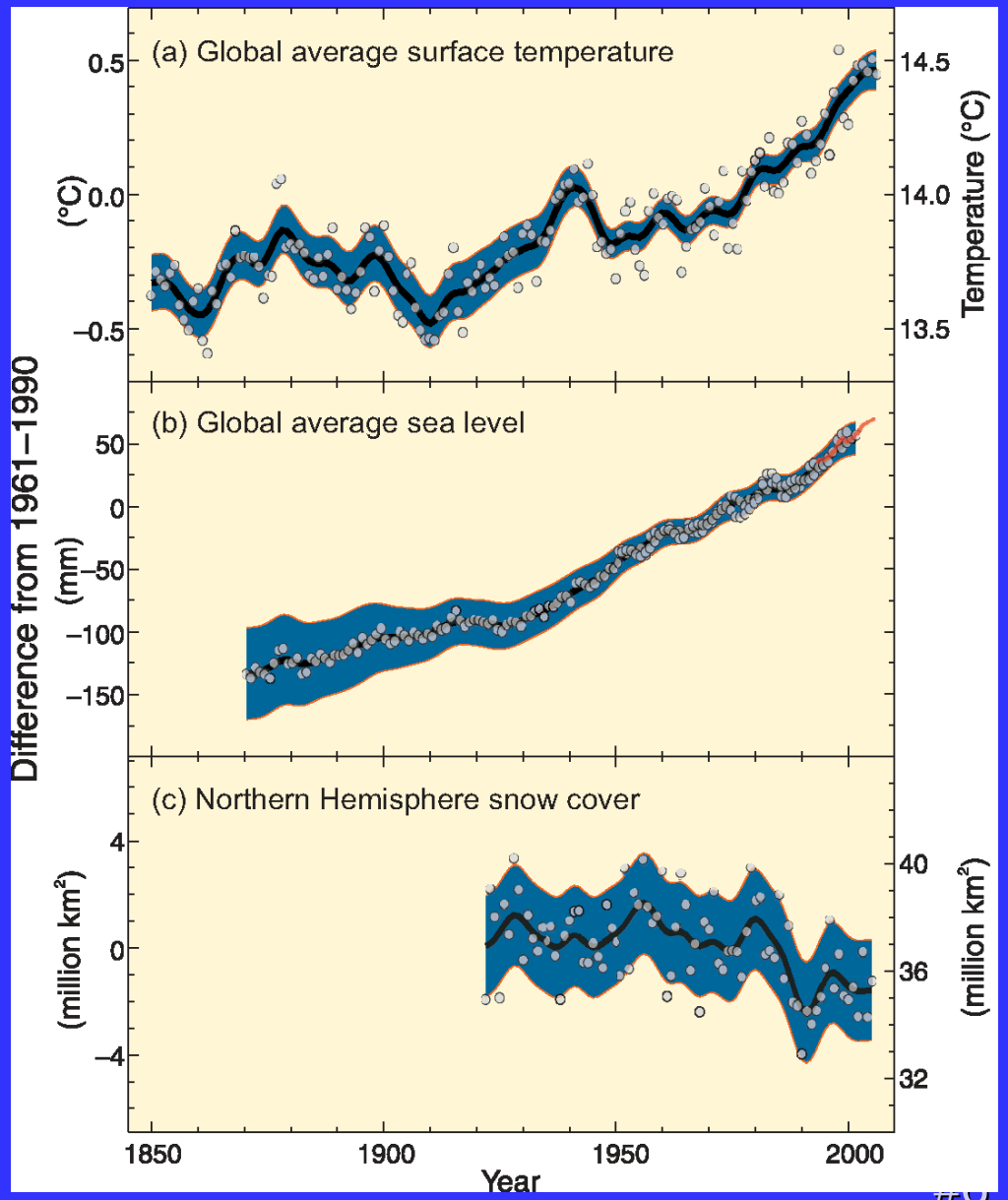
	1800	Factor	1900
Population (billion)	1	x1.6	1.6
GDP PPP (trillion 1990$)	0.5	x4	2
Primary Energy (EJ)	13	x3.3	40
CO_2 Emissions (GtC)	0-0.3	x3.0	0.5-1.0



GHG Concentrations over the last 10000 years

Source:
IPCC-AR4, 2007 #5

Observed Changes

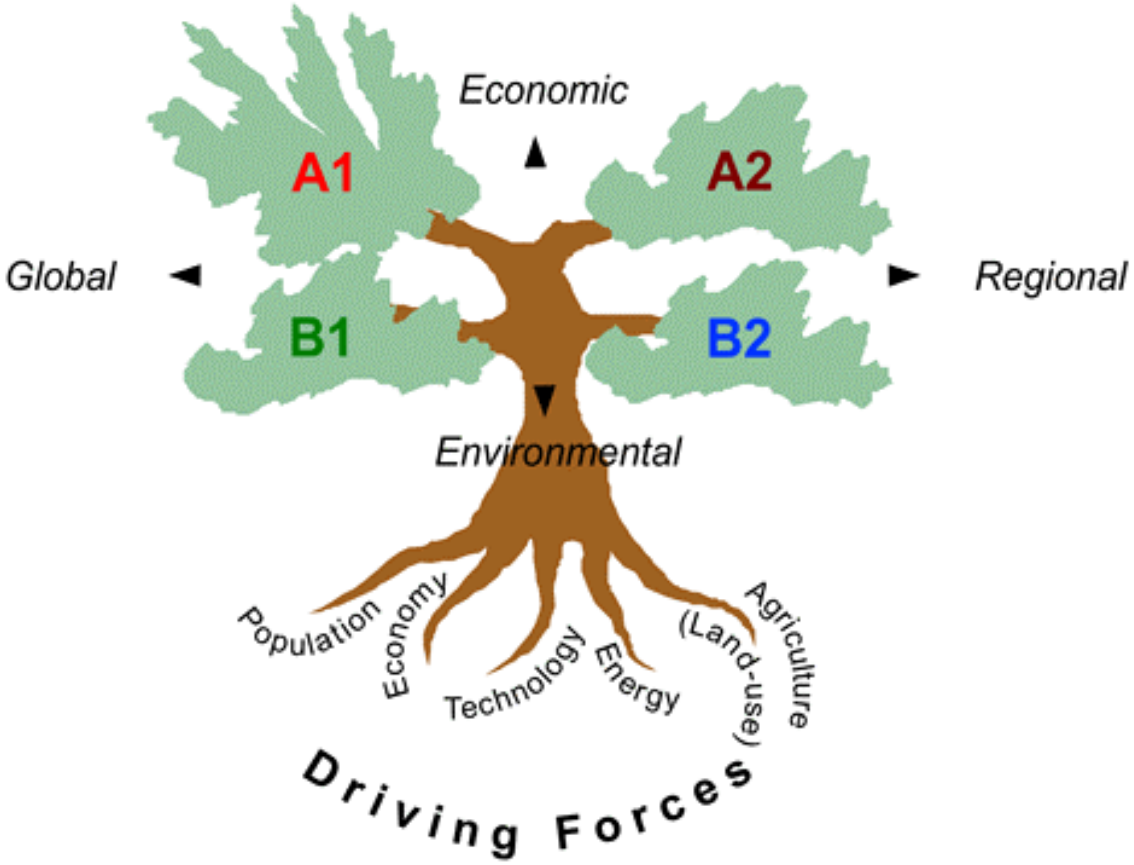


Source:
IPCC-AR4, 2007

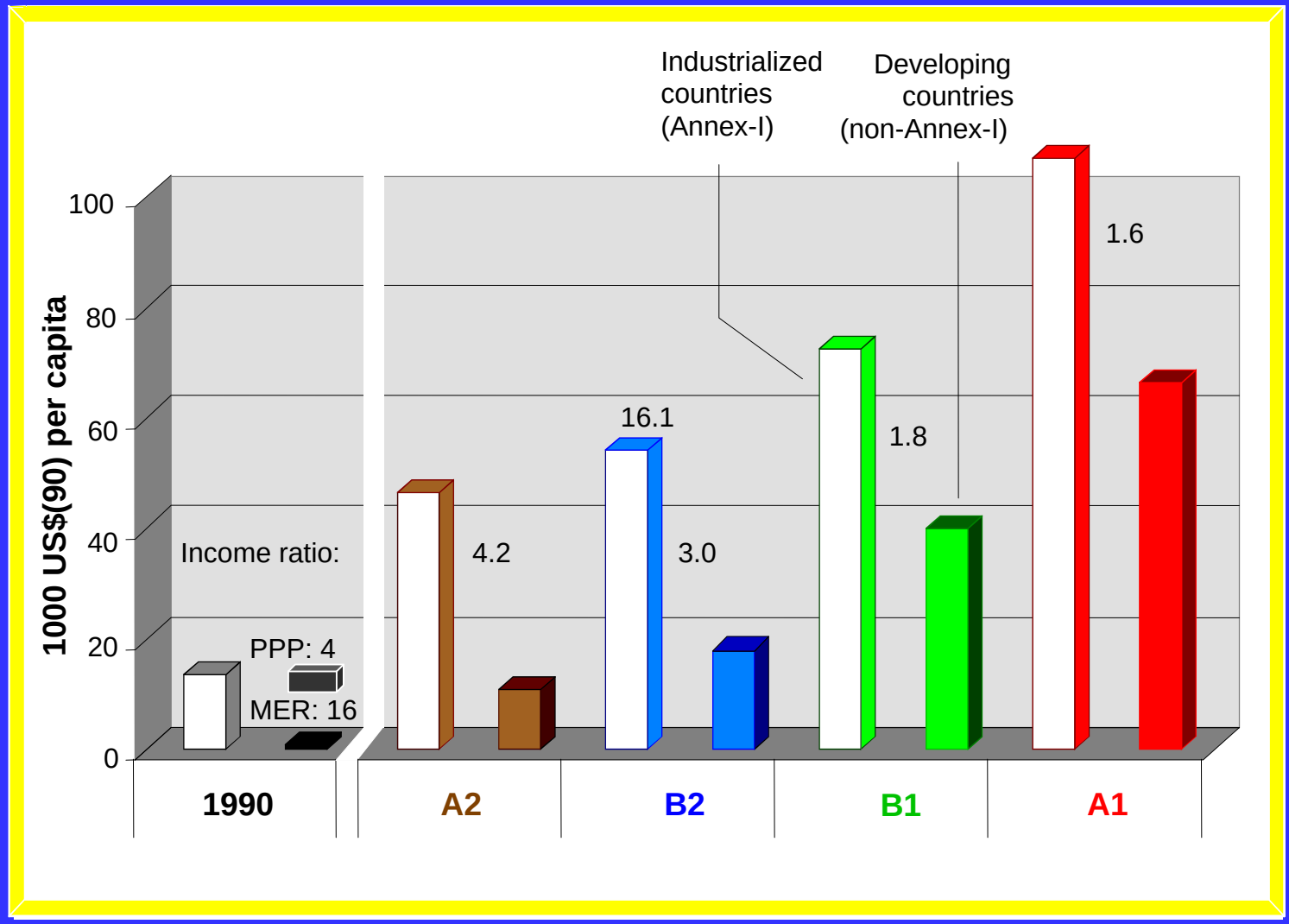
"Continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century"

Source: IPCC-AR4, 2007

IPCC SRES Storylines and Scenarios



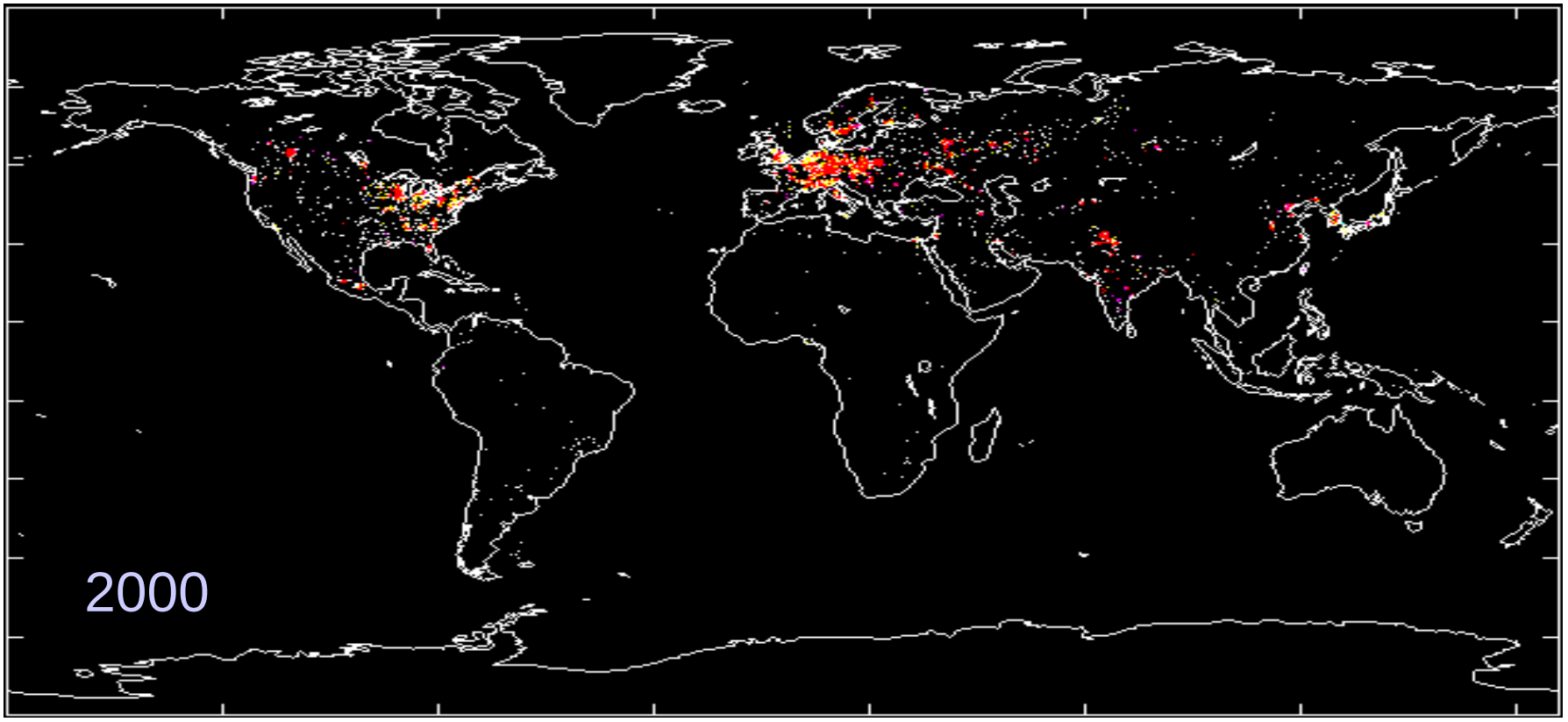
Per Capita Income Across SRES Scenarios



Nakicenovic *et al.*

IIASA 2000

Night Lights



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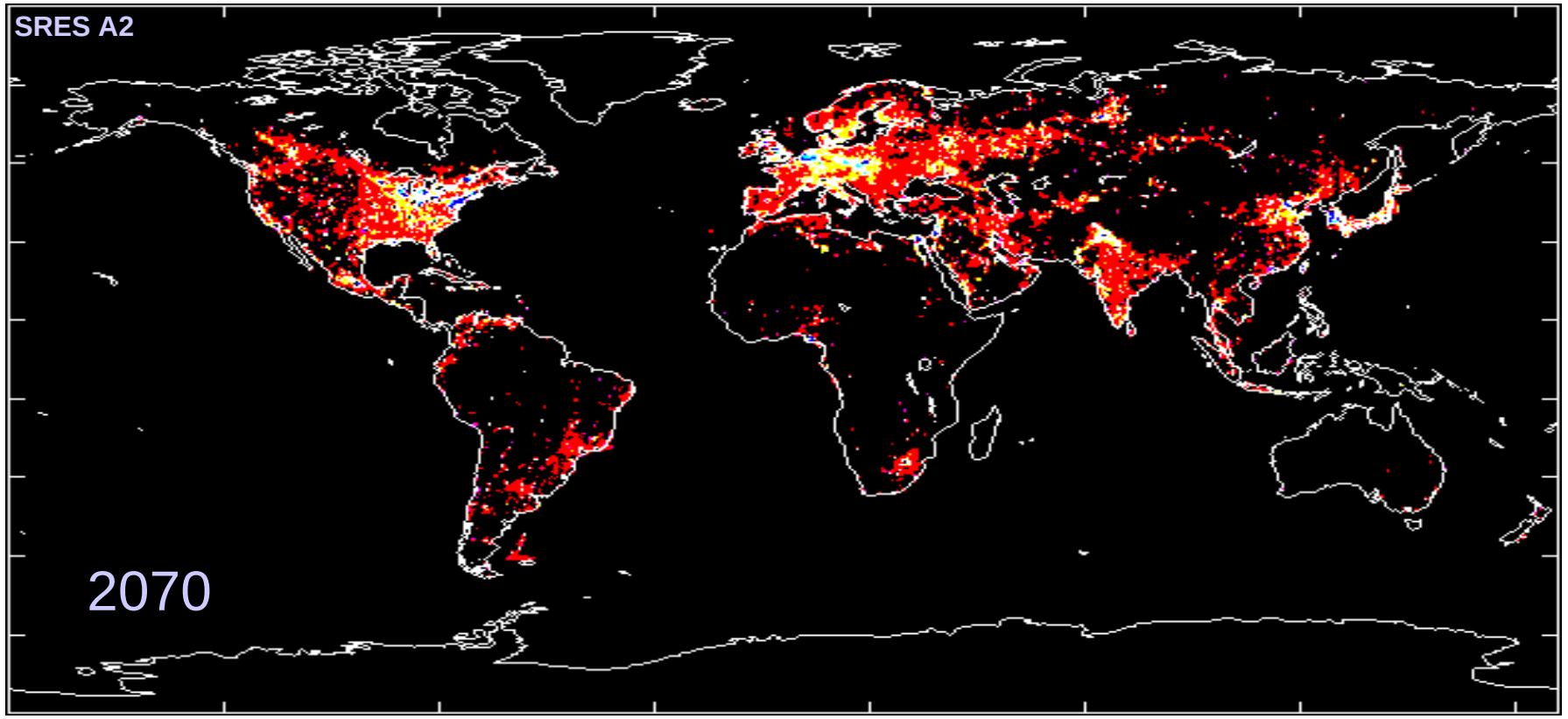
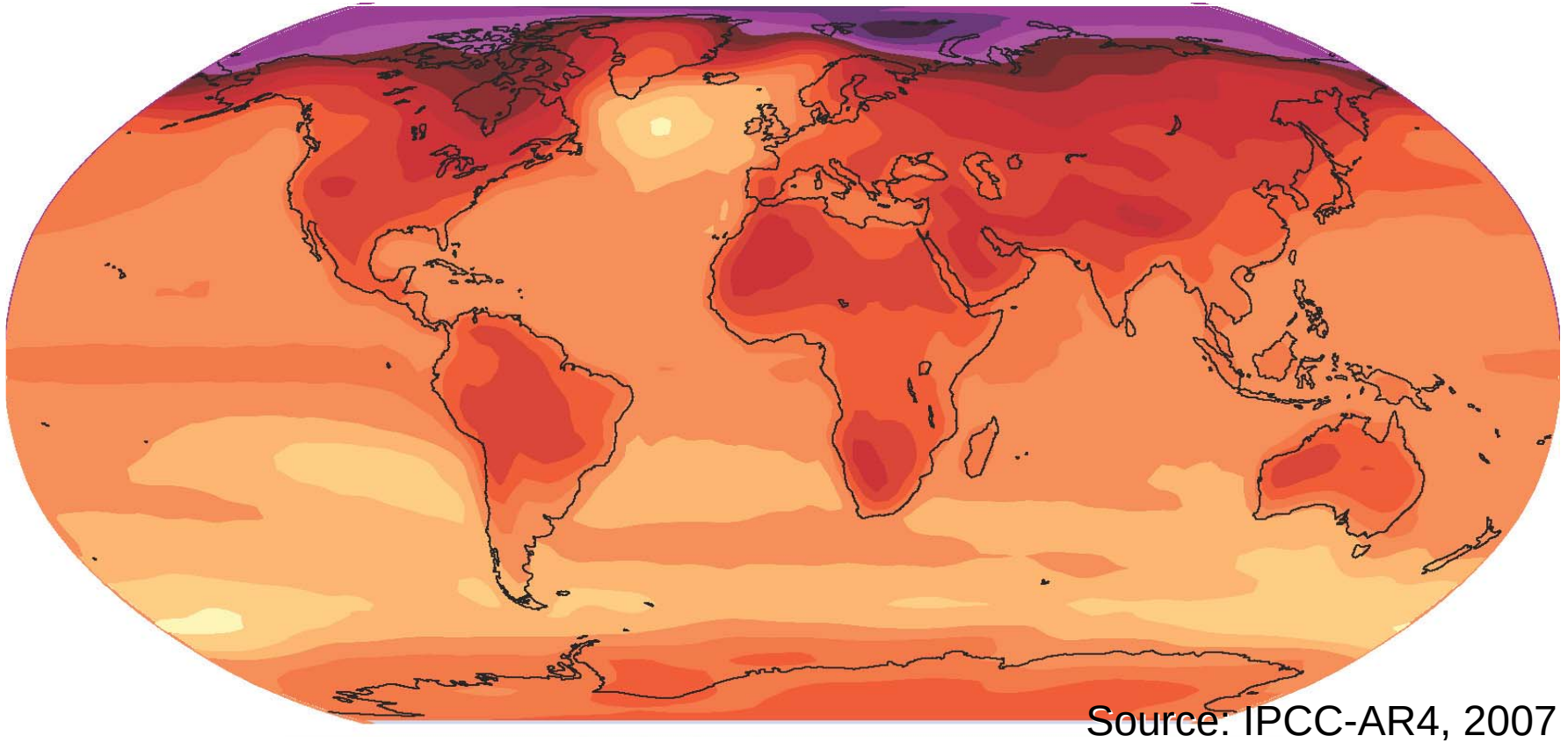
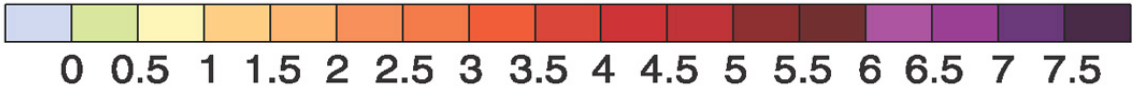


Surface Temperature

A1B, 2090-2099 relative to 1980-1999

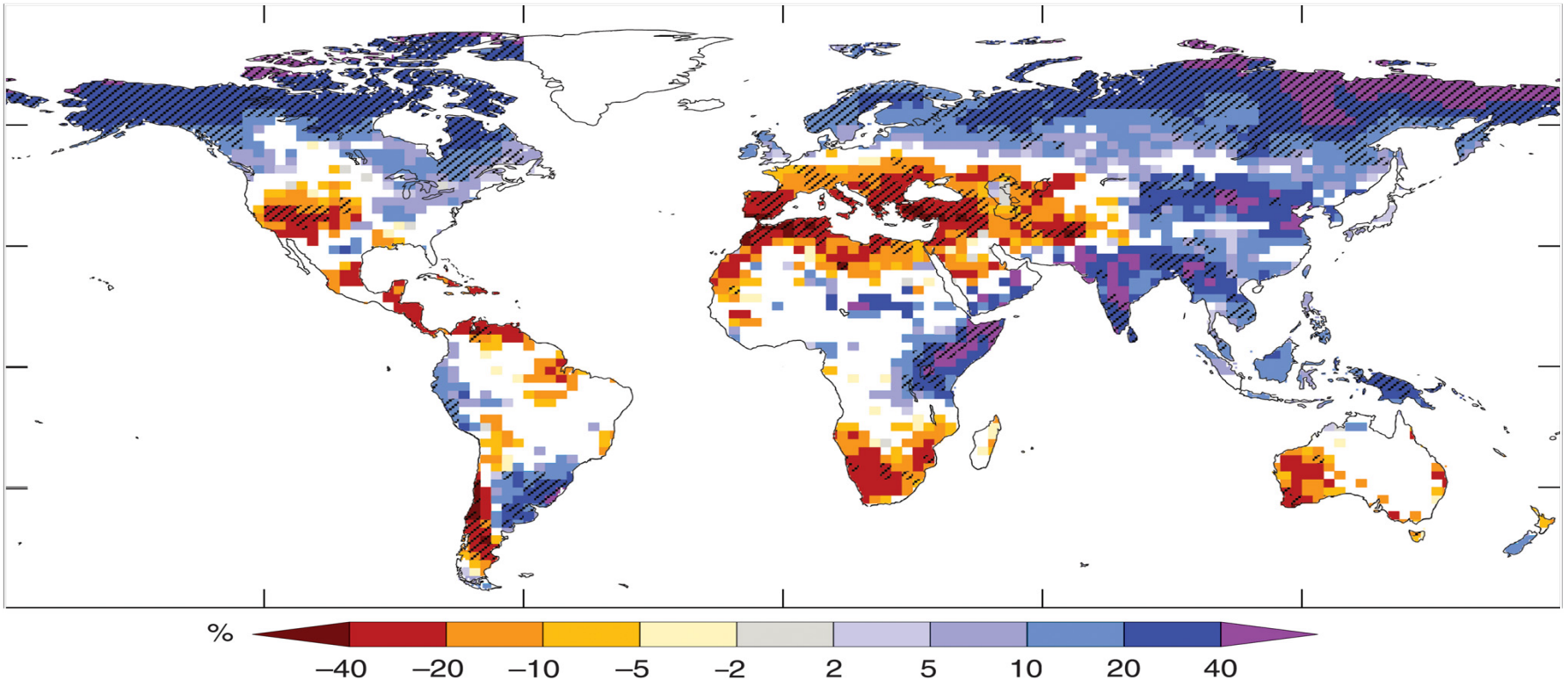


Source: IPCC-AR4, 2007



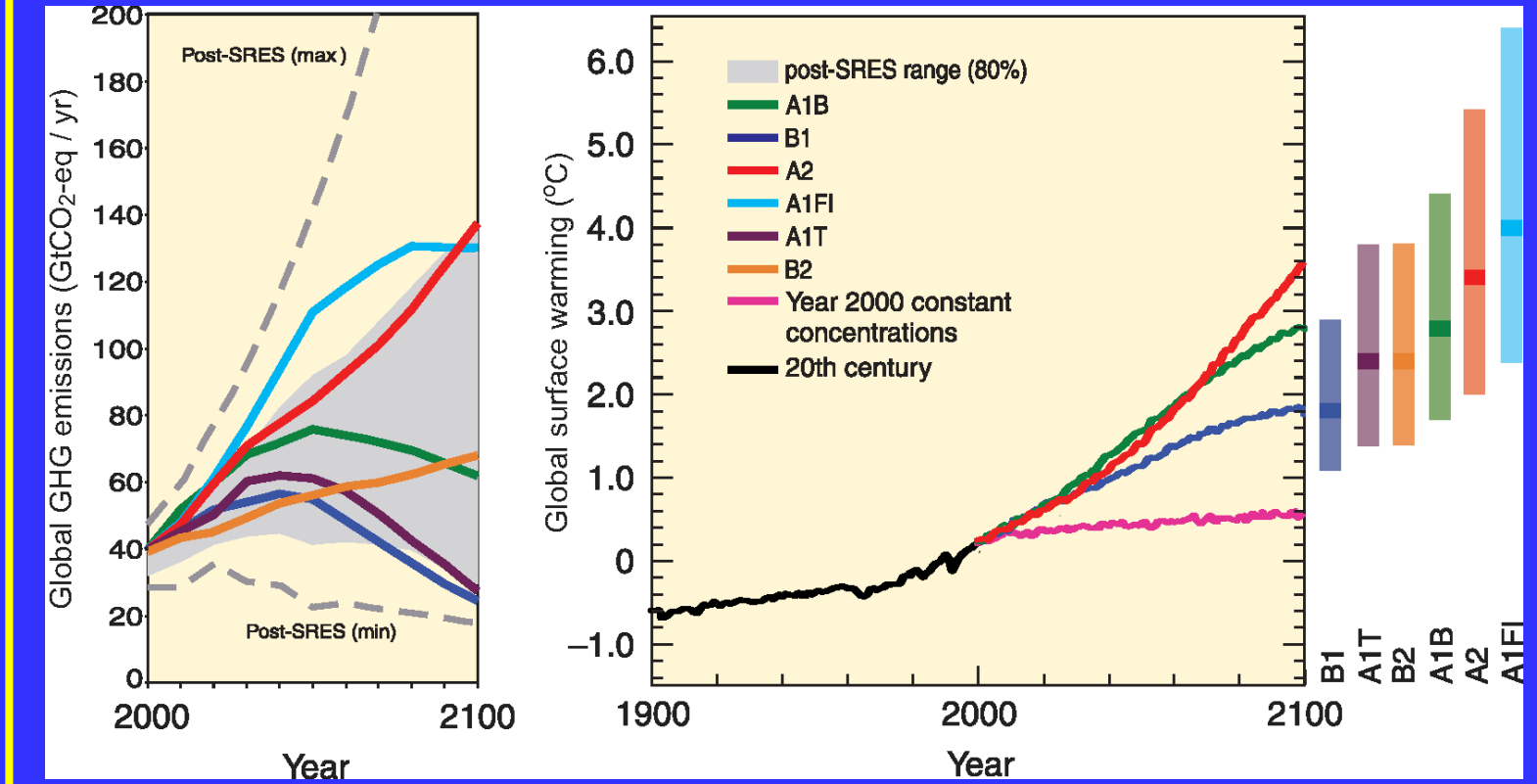
Water Availability (Runoff)

A1B, 2090-2099 relative to 1980-1999

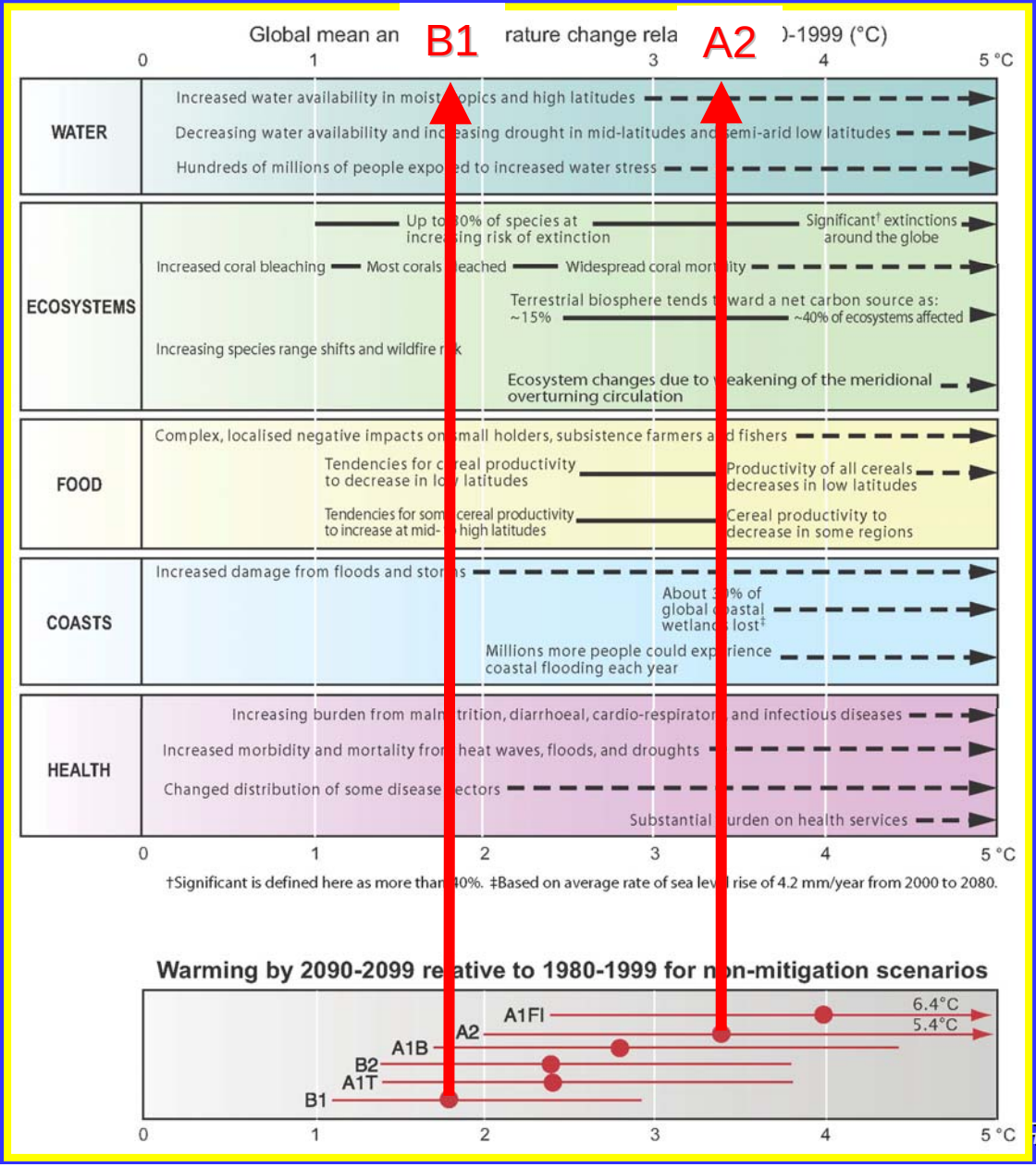


CO2-eq. Emissions and Temperature Change

Scenarios without additional climate policy



Impacts & Temperature Change

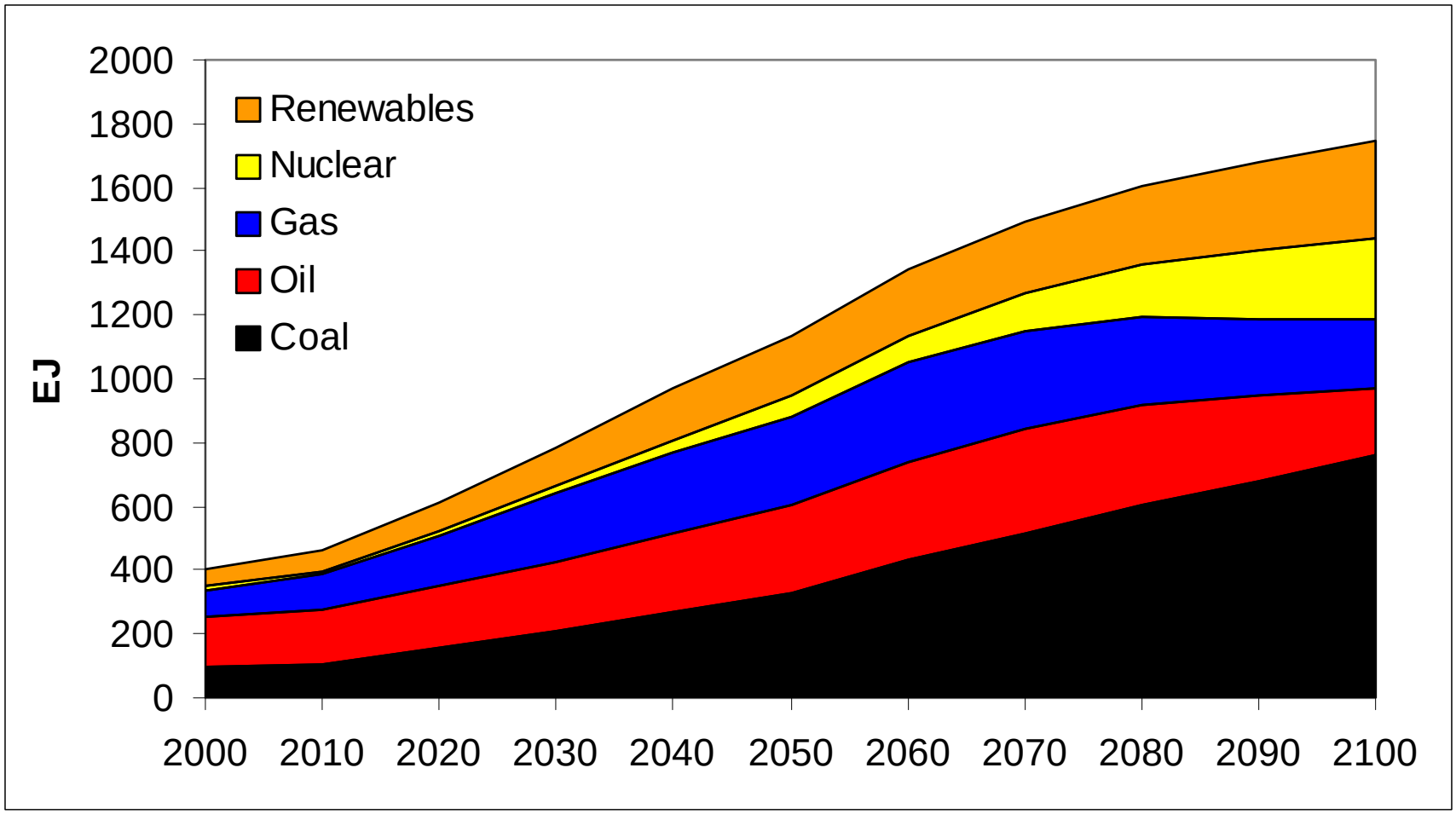


Impacts vary by:

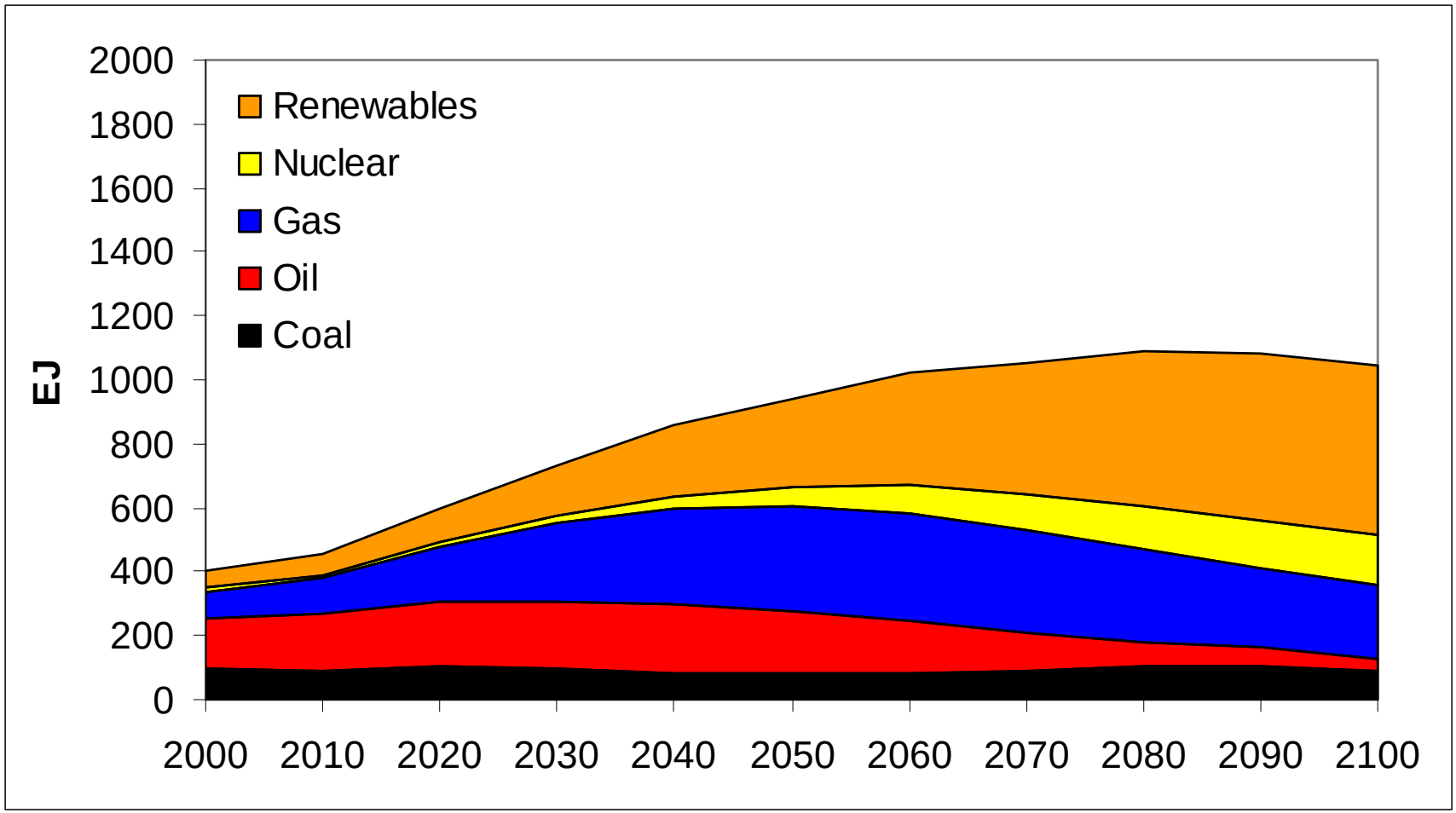
- Extend of adaptation
- Rate of T-change
- Socio-economic pathway (vulnerability)

Source:
IPCC-AR4, 2007

Global Primary Energy – A2r

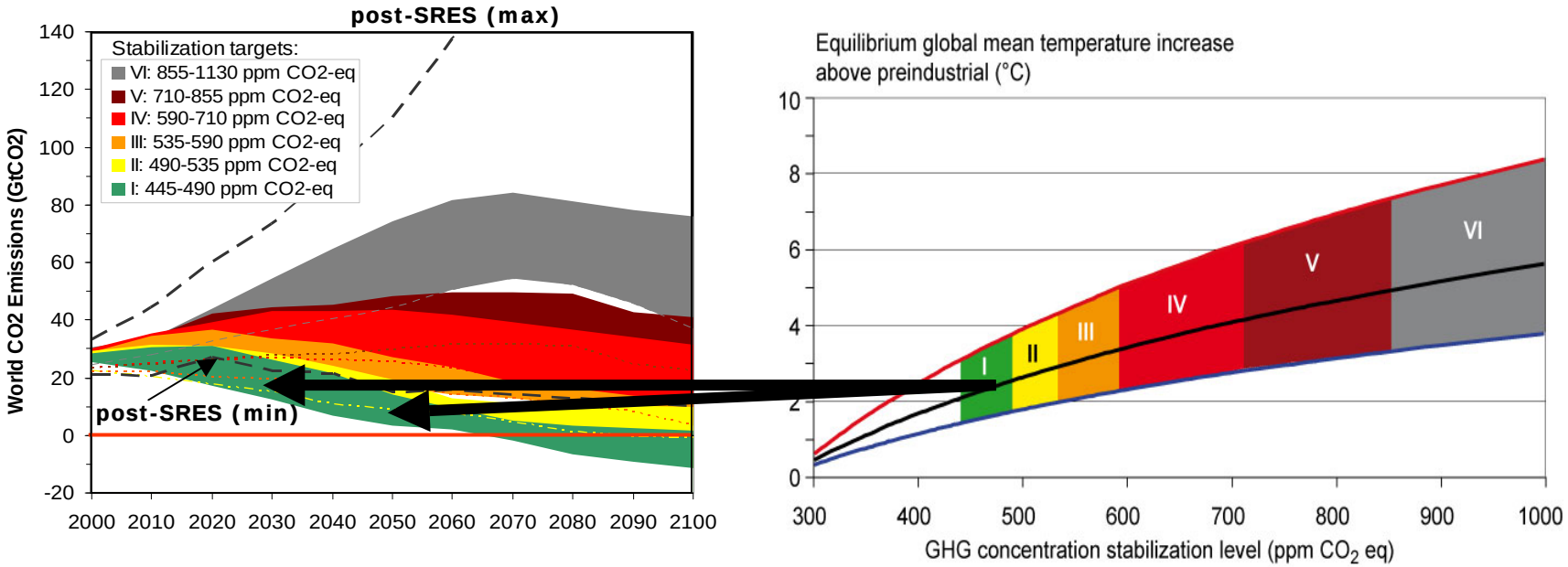


Global Primary Energy – B1



Long-term mitigation: stabilisation and equilibrium global mean temperatures

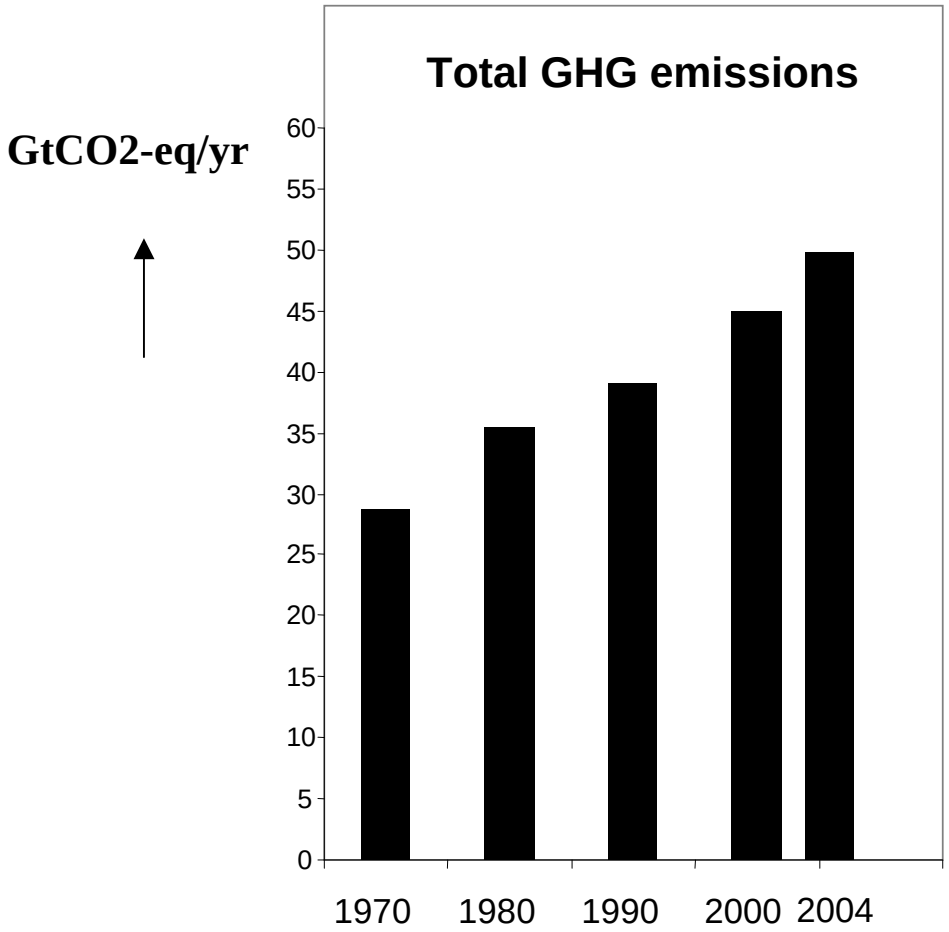
- The lower the stabilisation level the earlier global CO_2 emissions have to peak



Multigas and CO2 only studies combined

WMO UNEP

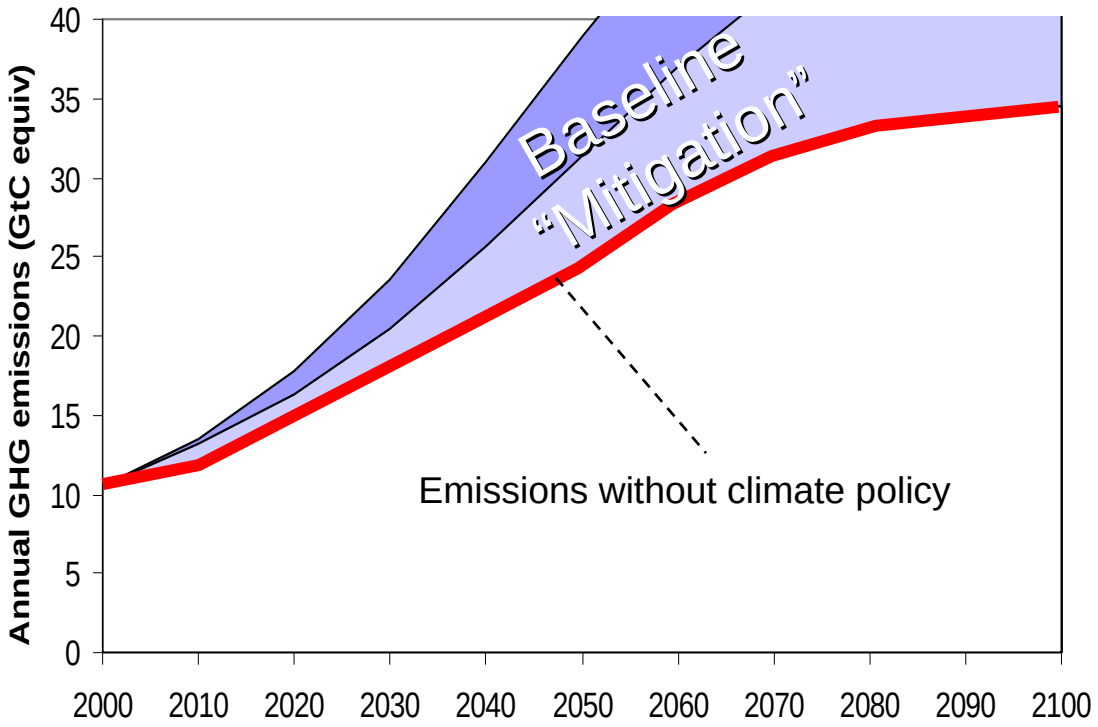
Between 1970 and 2004 global greenhouse gas emissions have increased by 70 %

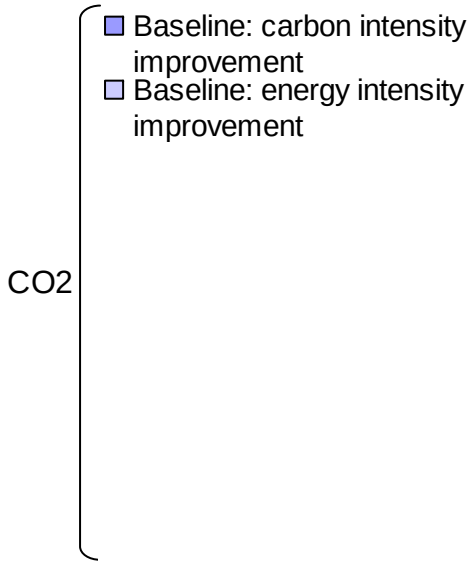


WMO

UNEP

World GHG Emissions
IIASA A2r Scenario





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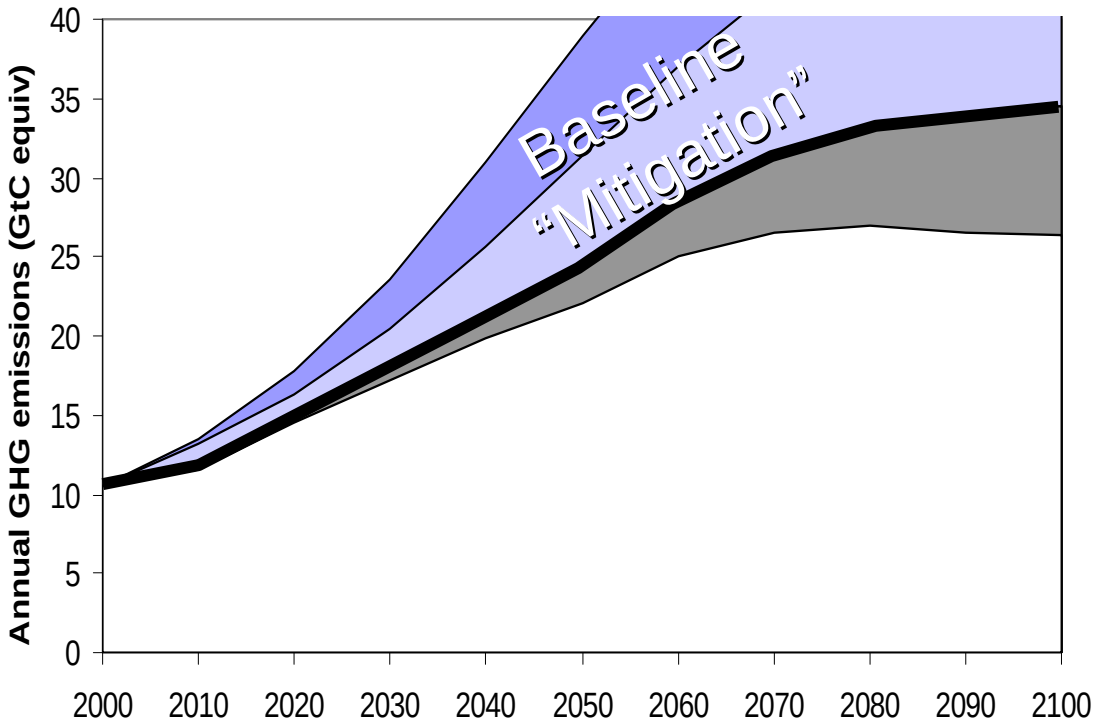

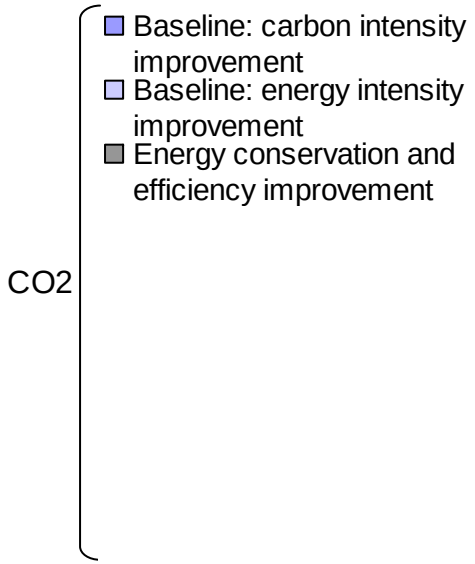

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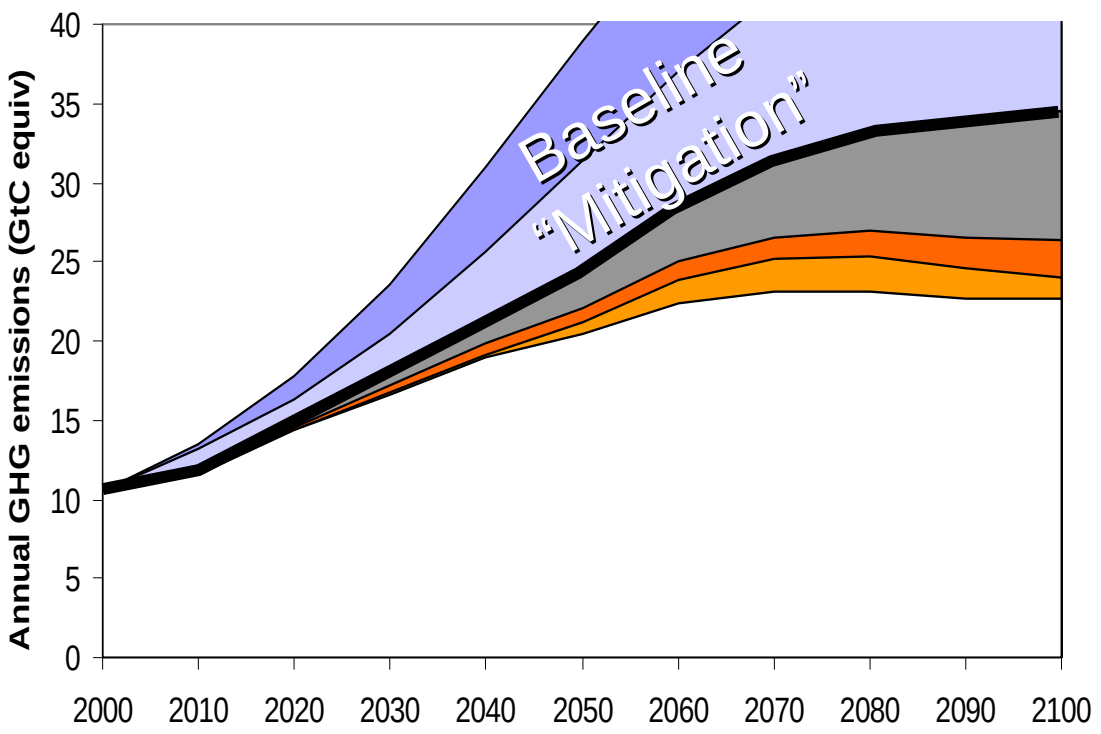
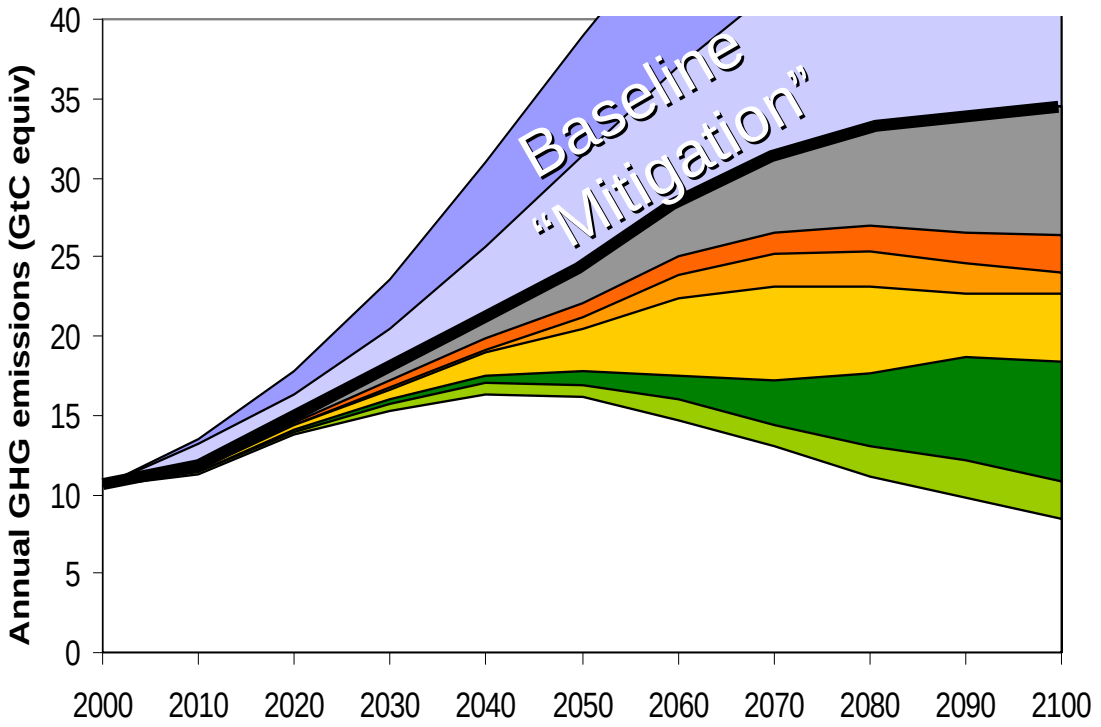


CO2

- Baseline: carbon intensity improvement
- Baseline: energy intensity improvement
- Energy conservation and efficiency improvement
- Switch to natural gas
- Fossil CCS

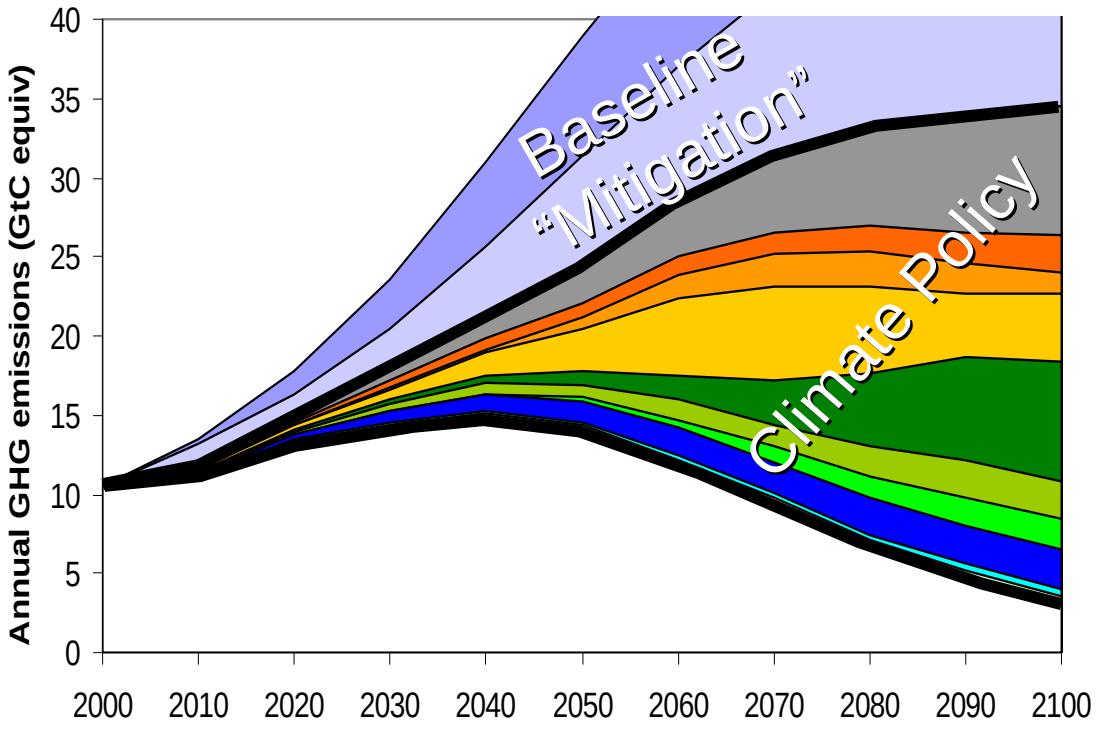
World GHG Emissions
IIASA A2r Scenario

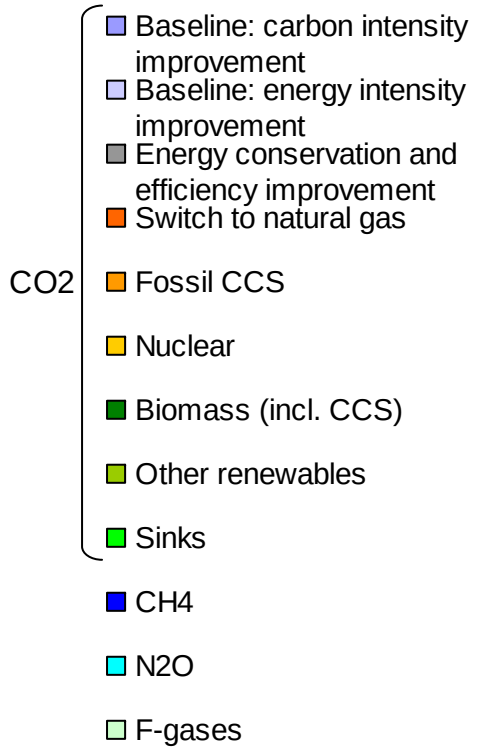


CO2

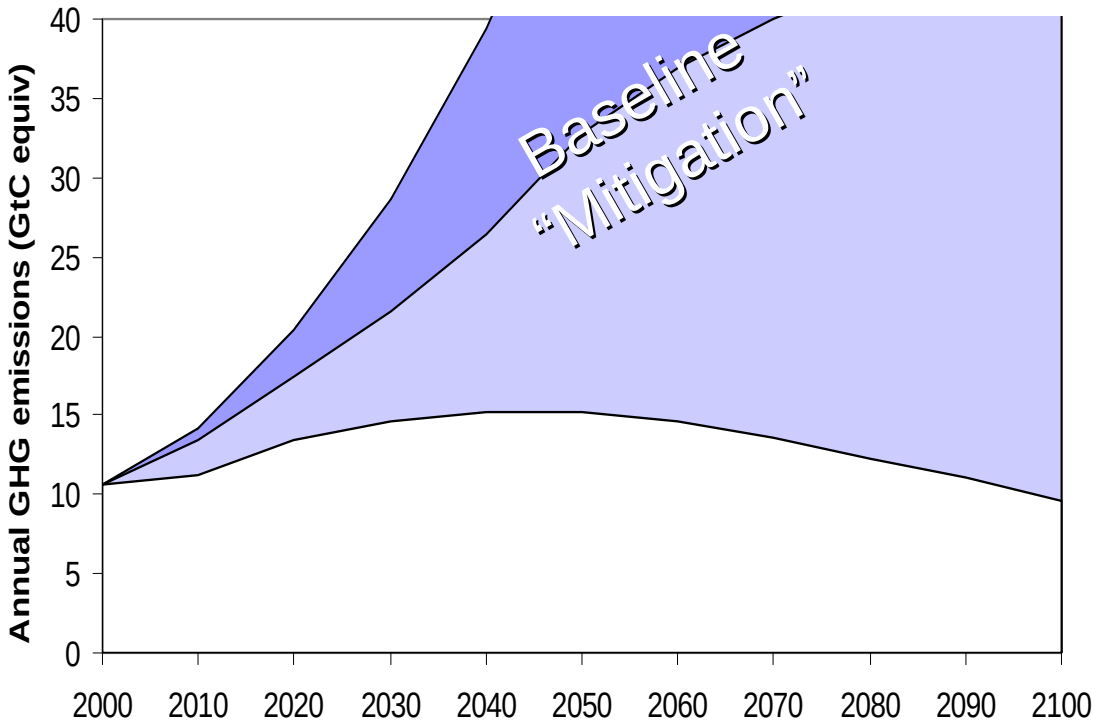
- Baseline: carbon intensity improvement
- Baseline: energy intensity improvement
- Energy conservation and efficiency improvement
- Switch to natural gas
- Fossil CCS
- Nuclear
- Biomass (incl. CCS)
- Other renewables

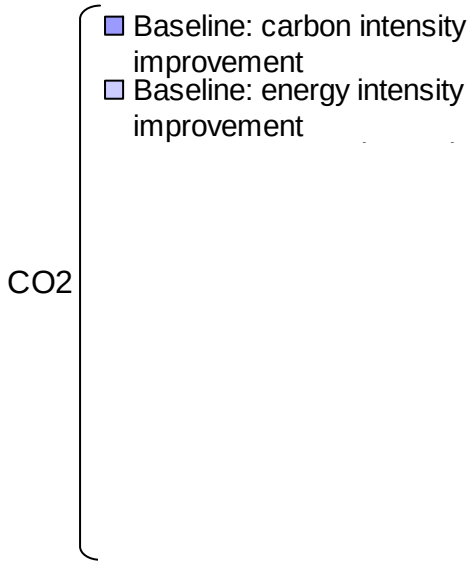
World GHG Emissions
IIASA A2r Scenario



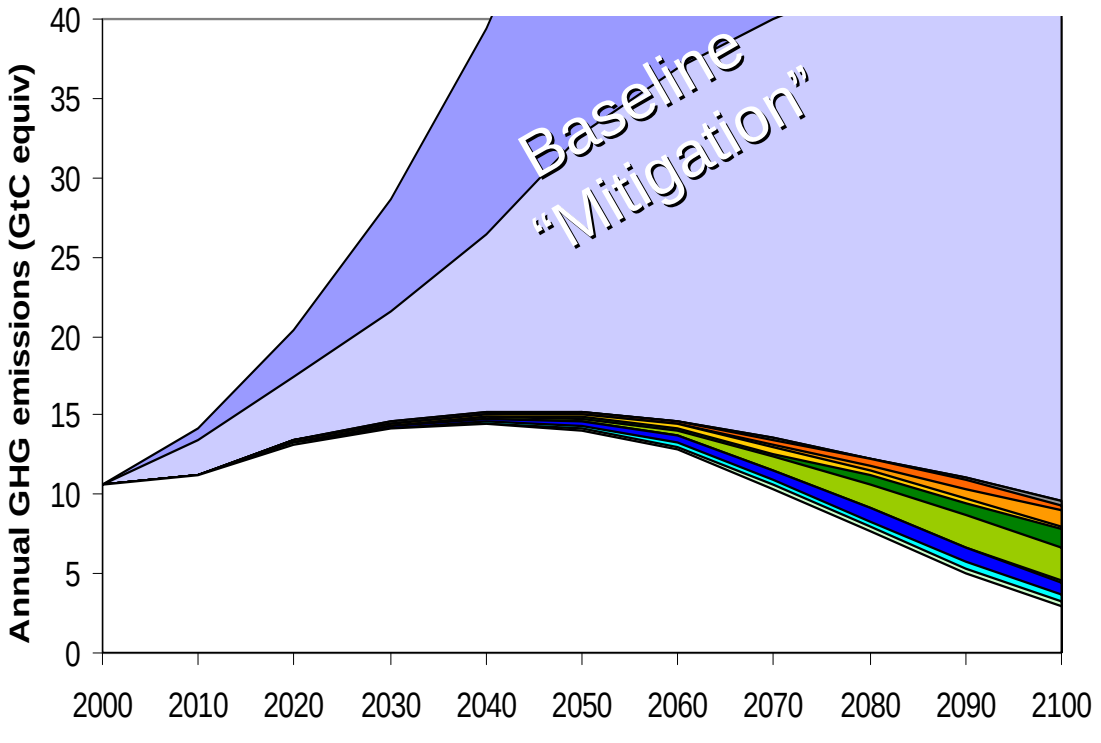


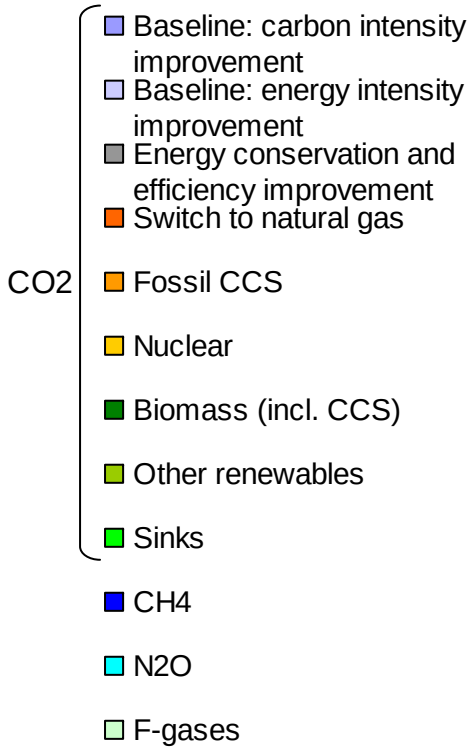
World GHG Emissions
IIASA B1 Scenario



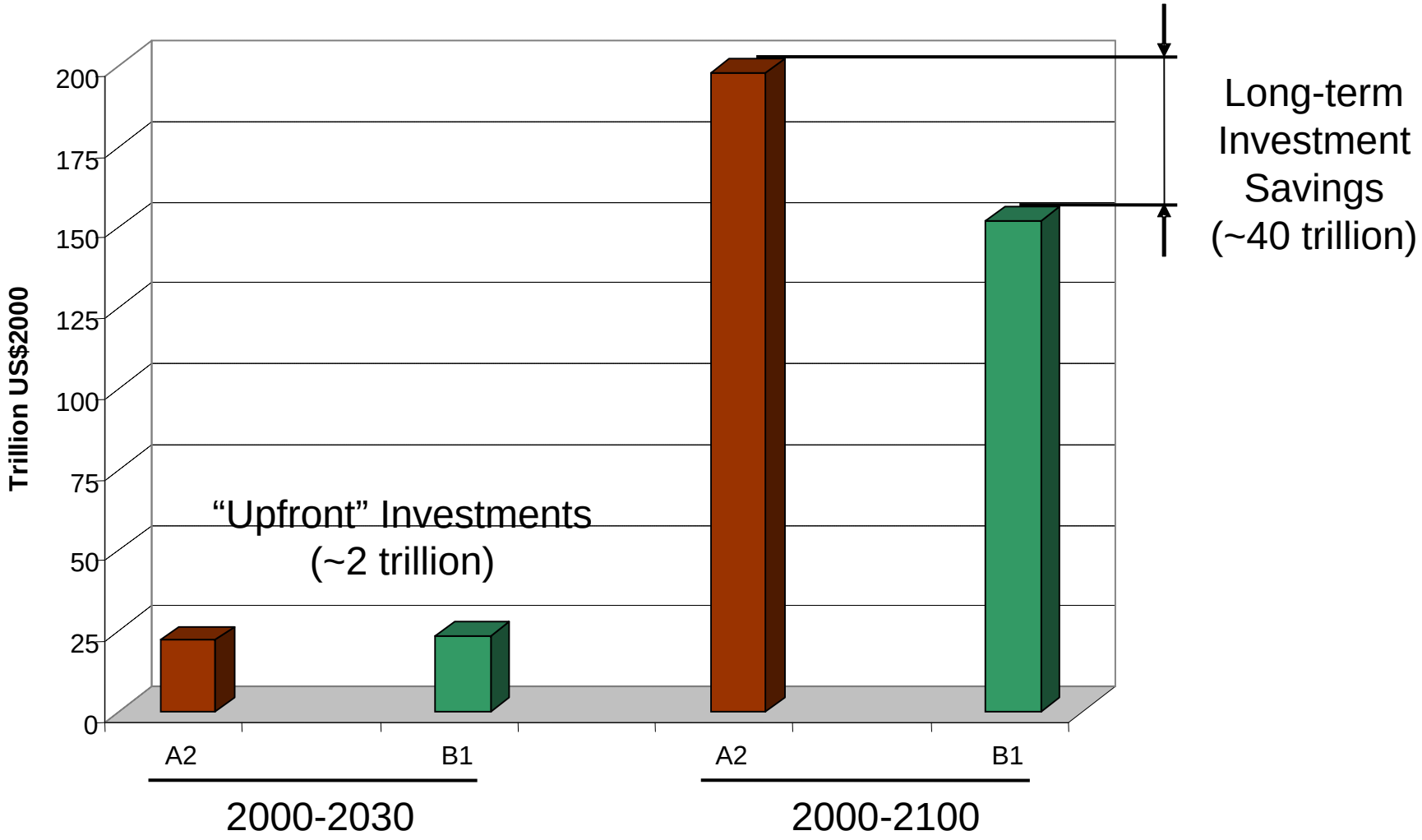


World GHG Emissions
IIASA B1 Scenario





Total Energy-related Investments (World, short & long-term)



What are the macro-economic costs in 2030?

Stabilization levels (ppm CO_2-eq)	Median GDP reduction [1] (%)	Range of GDP reduction [2] (%)	Reduction of average annual GDP growth rates [3] (percentage points)
590-710	0.2	-0.6 – 1.2	< 0.06
535-590	0.6	0.2 – 2.5	<0.1
445-535 [4]	Not available	< 3	< 0.12

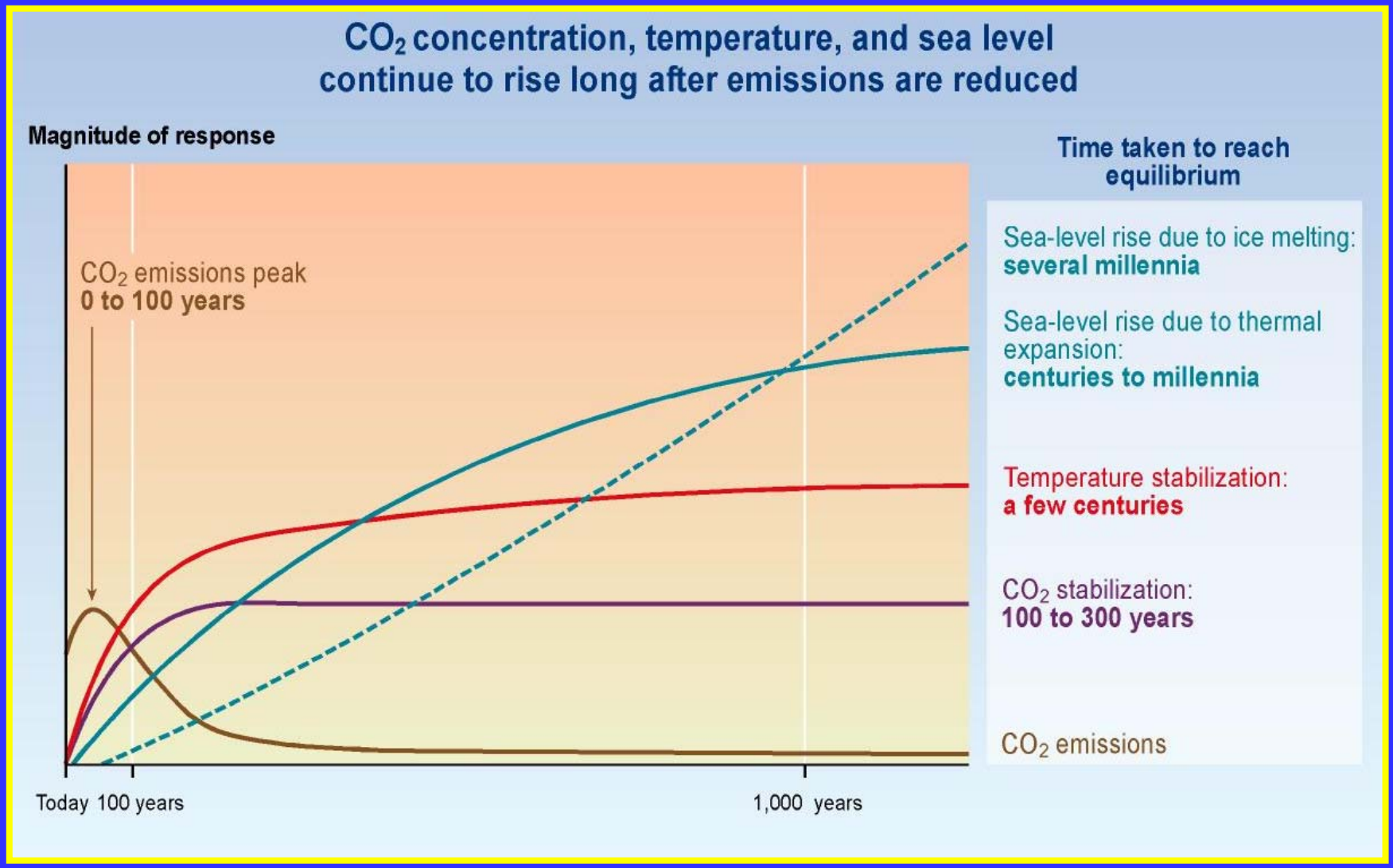
[1] This is global GDP based market exchange rates.
[2] The median and the 10th and 90th percentile range of the analyzed data are given.
[3] The calculation of the reduction of the annual growth rate is based on the average reduction during the period till 2030 that would result in the indicated GDP decrease in 2030.
[4] The number of studies that report GDP results is relatively small and they generally use low baselines.

WMO UNEP

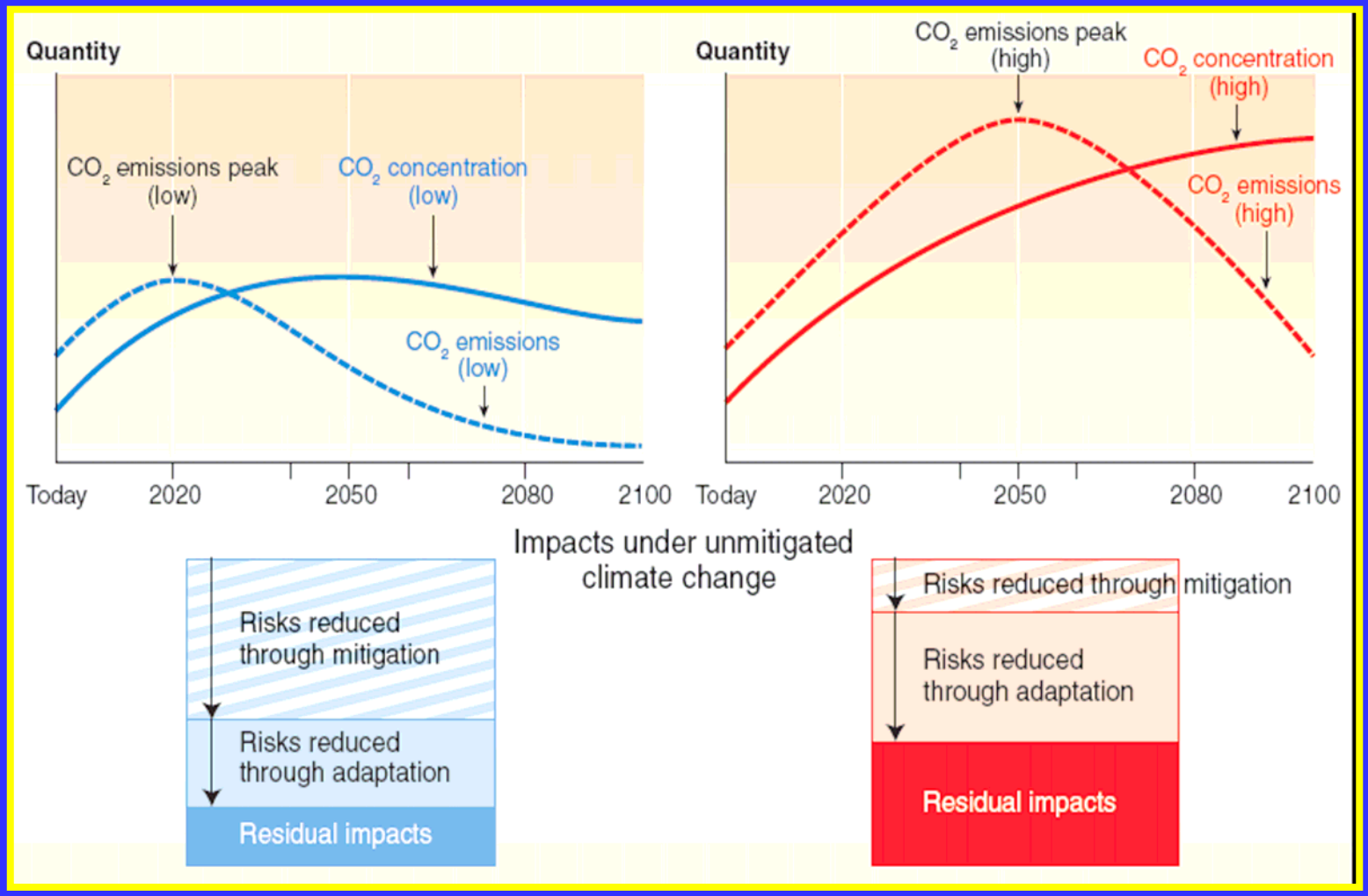
Some Impacts Appear Unavoidable (even under most stringent mitigation)

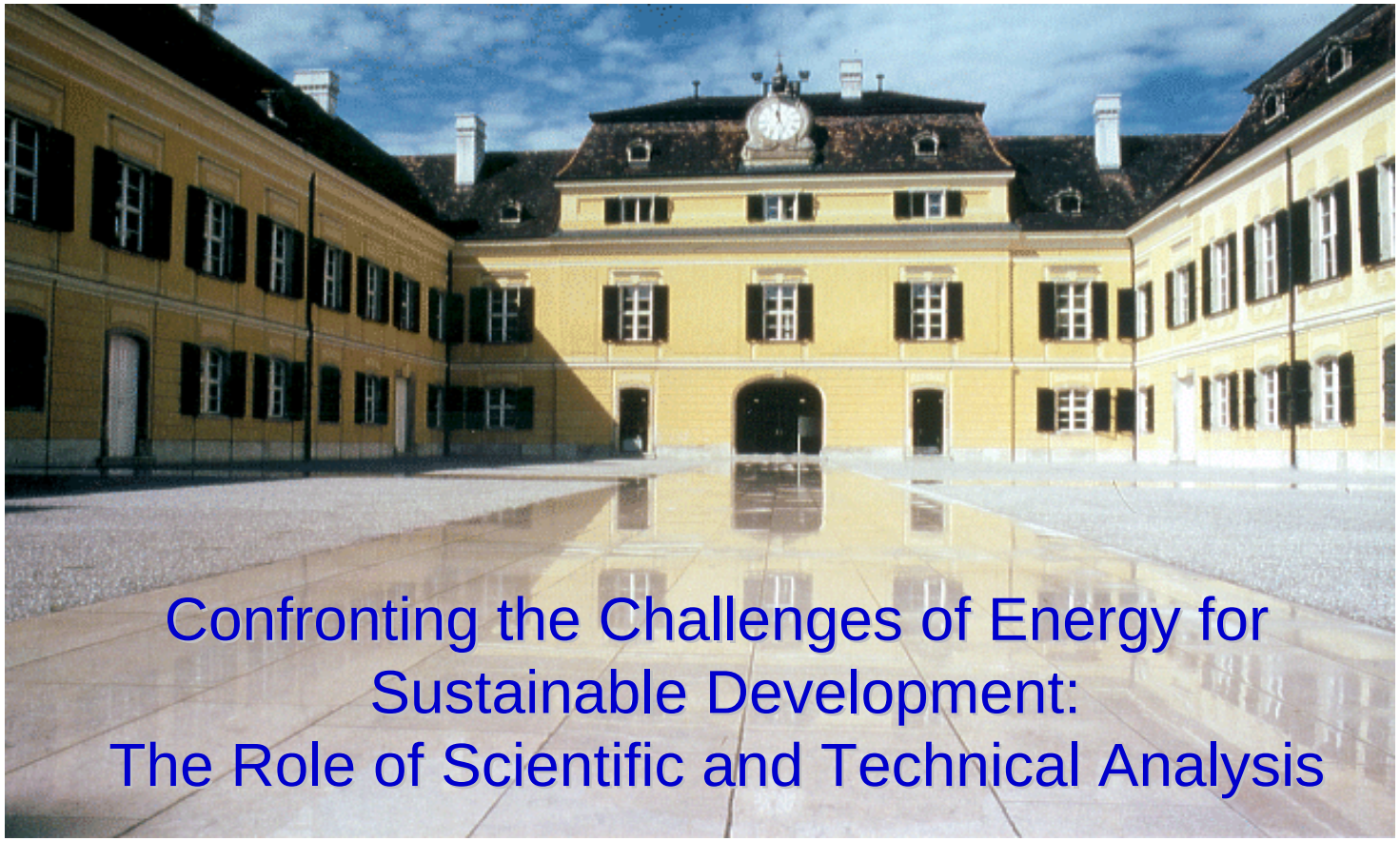
- Coral bleaching
- Species range shift
- Drought risk and water scarcity (Mediterranean, and particularly in the dry tropics and subtropics)
- Risk of wildfire
- Coastal damage from floods combined with sea level rise

Timescales


CO_2 concentration, temperature, and sea level continue to rise long after emissions are reduced
Magnitude of response
CO_2 emissions peak
0 to 100 years
Today
100 years
1,000 years
Time taken to reach equilibrium
Sea-level rise due to ice melting:
several millennia
Sea-level rise due to thermal expansion:
centuries to millennia
Temperature stabilization:
a few centuries
CO_2 stabilization:
100 to 300 years
CO_2 emissions

Mitigation and Adaptation Need to Complement Each Other





Confronting the Challenges of Energy for Sustainable Development: The Role of Scientific and Technical Analysis

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