



POTSDAM INSTITUTE FOR  
CLIMATE IMPACT RESEARCH

Prof. Dr. Ottmar Edenhofer

# Mitigation and Adaptation

Our Common Future  
Hannover, 4th November 2010

Volkswagen Stiftung



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



Working Group III  
Mitigation of Climate Change



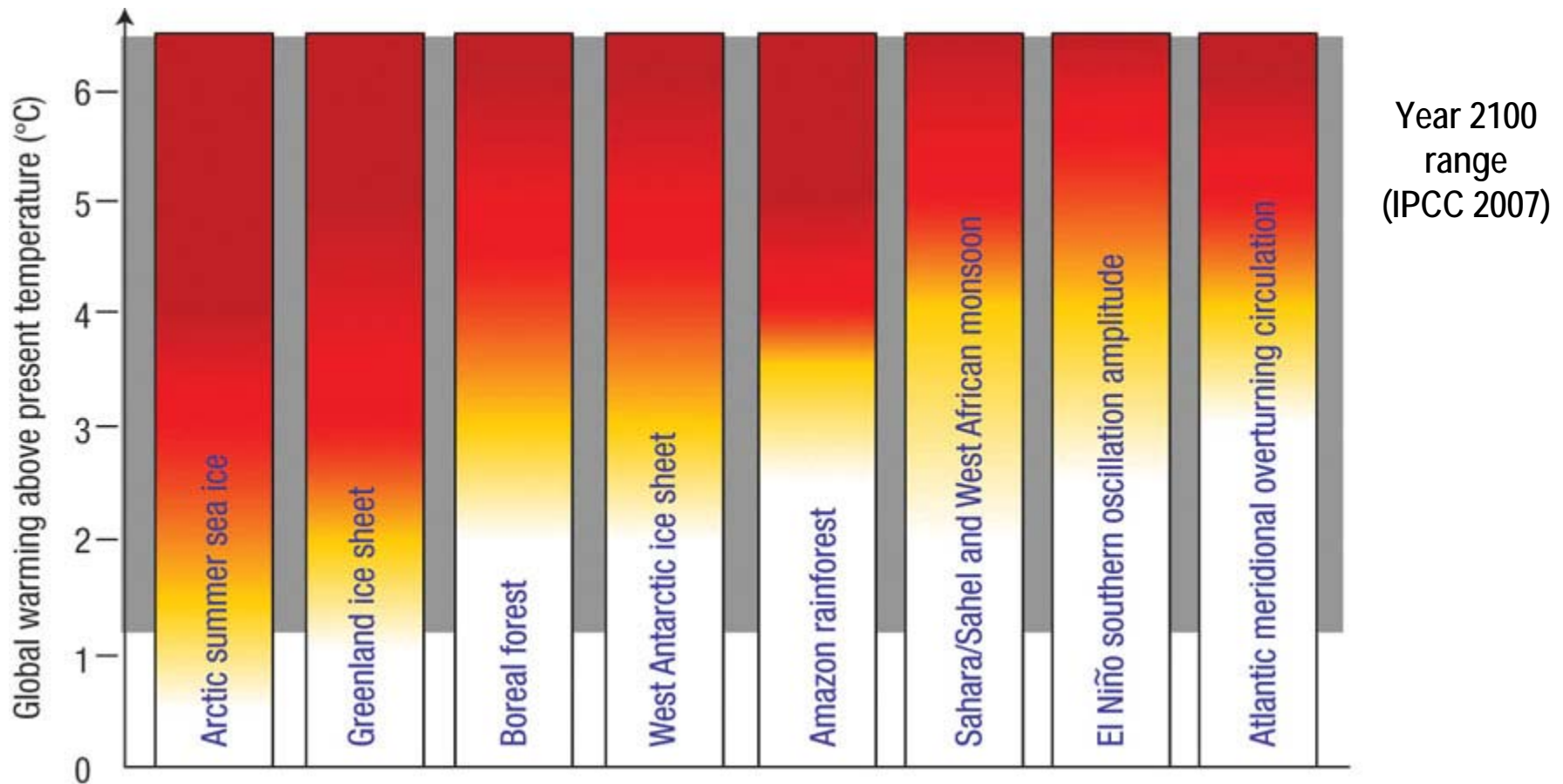
Technische Universität Berlin

# Tipping Points in the Earth System



T. M. Lenton & H. J. Schellnhuber (Nature Reports Climate Change, 2007)

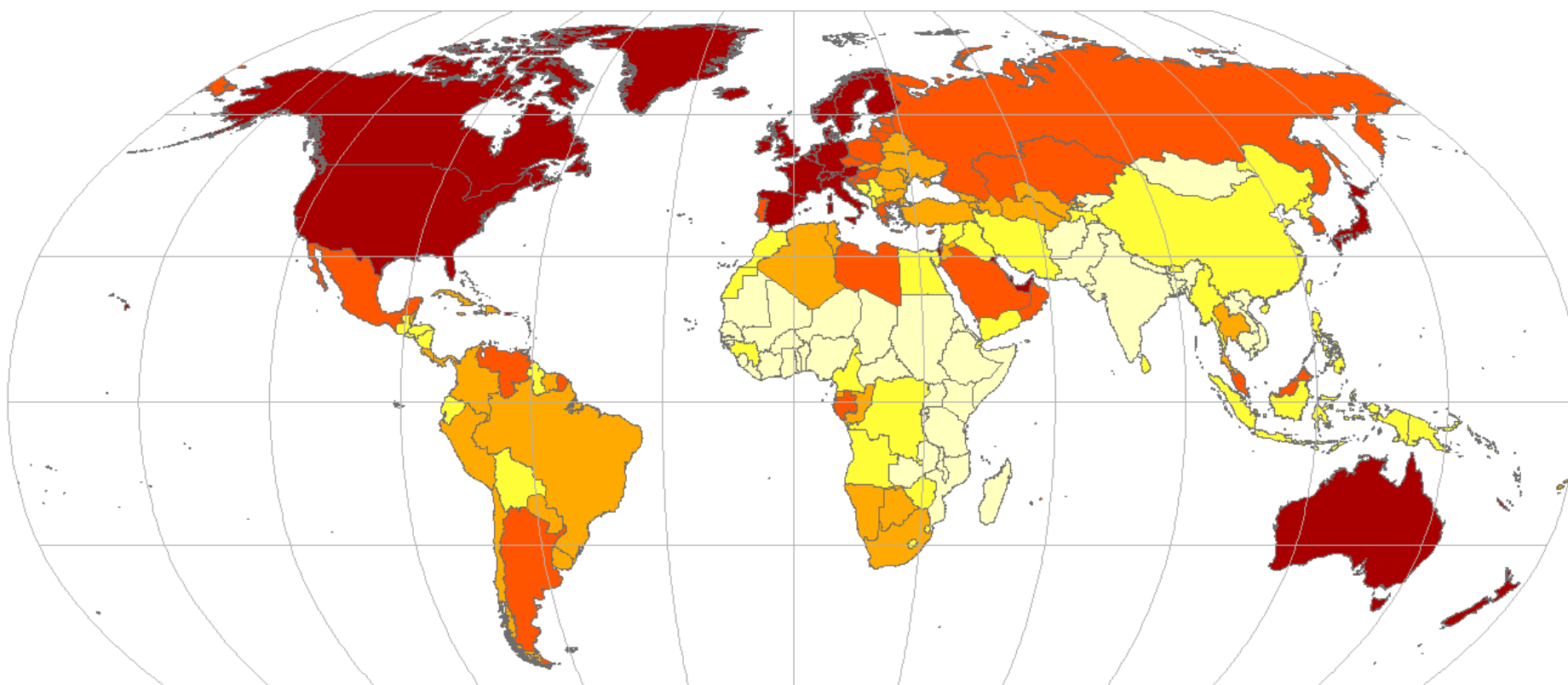
# Burning Embers



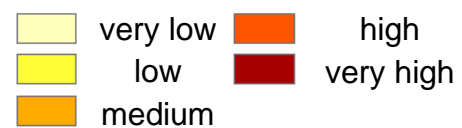
Potential policy-relevant tipping elements that could be triggered by global warming this century, with shading indicating their uncertain thresholds. For each threshold, the transition from white to yellow indicates a lower bound on its proximity, and the transition from yellow to red, an upper bound. The degree of uncertainty is represented by the spread of the colour transition.

T. M. Lenton & H. J. Schellnhuber (Nature Reports Climate Change, 2007)

# World Map of Wealth

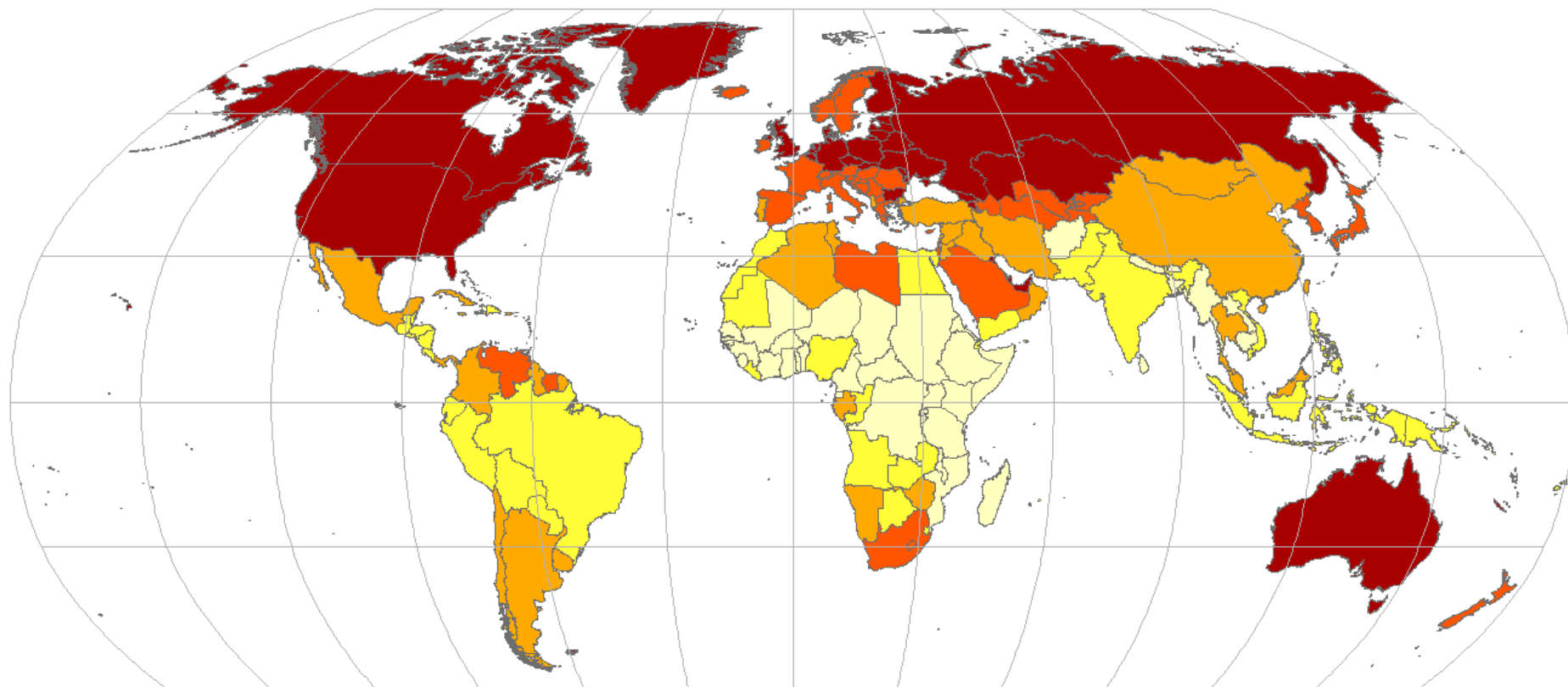


## Capital stock per person

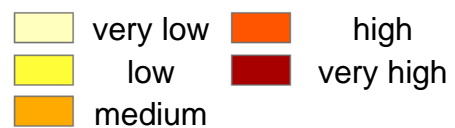


Source: Füssel (2007)

## World Map of Carbon Debt

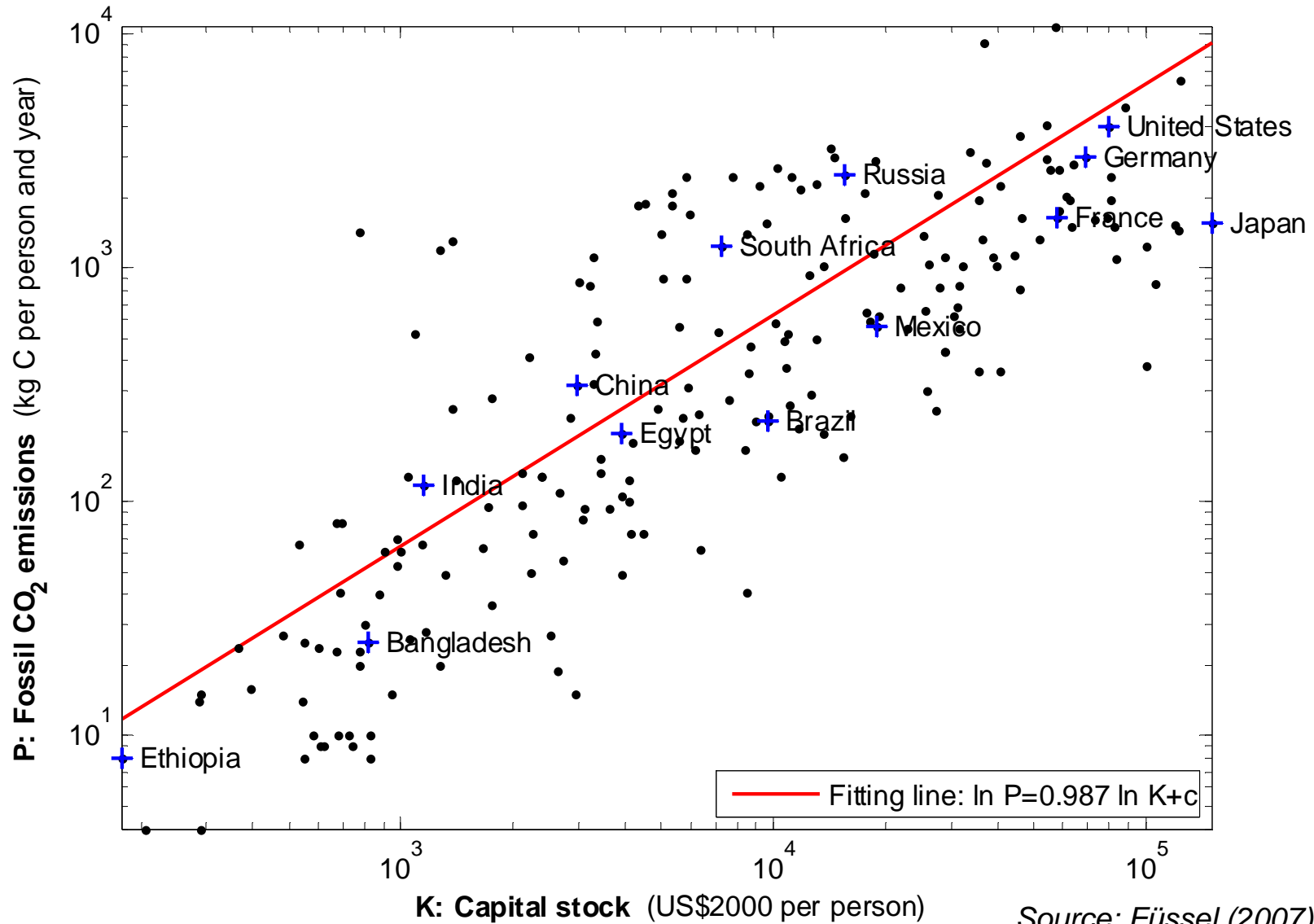


Carbon emissions per person from fossil fuel burning (1950-2003)



Source: *Füssel (2007)*

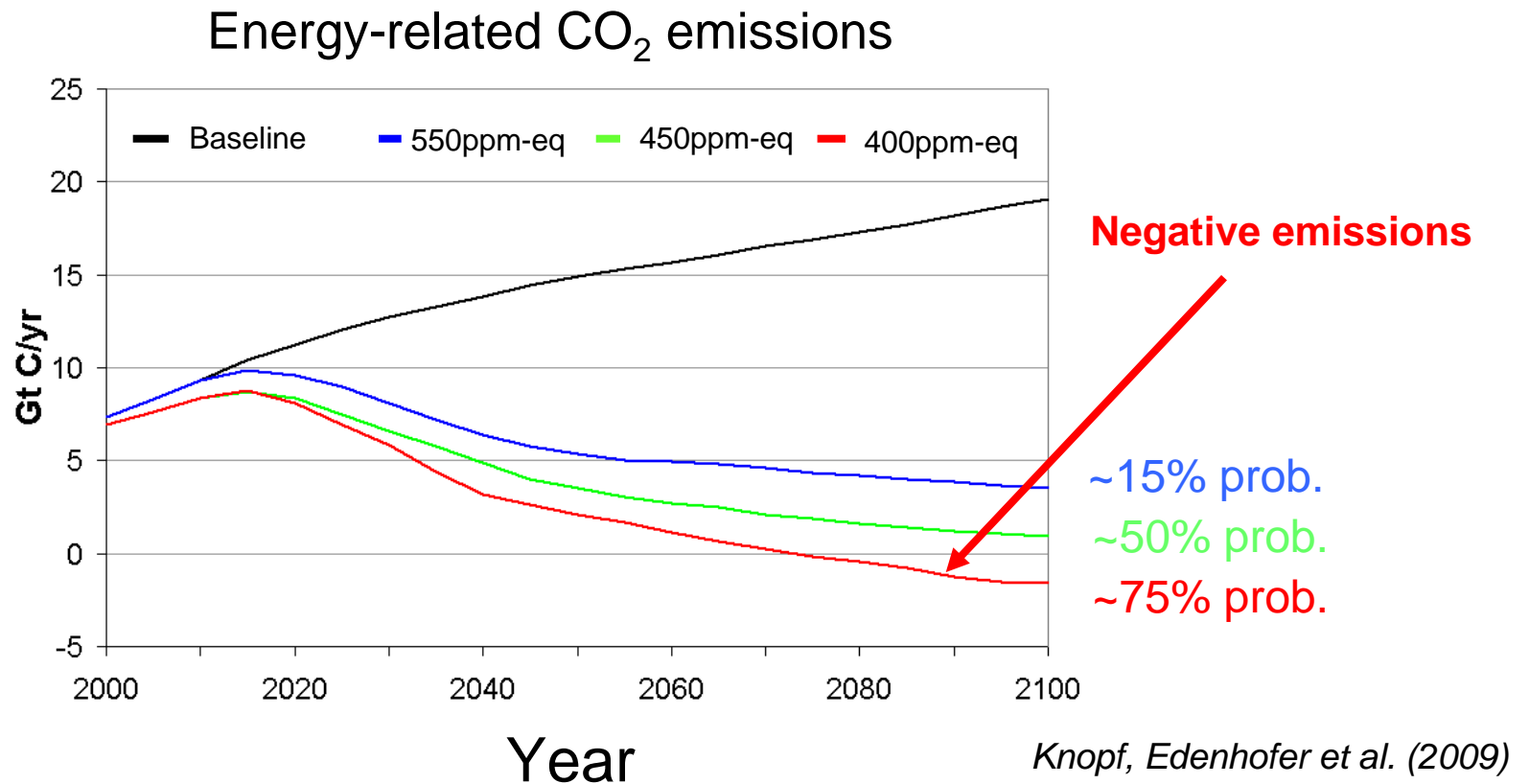
# Carbon Debt and Wealth



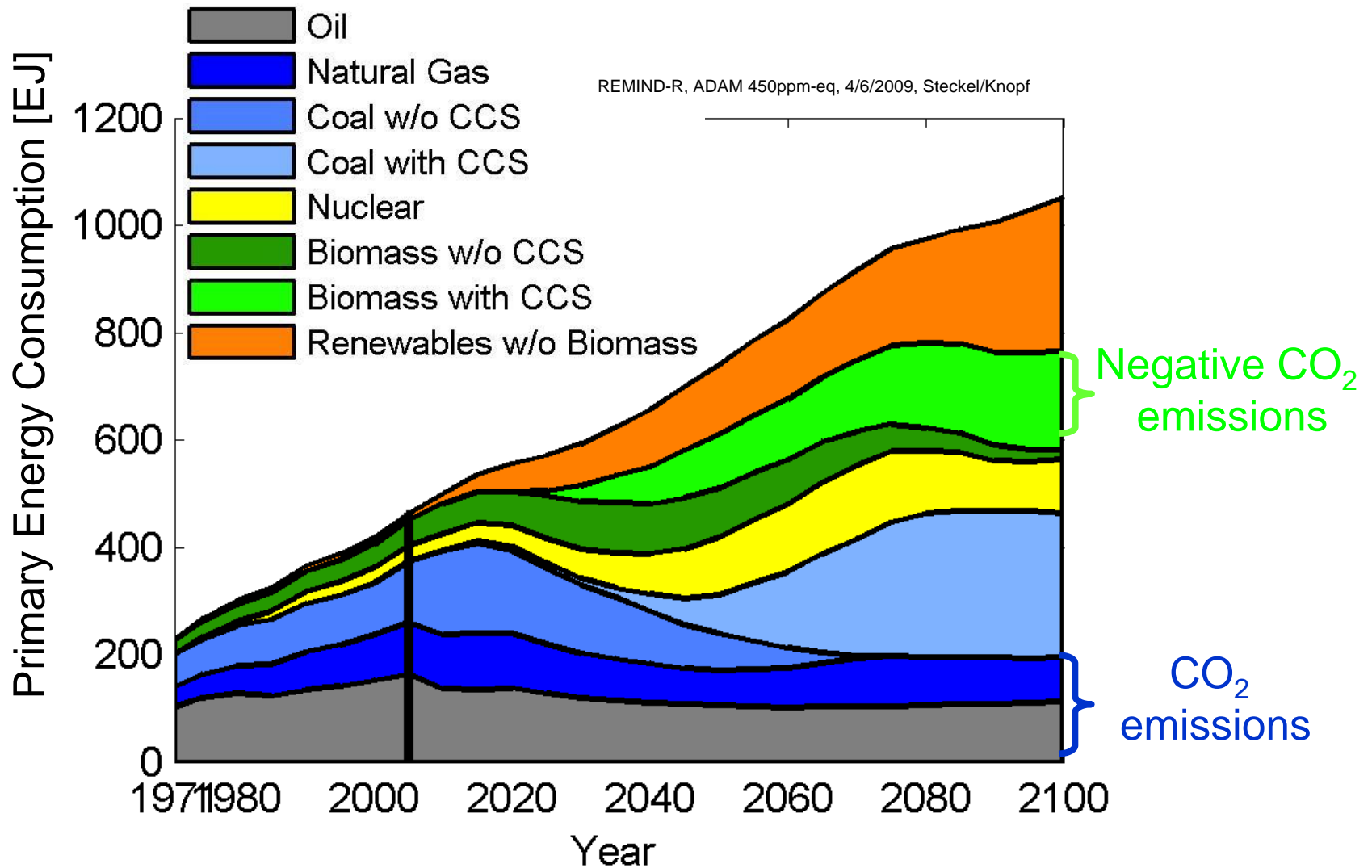
# The Economics of Atmospheric Stabilisation



3 stabilisation targets with different probabilities to reach the 2° target:  
550ppm-eq, 450ppm-eq, 400ppm-eq

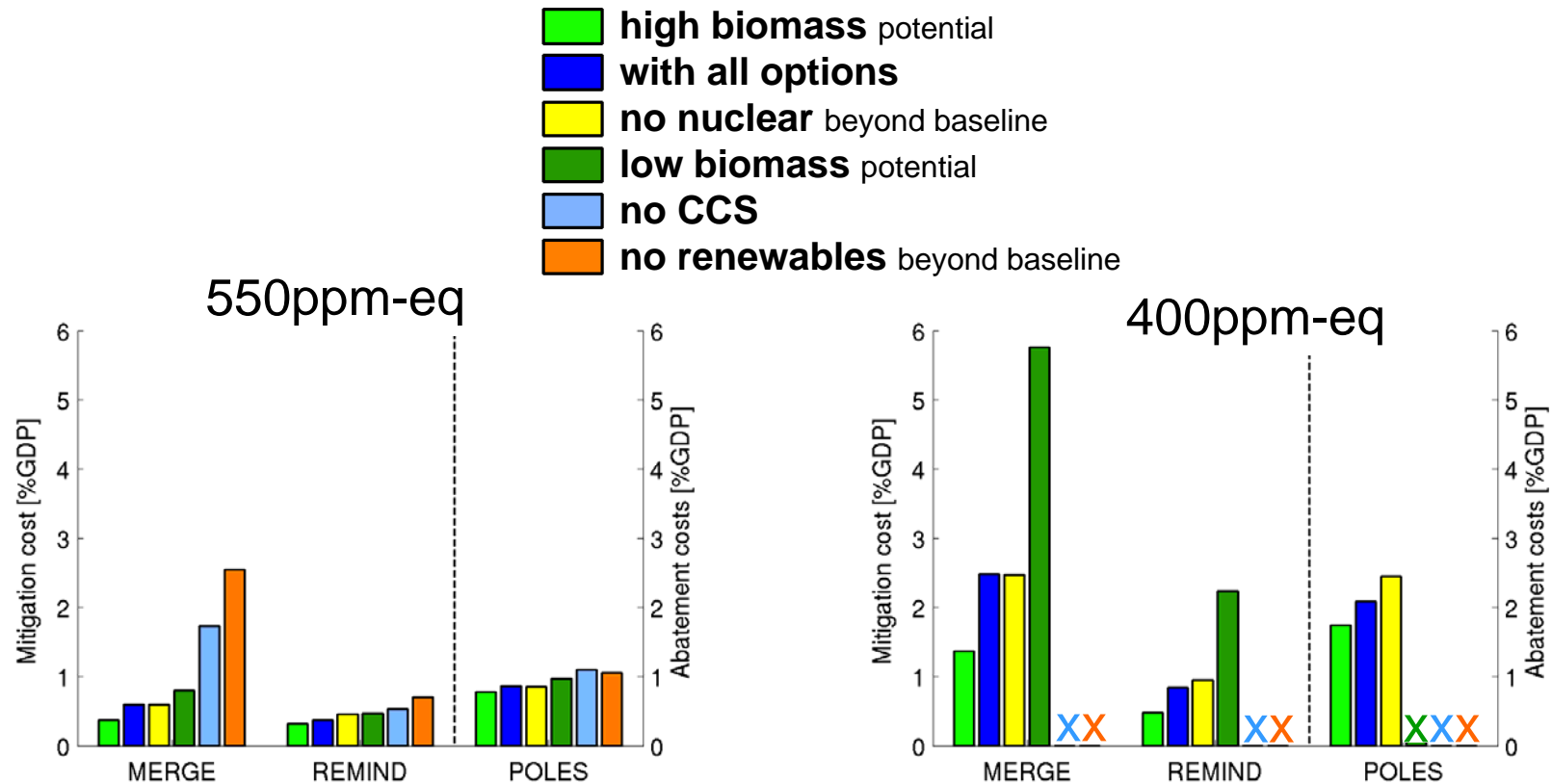


# The Great Transformation



Based on IEA Data (1971-2005) and REMIND-R results for 450ppm-eq (ADAM); Graphic by Steckel/Knopf (PIK)

# Technology Options for Low Stabilisation



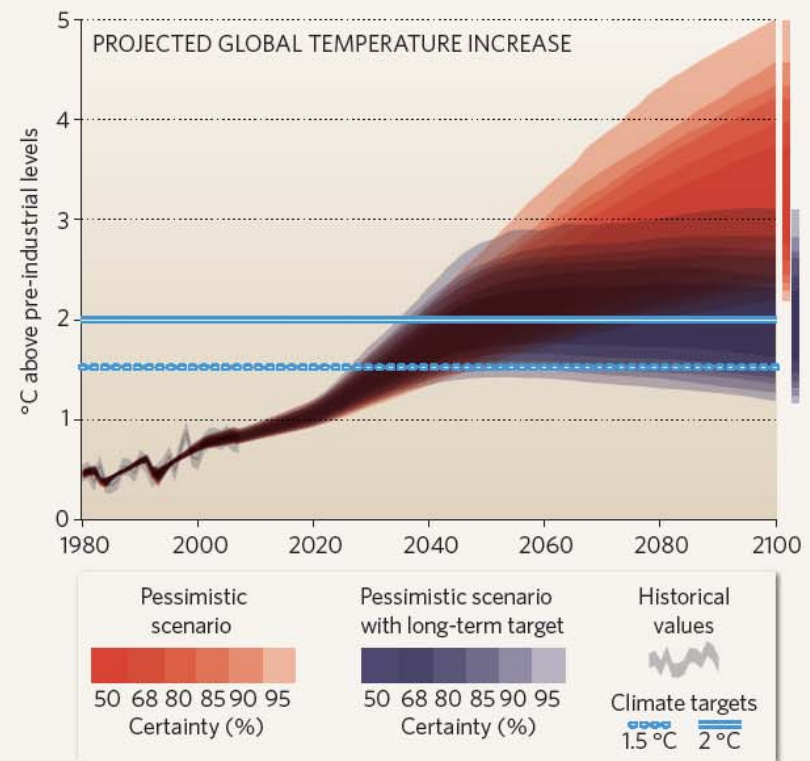
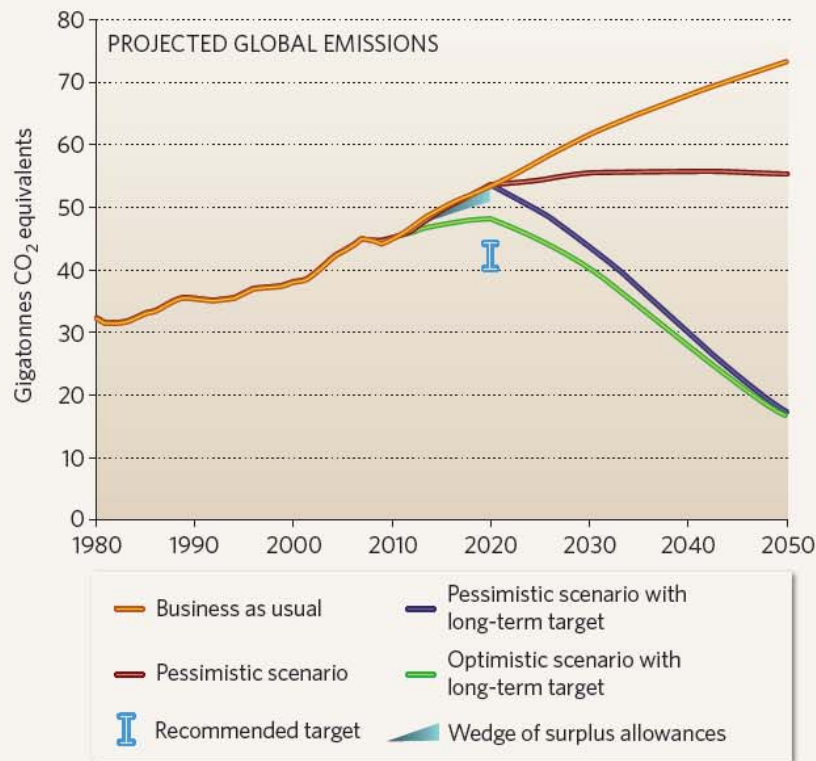
*Knopf, Edenhofer et al. (2009)*

- ➔ 400 ppm neither achievable without CCS nor without an extension of renewables
- ➔ Biomass potential dominates the mitigation costs of low stabilisation
- ➔ Nuclear is not important beyond its (high) use in the baseline

# Copenhagen Pledges – Not Enough for 2°C

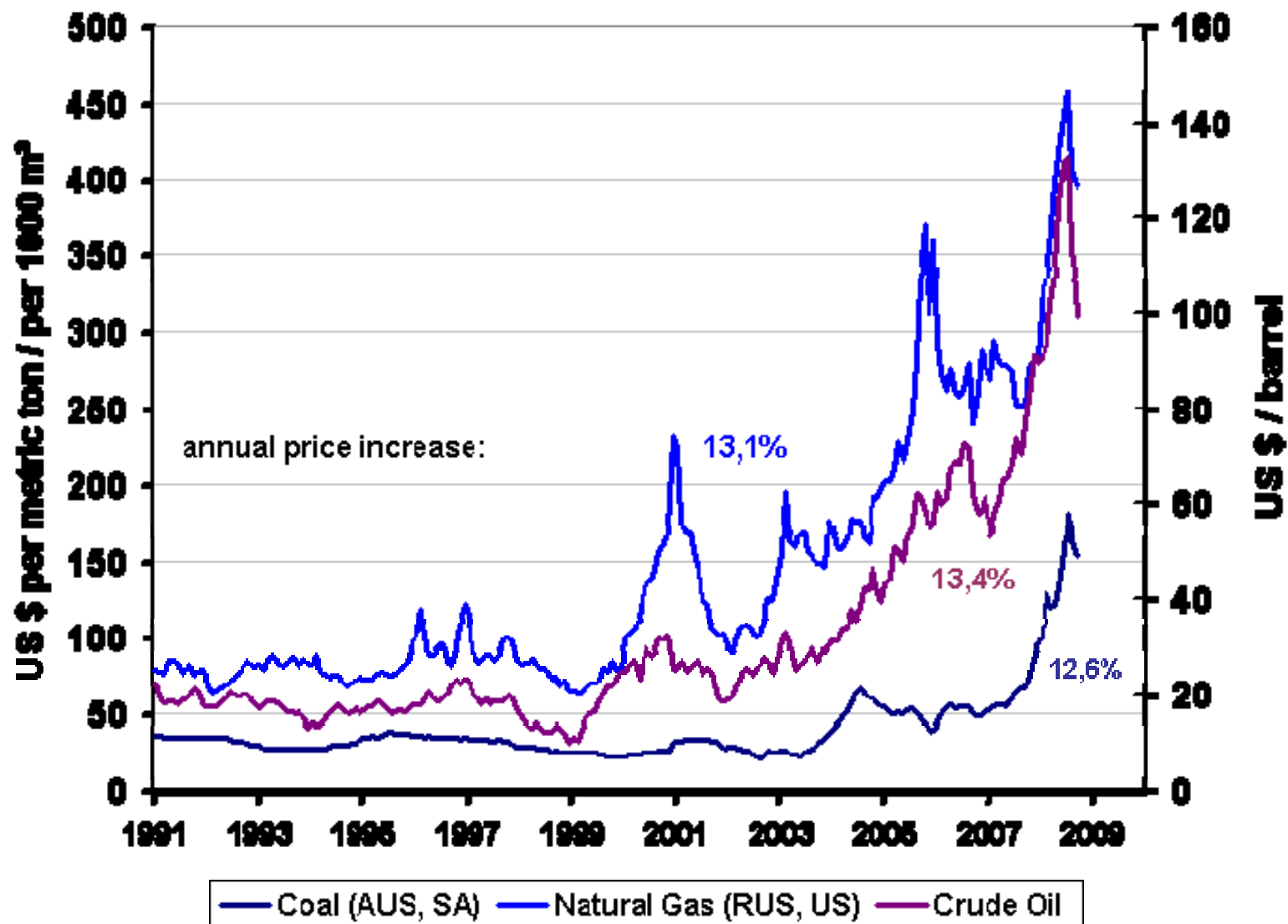


EFFECTS OF NATIONAL EMISSIONS PLEDGES IN THE COPENHAGEN ACCORD



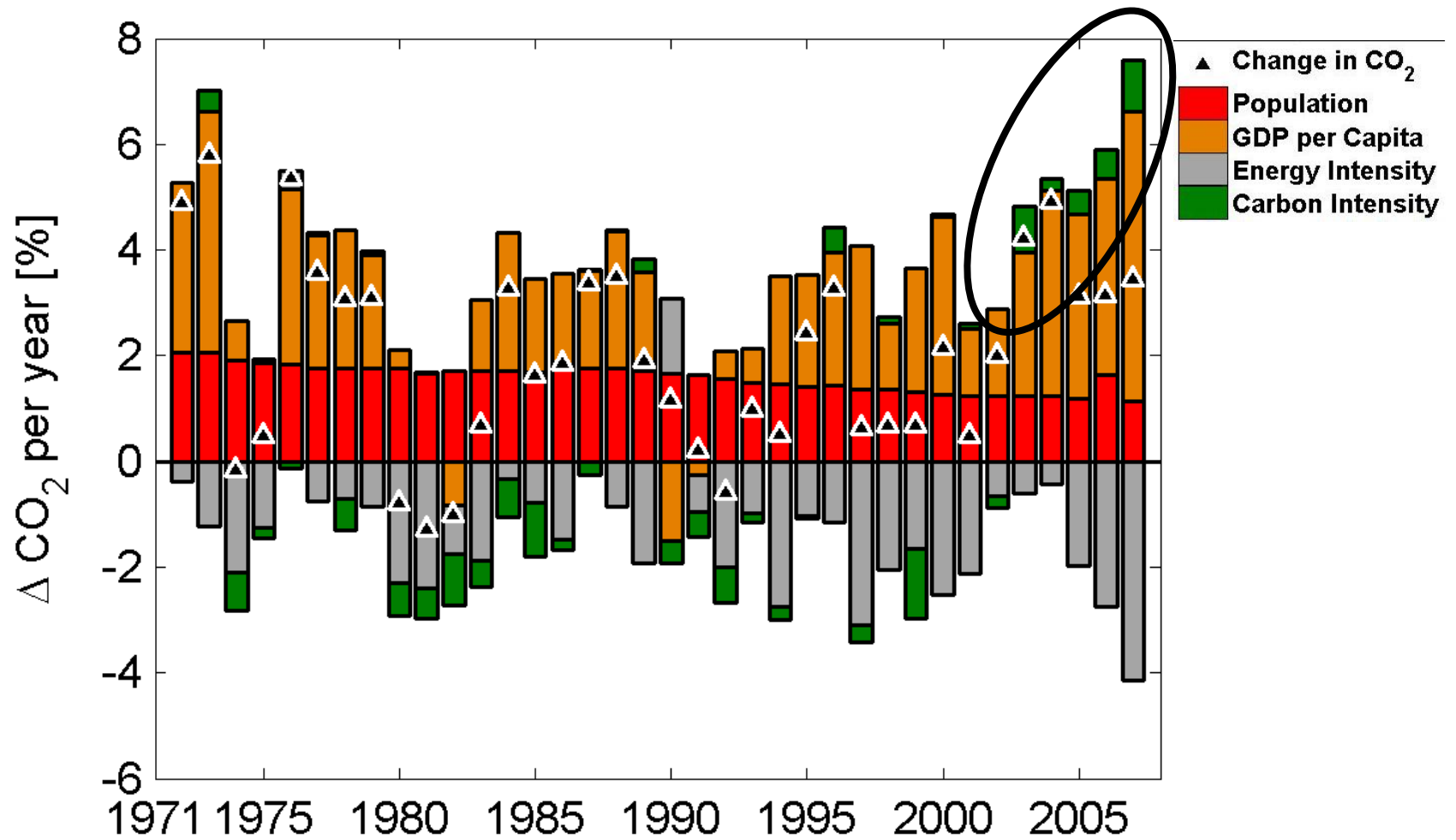
The pessimistic scenario assumes that nations meet only their lowest stated ambitions, and use all surplus allowances and land-use credits. The optimistic scenario assumes that nations meet their highest stated ambitions, and do not use surplus allowances or land-use credits. The long-term target is to halve emissions from 1990 levels by 2050.

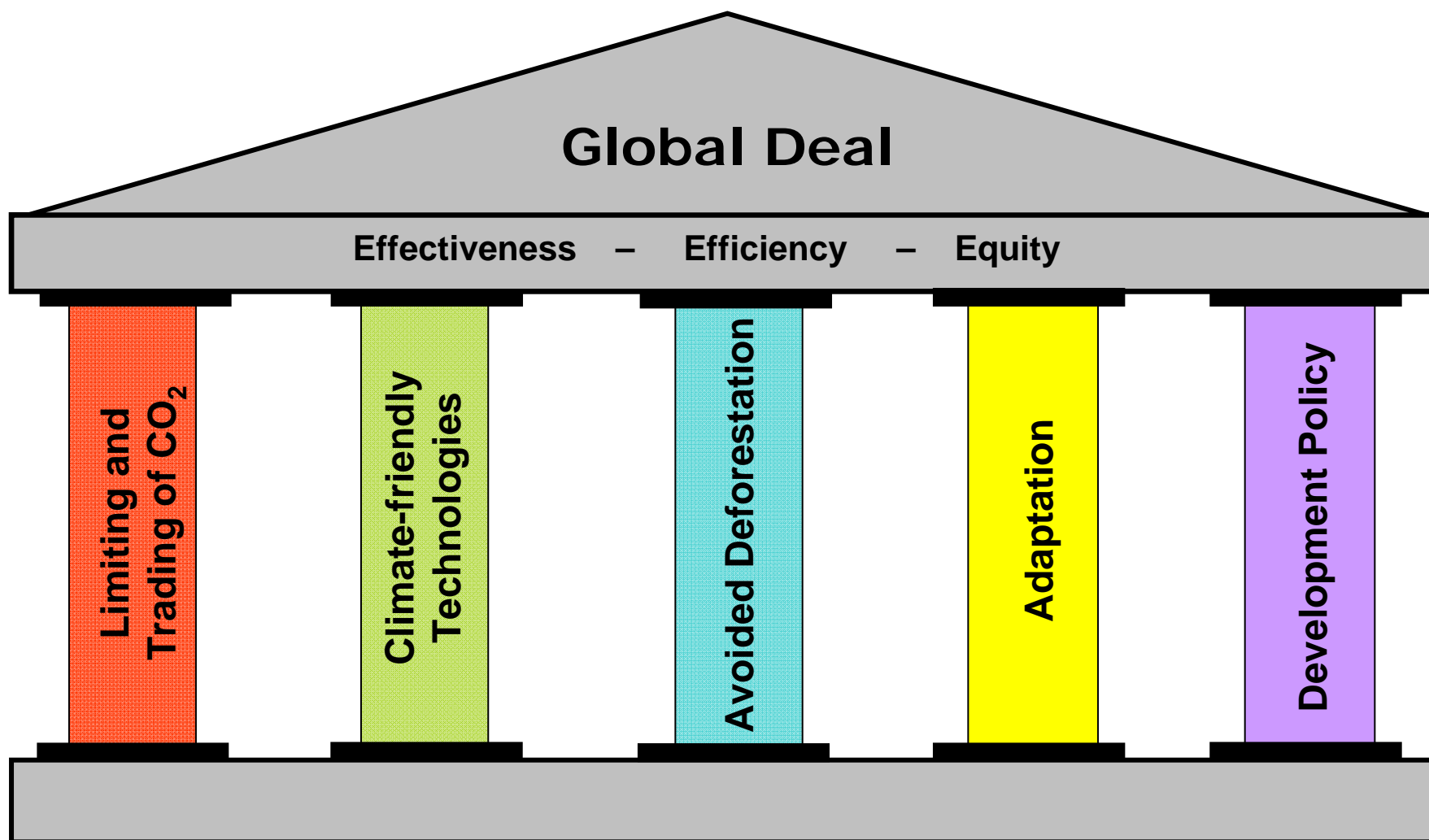
# Global Fossil Fuel Prices 1991 - 2008

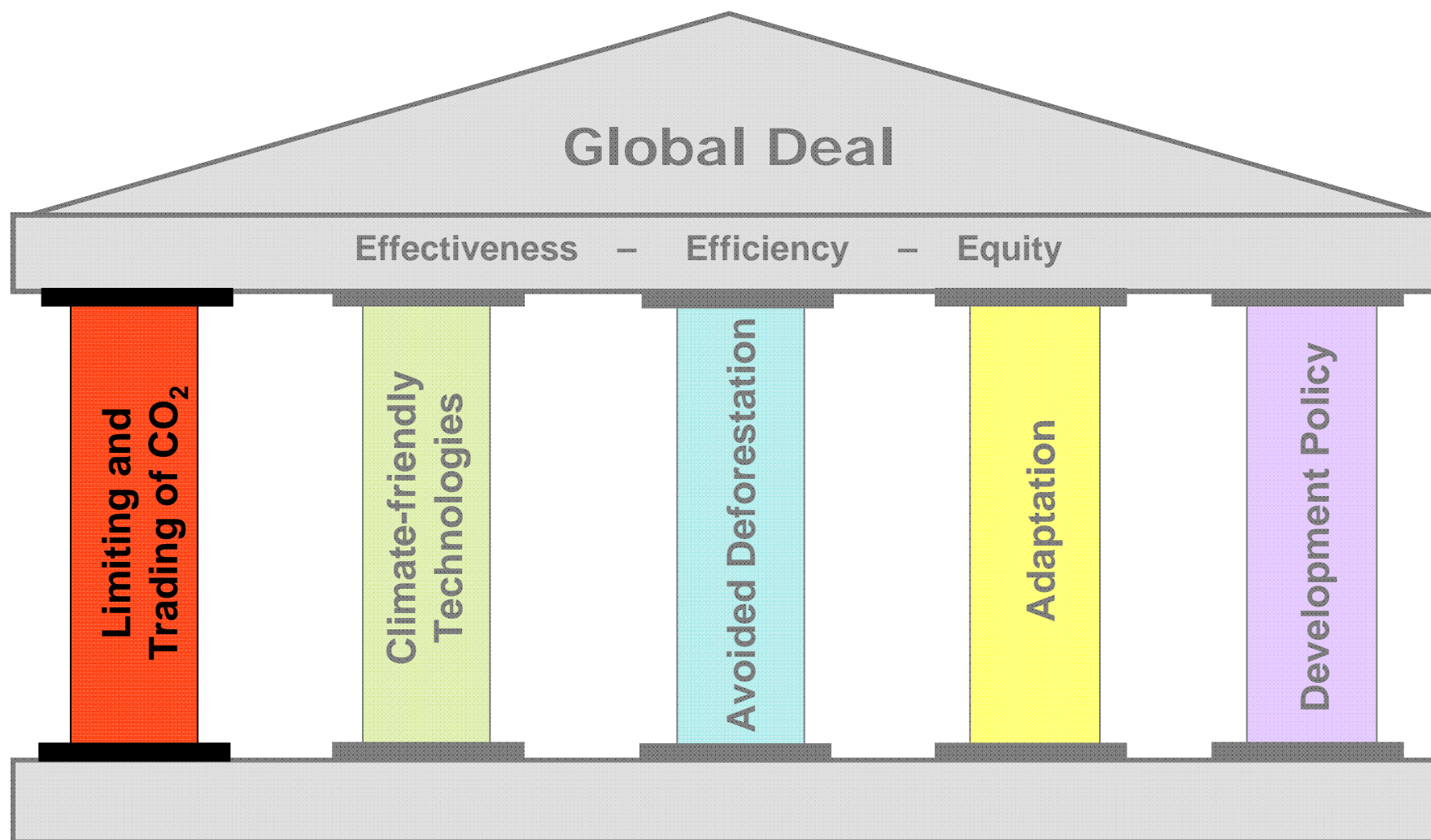


Source: IMF International Commodities Database

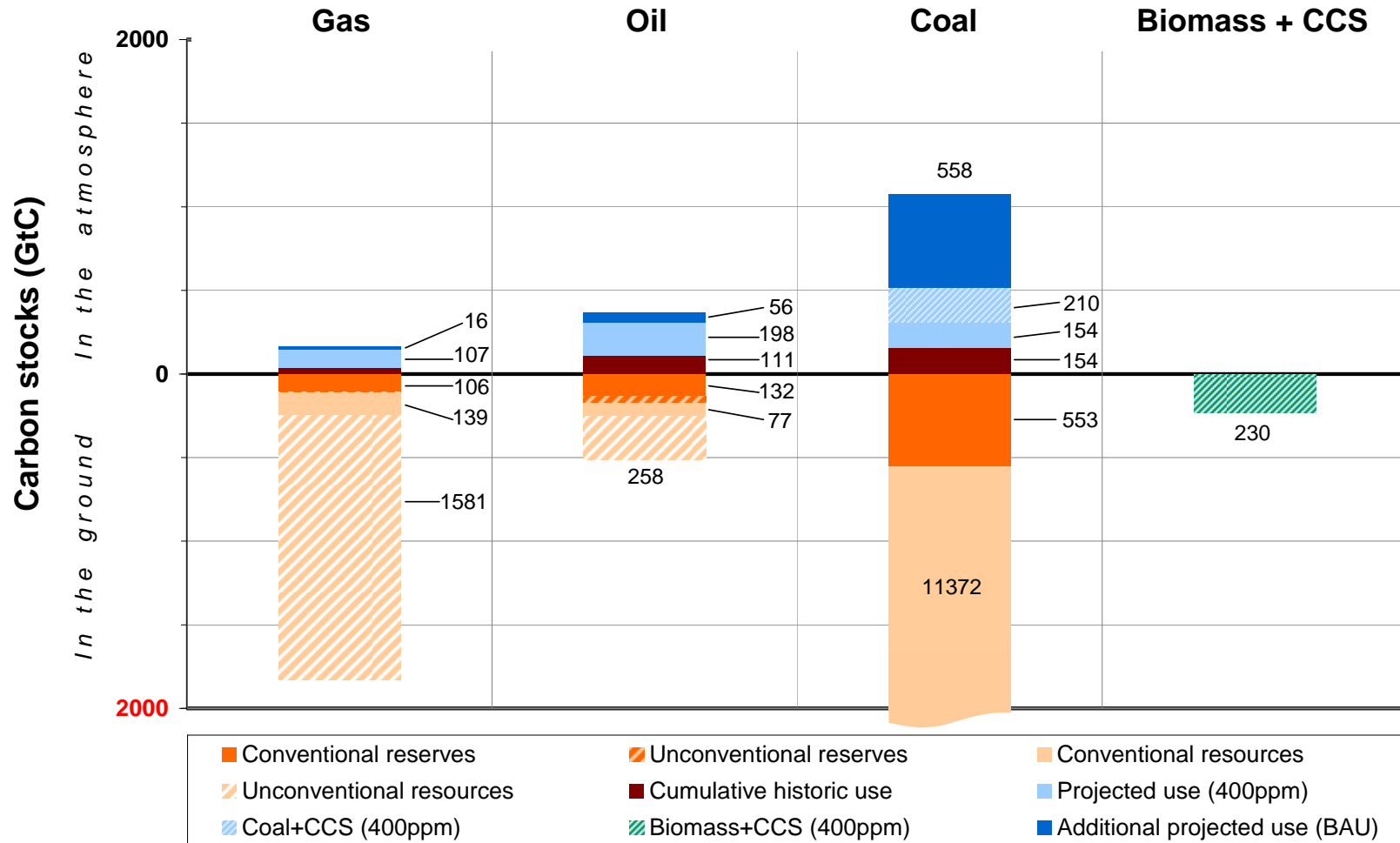
# Renaissance of Coal







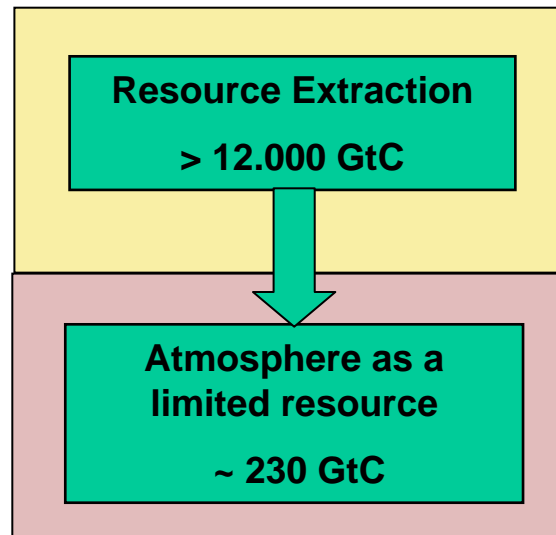
# The Supply-side of Global Warming



Cumulative historic carbon consumption (1750-2004), estimated carbon stocks in the ground, and estimated future consumption (2005-2100) for business-as-usual (BAU) and ambitious 400-ppm-CO<sub>2</sub>-eq. scenario

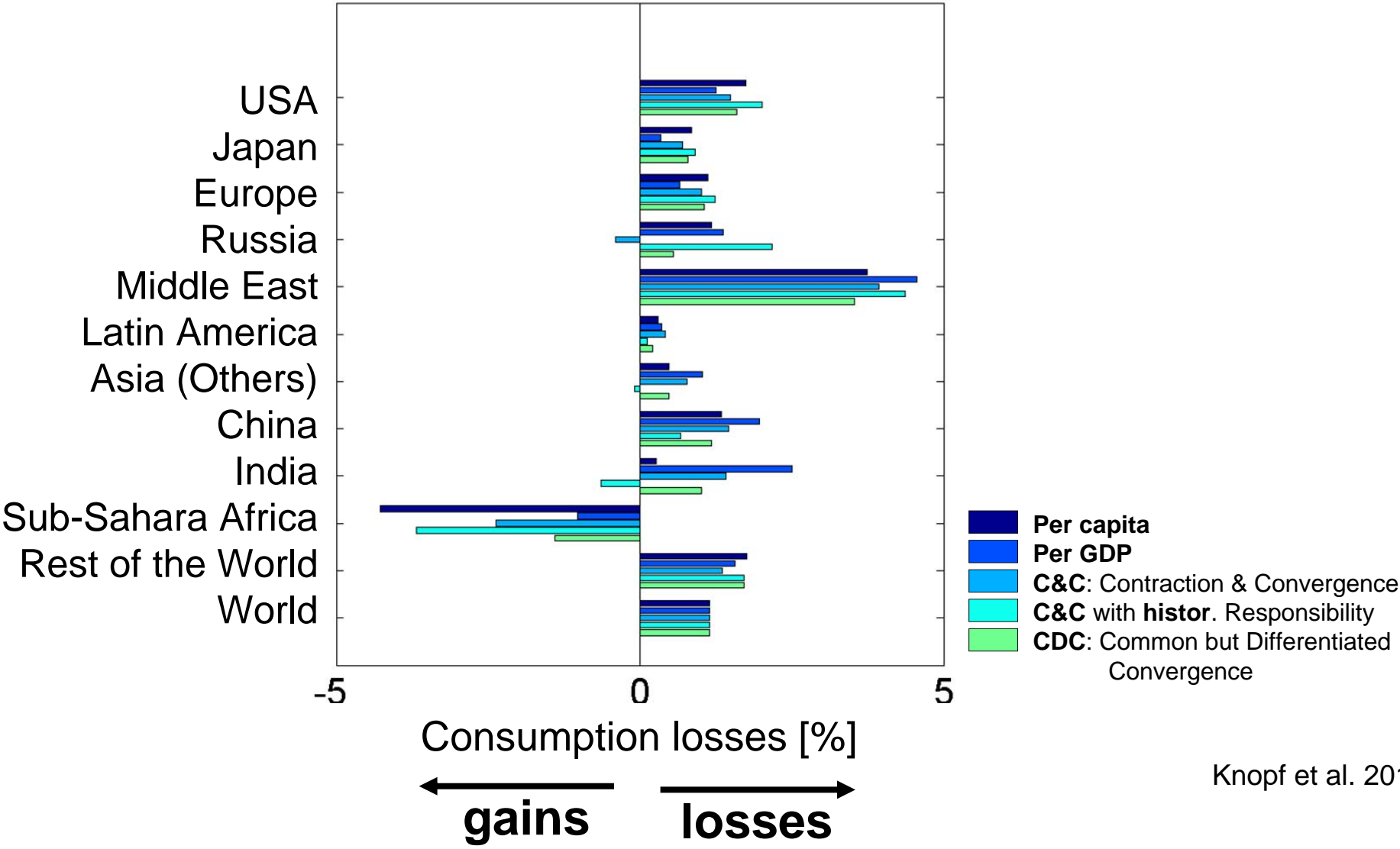
Source: Kalkuhl, Edenhofer and Lessmann, 2009

# Atmosphere as a Global Common

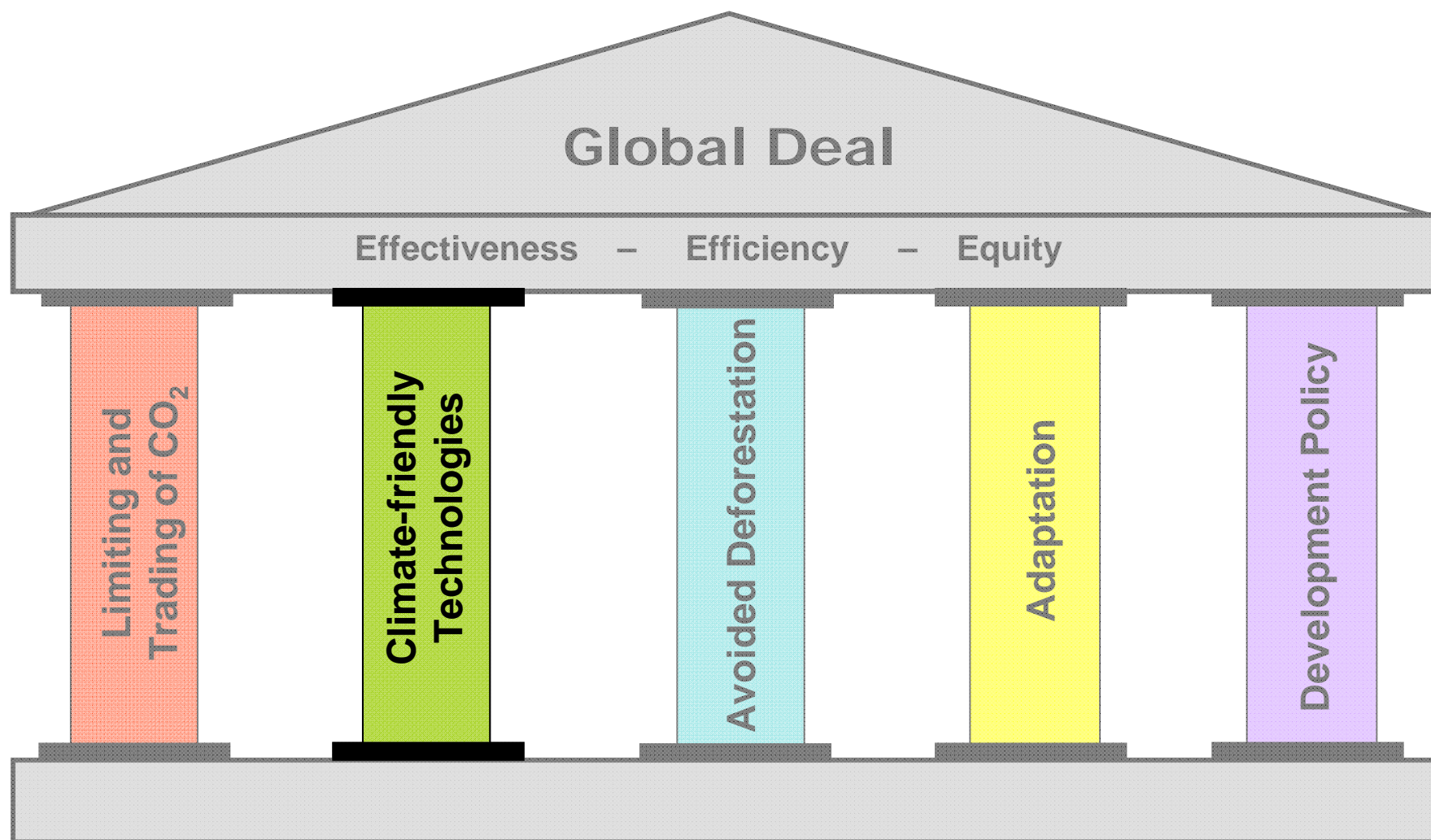


- Atmosphere is a scarce resource – fossil carbon is not
- Economic approach to deal with scarcity in an efficient way:
  - Establish prices on scarcities
- How to determine scarcity price on carbon?
  - Assigning property rights according to the scarcity of the atmosphere
  - Distributing the emission rights according to principles of fairness and justice

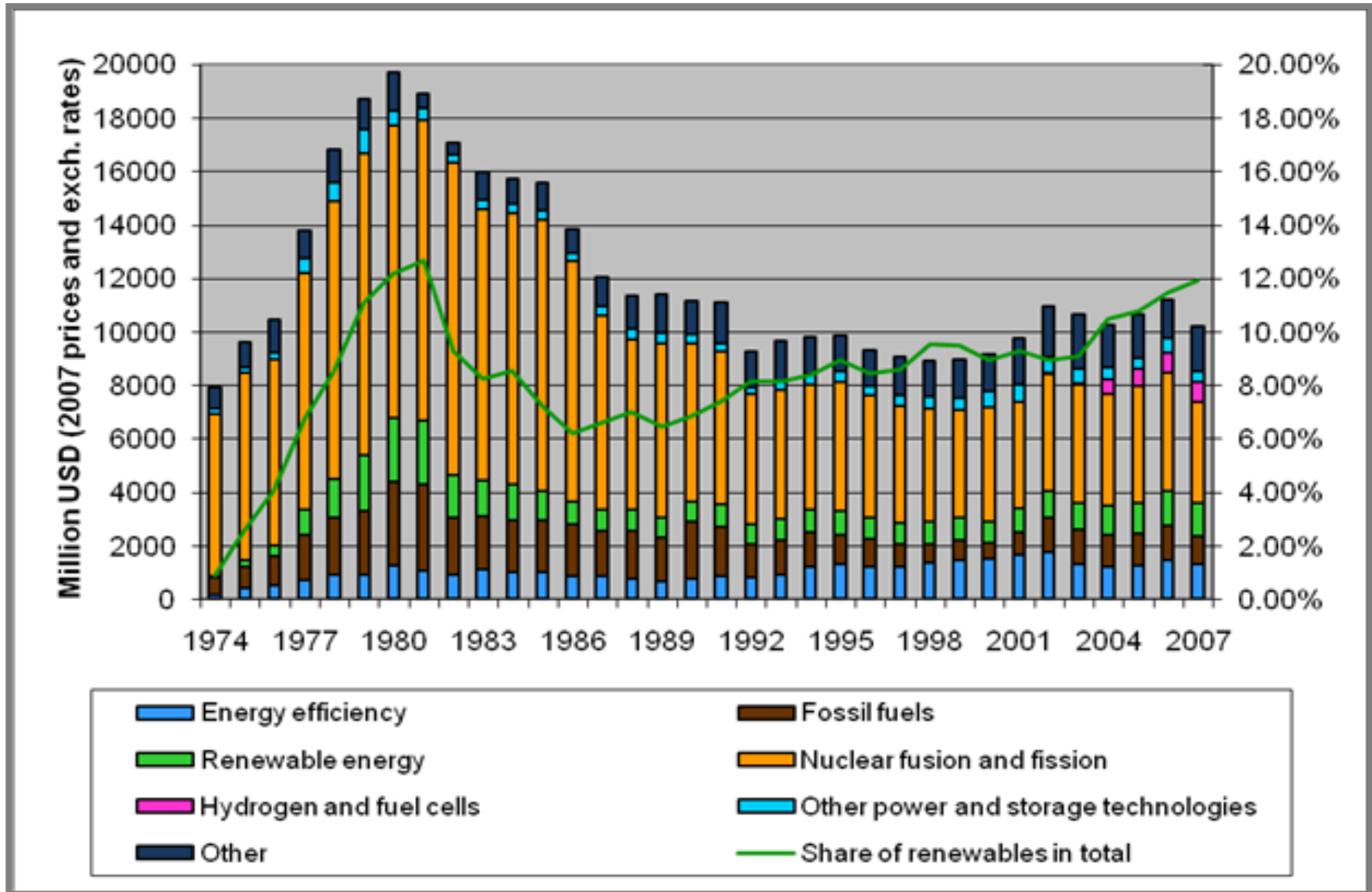
# Allocation of Emission Rights



Knopf et al. 2010



# R&D-Investment in Energy Technologies

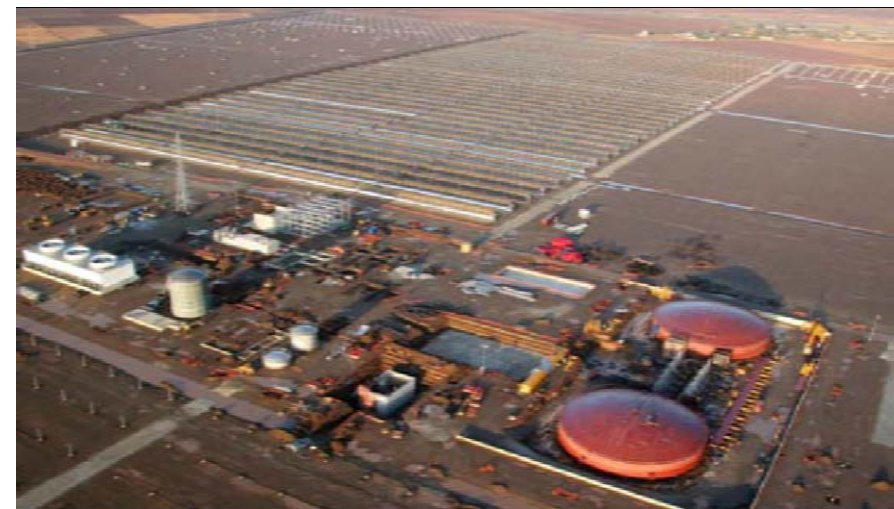


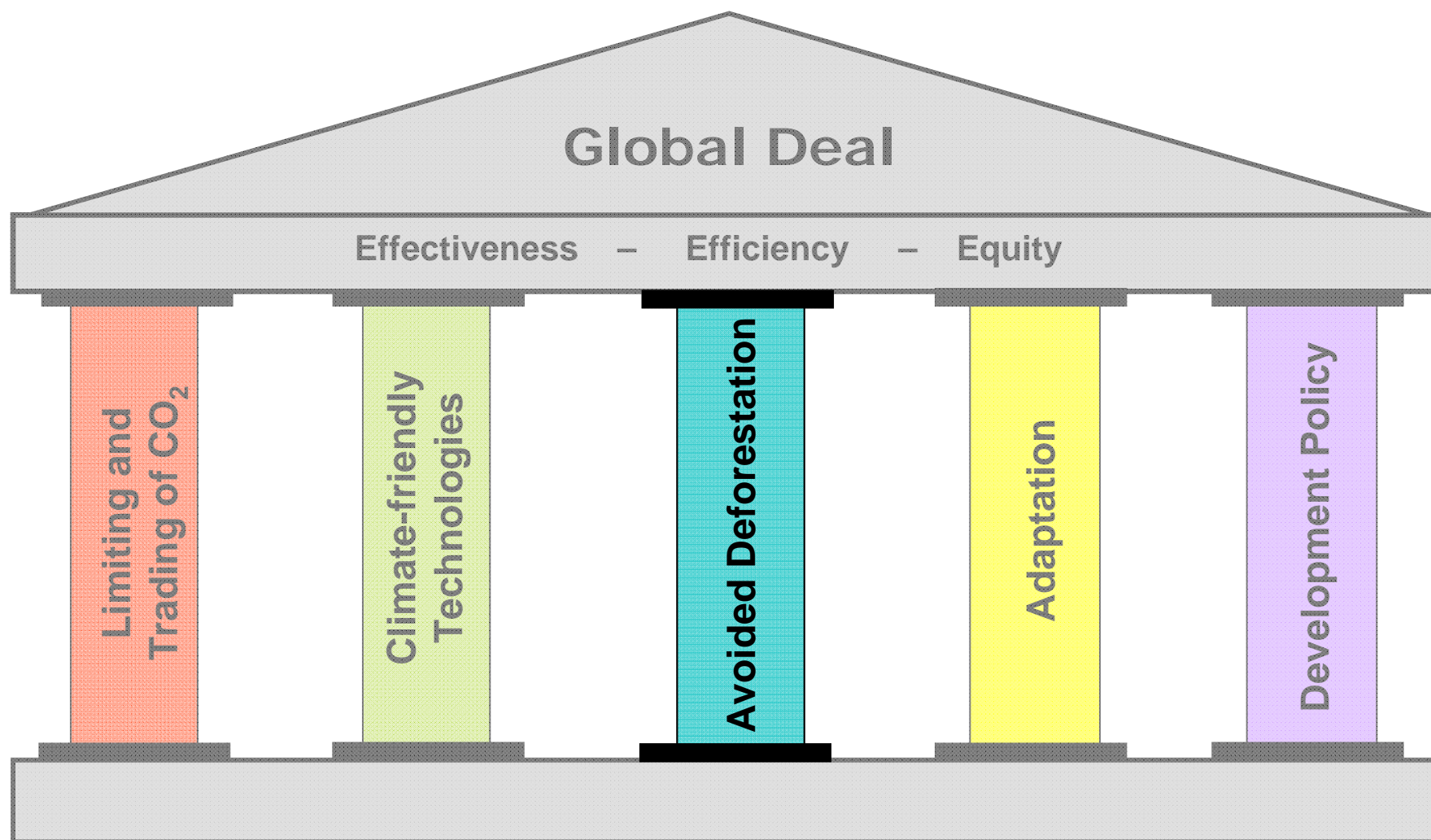
Source: Updated version of IPCC (2007), AR4

# New Storage Technologies



**Andasol I, Spain**

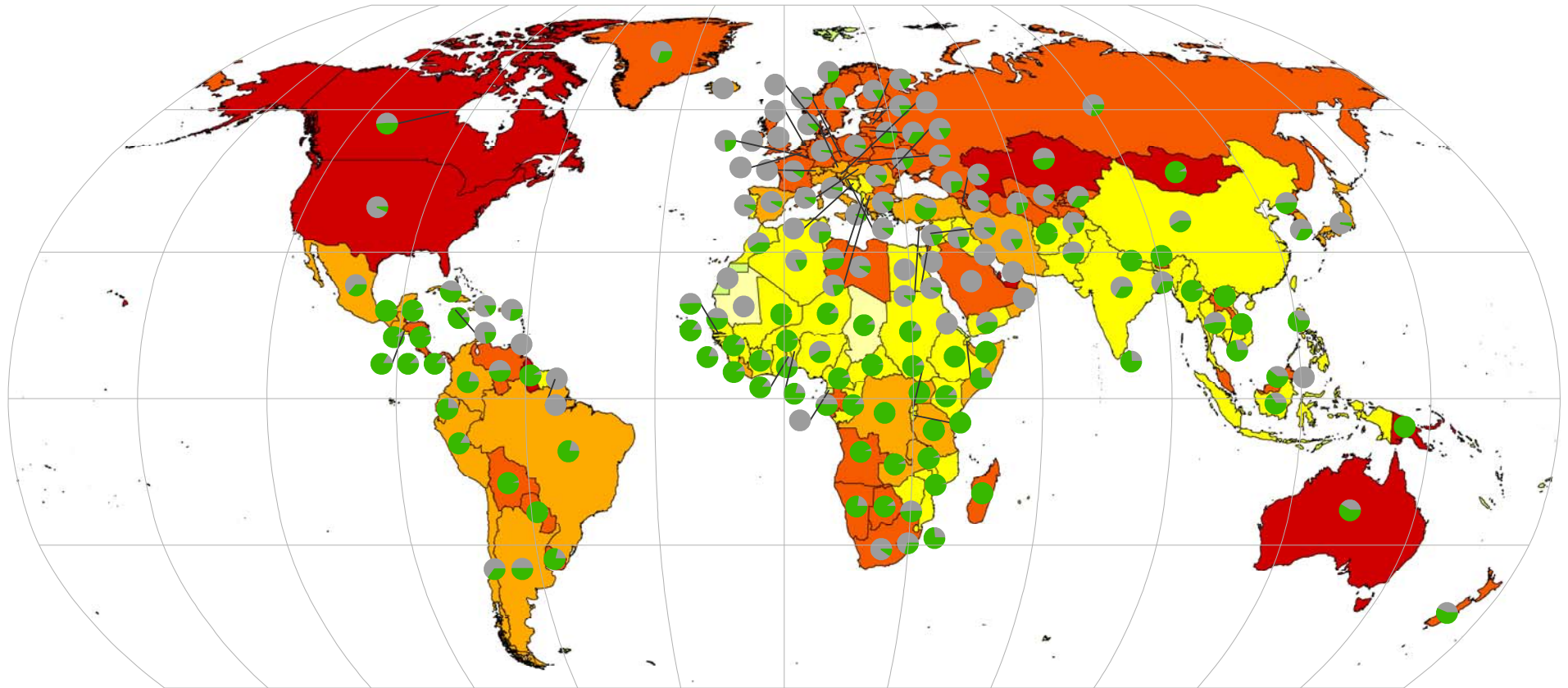




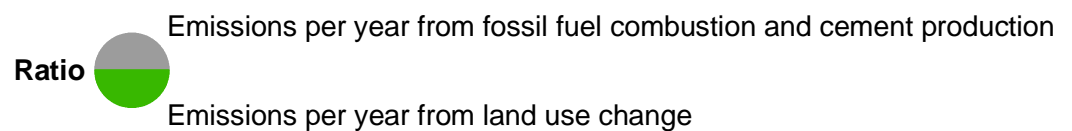
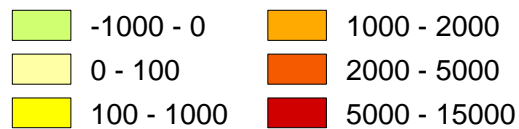


# Reducing Deforestation: Fossil vs. LUCF CO<sub>2</sub> Emissions

## CO<sub>2</sub> emissions per person and year, 1950 - 2003

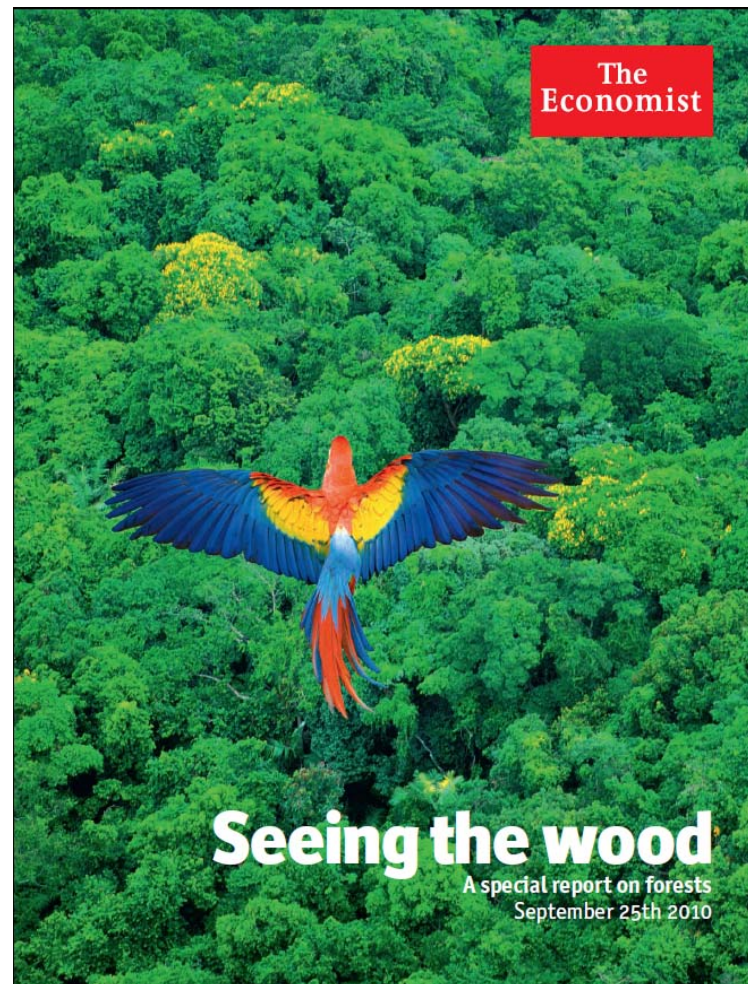


CO<sub>2</sub> emissions from fossil fuel combustion and cement production, and including land use change (kg C per person and year from 1950 - 2003)

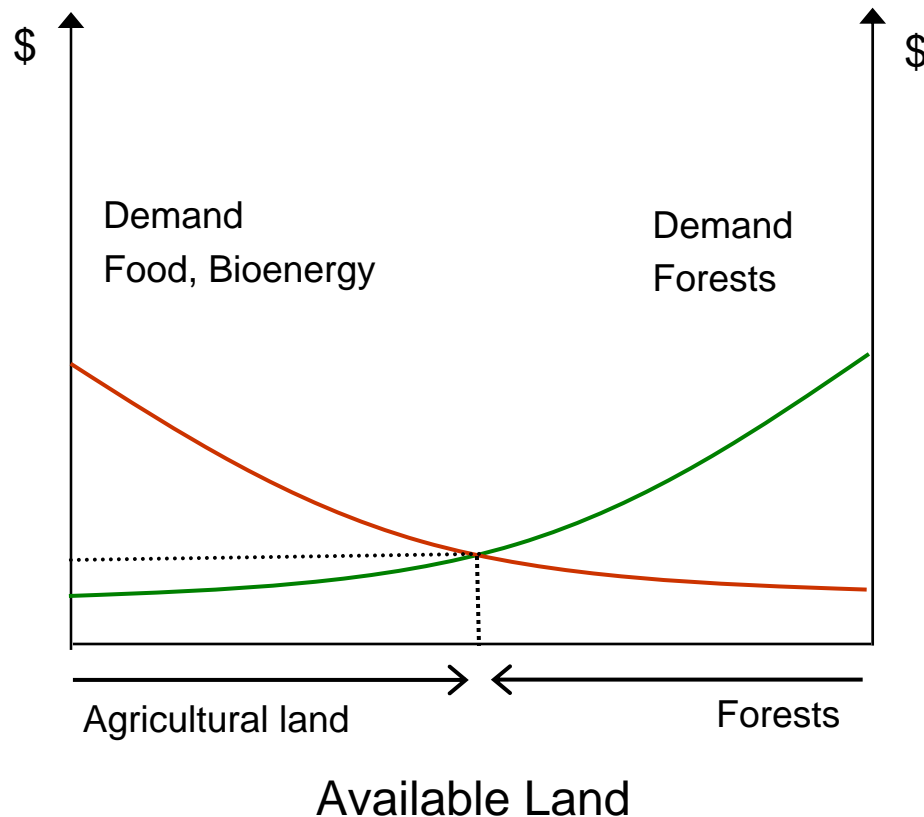


# Cancun - Better REDD than dead?

---

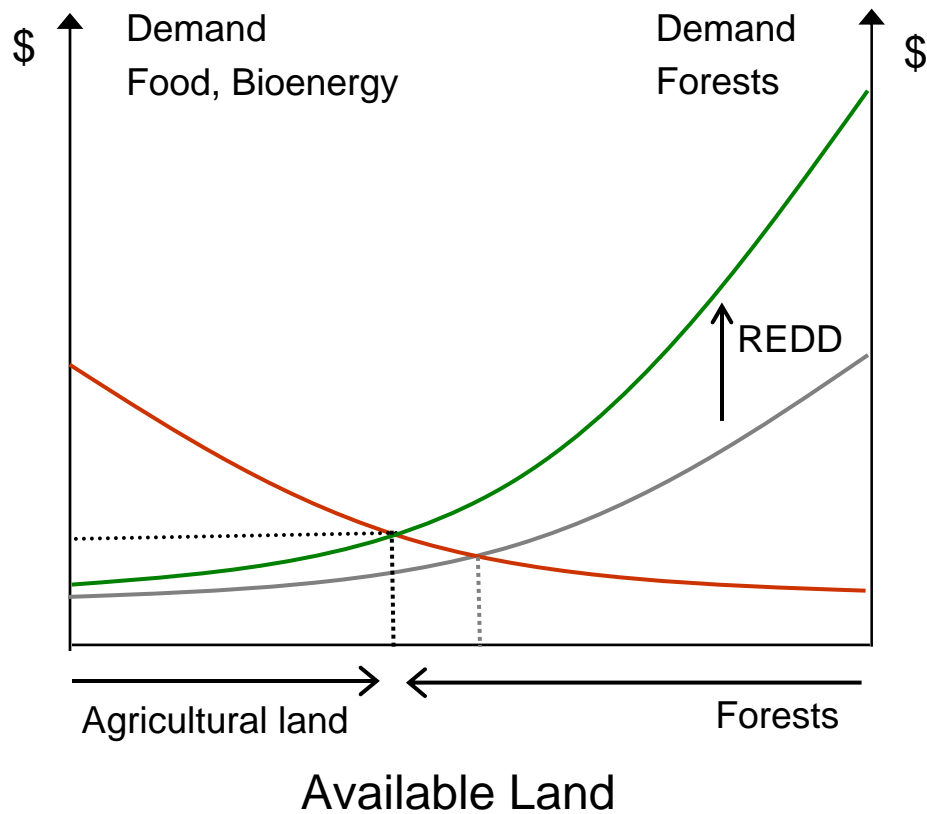


# Agriculture versus Forest Protection



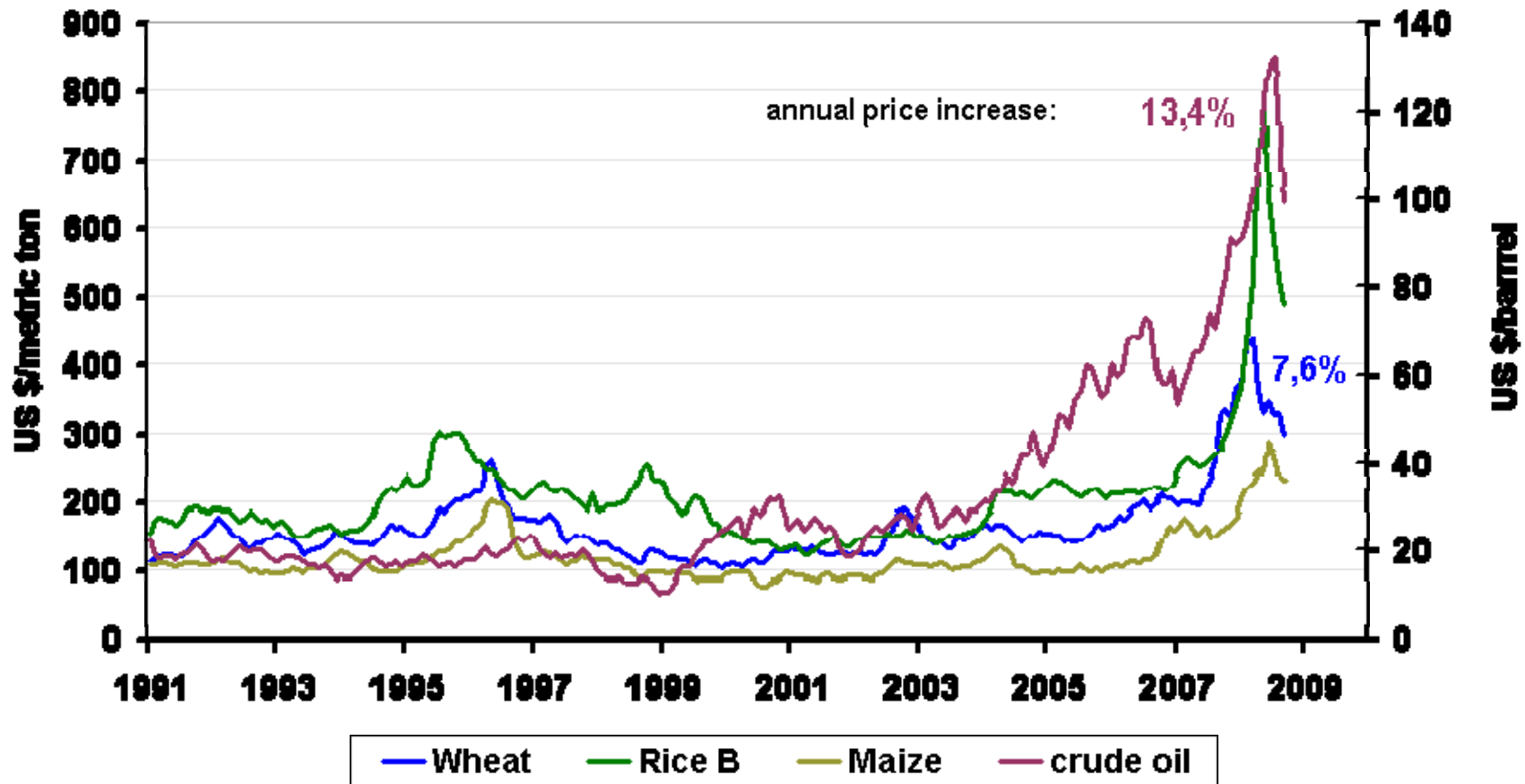
- Agriculture and forest protection compete for scarce land
- Optimal allocation of available land

# Agriculture versus Forest Protection



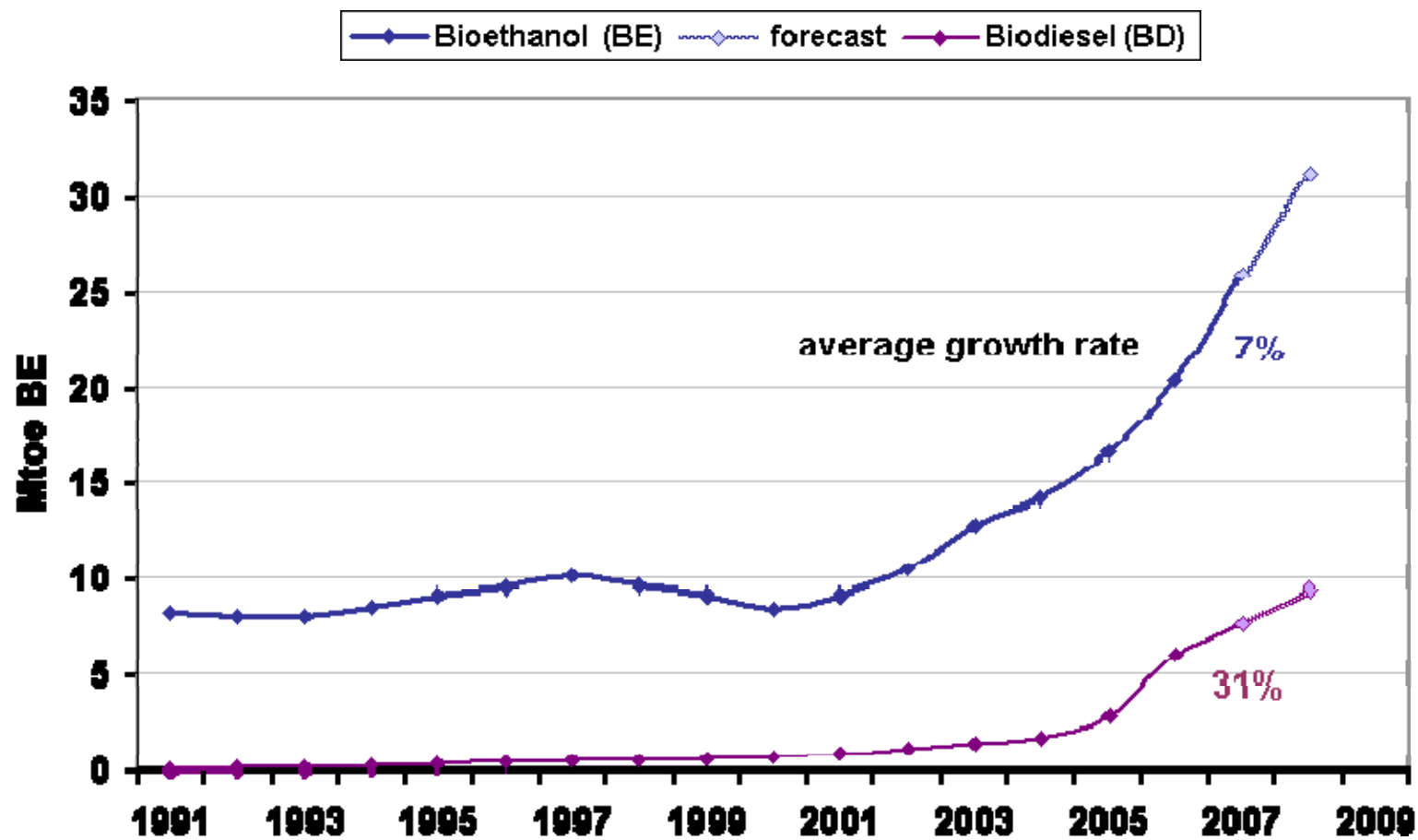
- REDD protects forests

# Market Prices for staple foods and crude oil monthly averages 1991 - 2008



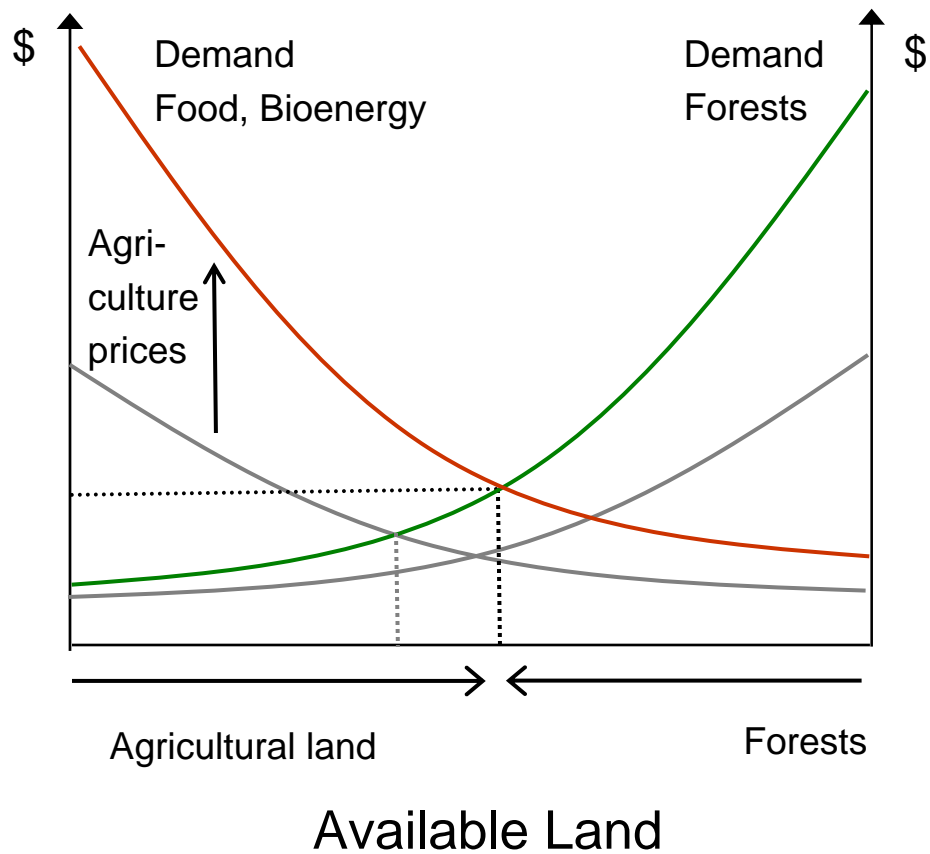
Source: IMF; FAO International Commodity Prices

# Annual World Biofuel Production 1991 - 2008



Source: BP Statistical Energy Review; WRI

# Agriculture versus Forest Protection



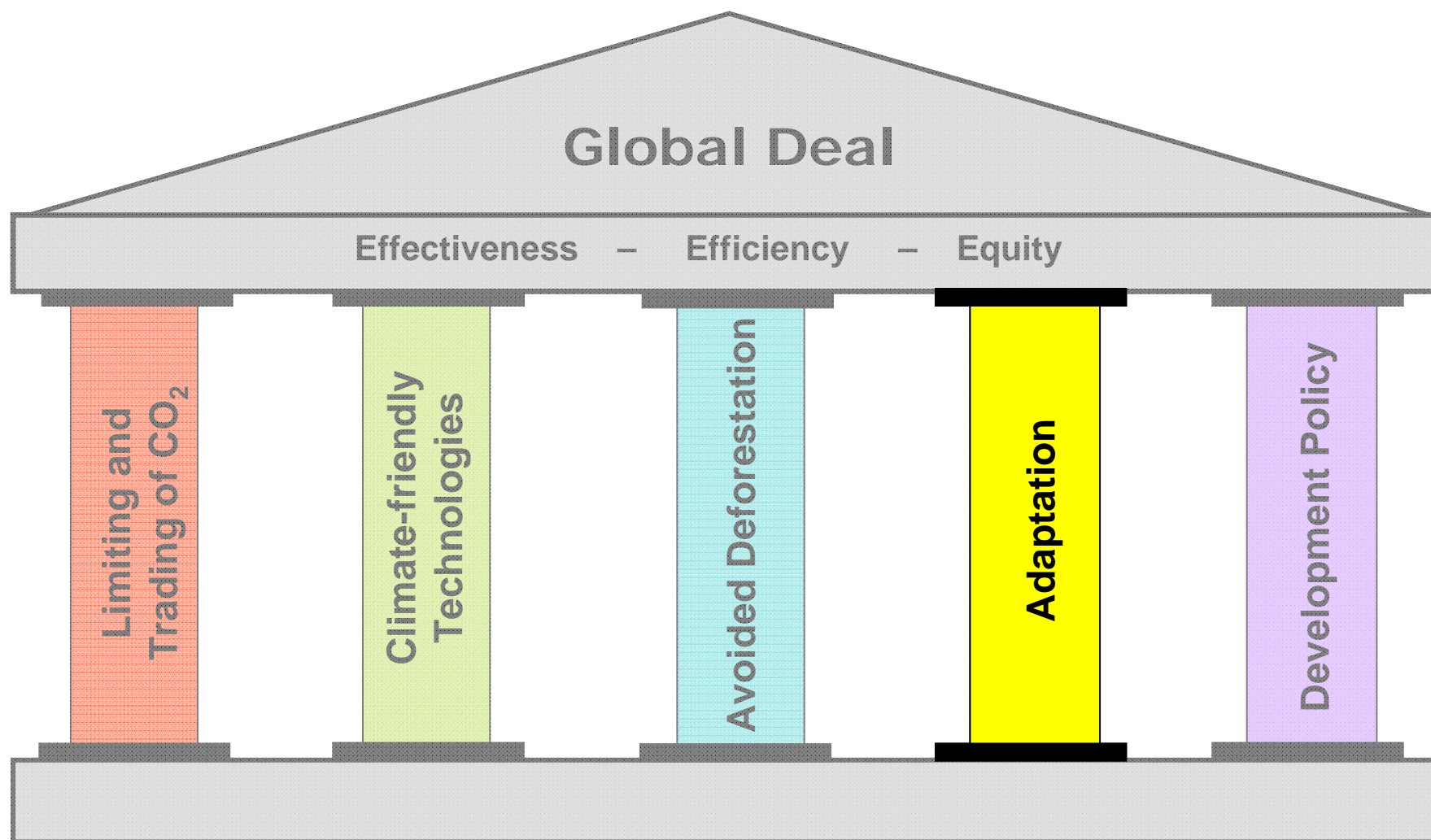
- Rising agricultural prices (oil price, food, bioenergy) counter the effect of REDD programs
- Higher prices for forest protection!

# Supposed Effects

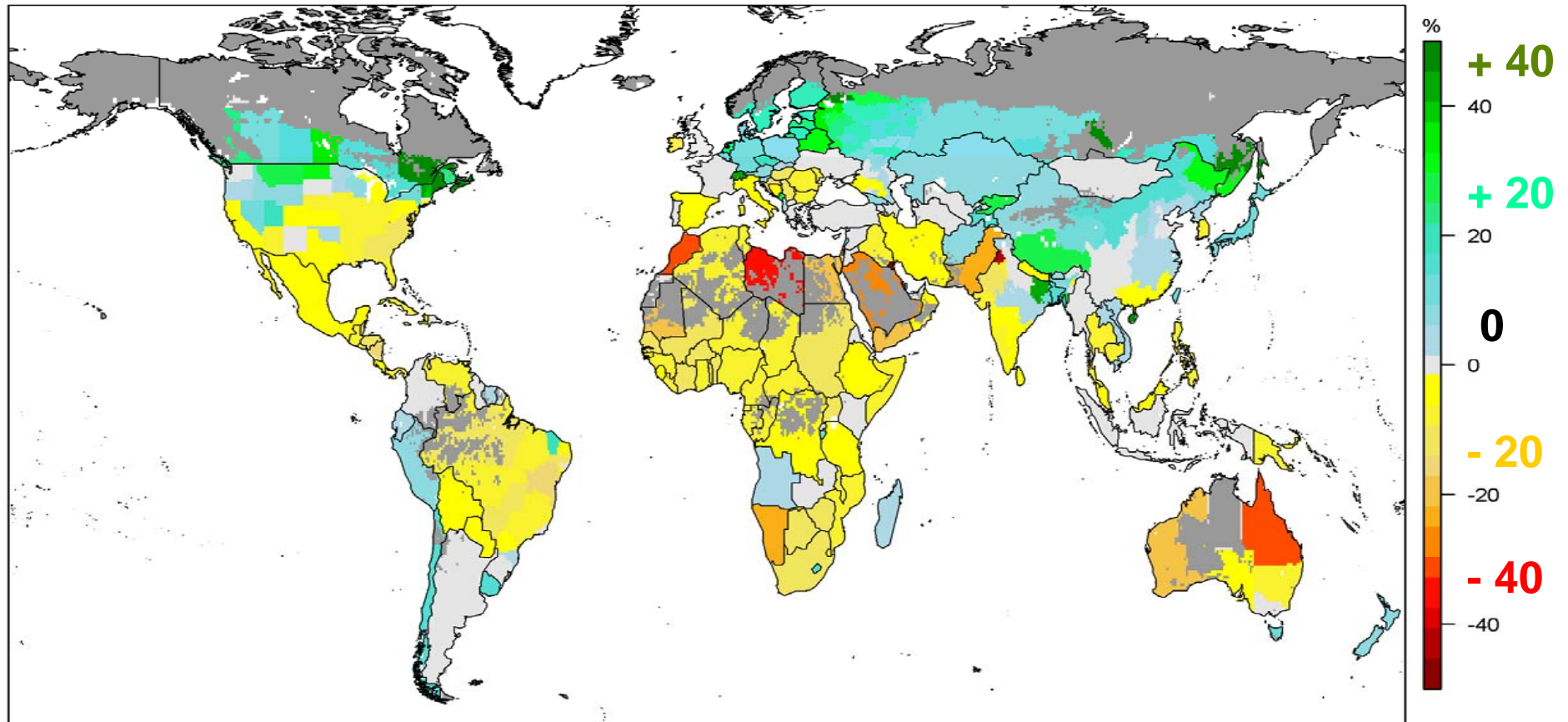
---



- Costs of REDD are underestimated
- Proposed fund solutions would have to stabilize the price on a high level to compensate the effects of rising oil prices. This is politically unlikely
- Including forests into fragmented emission trading systems can thus lead to higher deforestation rates than a comprehensive fund approach

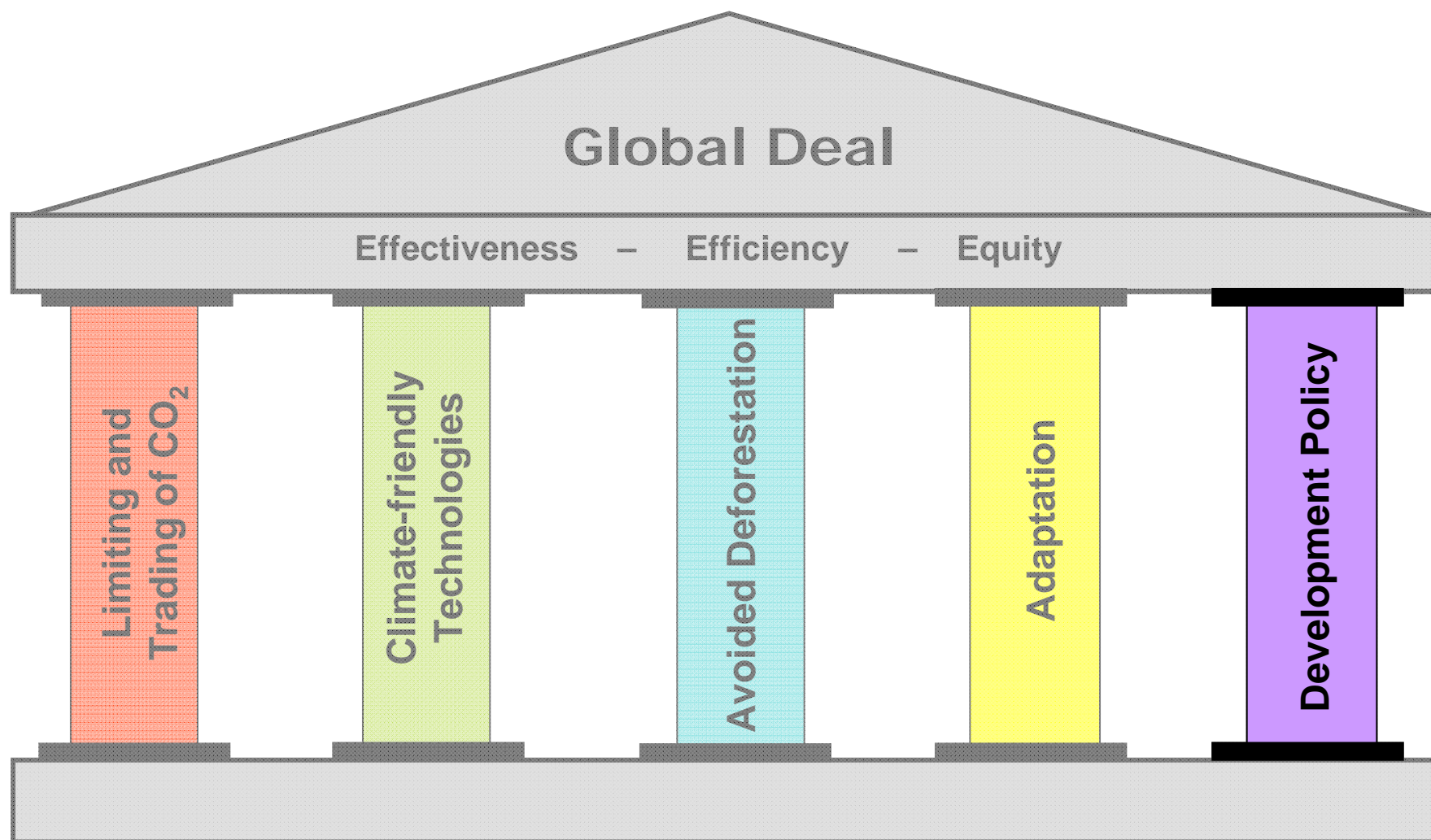


# Agricultural Productivity

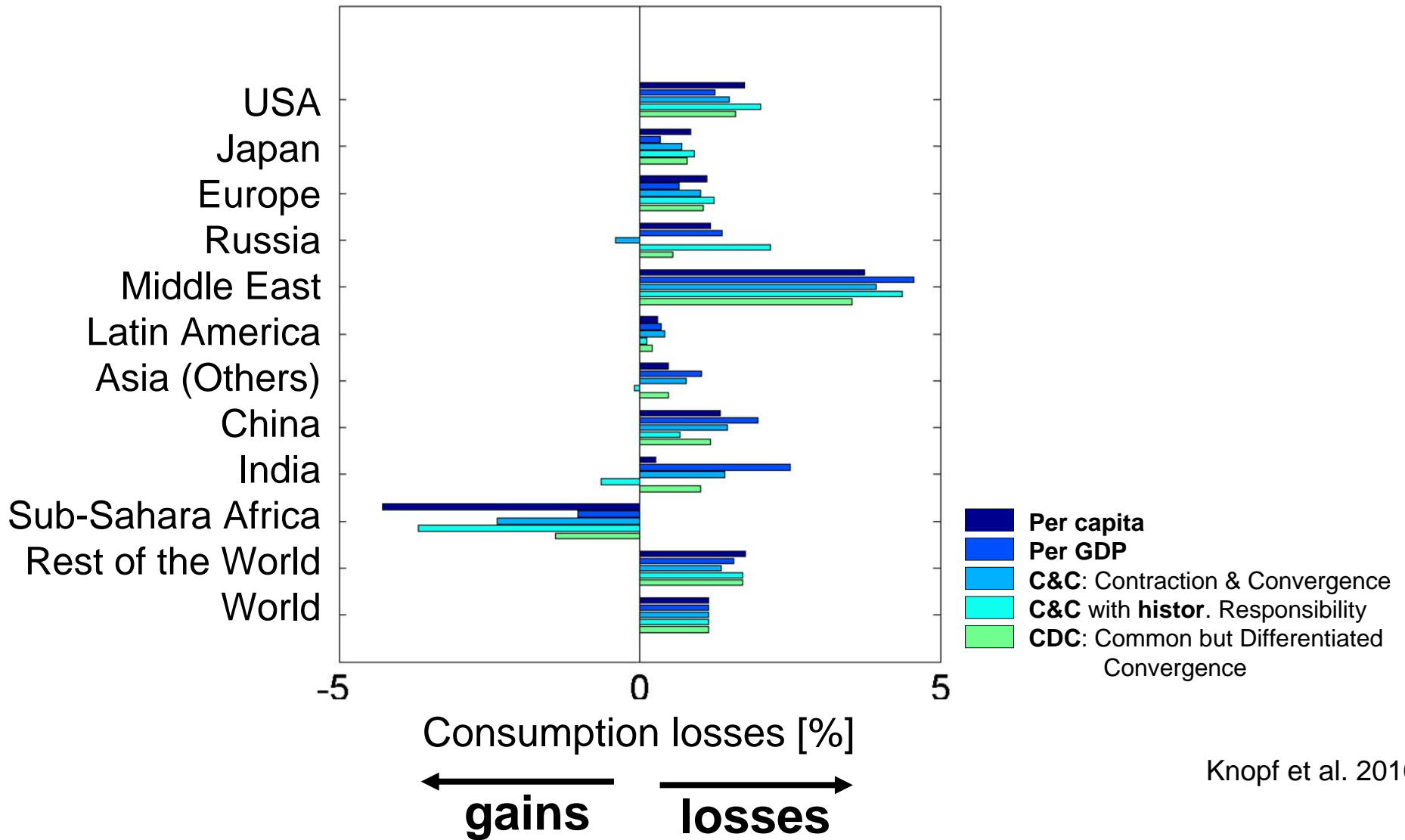


Change of agricultural production (all crops) in percent due to yield changes as a result of climate change between 1990 and 2050

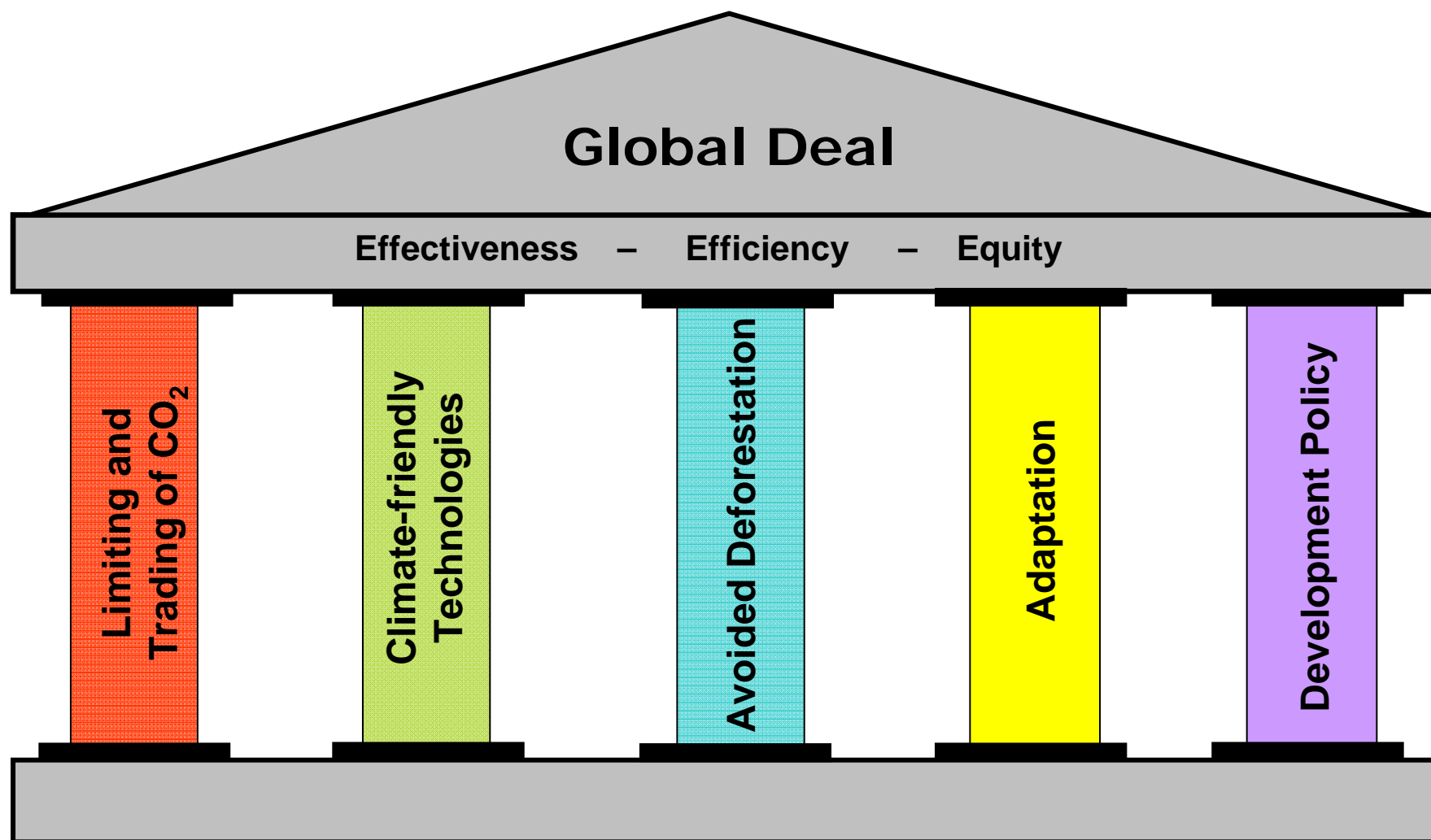
Source: Müller et al. 2010  
31



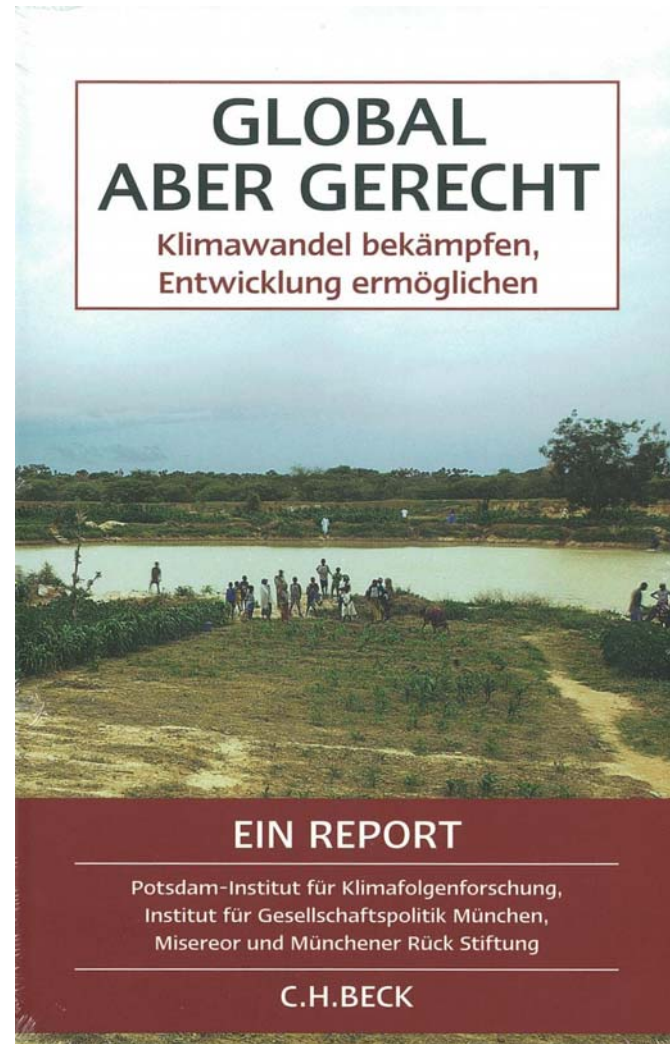
# Allocation of Emission Rights



Knopf et al. 2010



# Book Cover



<http://www.klima-und-gerechtigkeit.de/>