POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH

Prof. Dr. Ottmar Edenhofer

On the Economics and Politics of Climate Change

Challenges for the Science-Policy Interface

Advancing Sustainability in a Time of Crisis

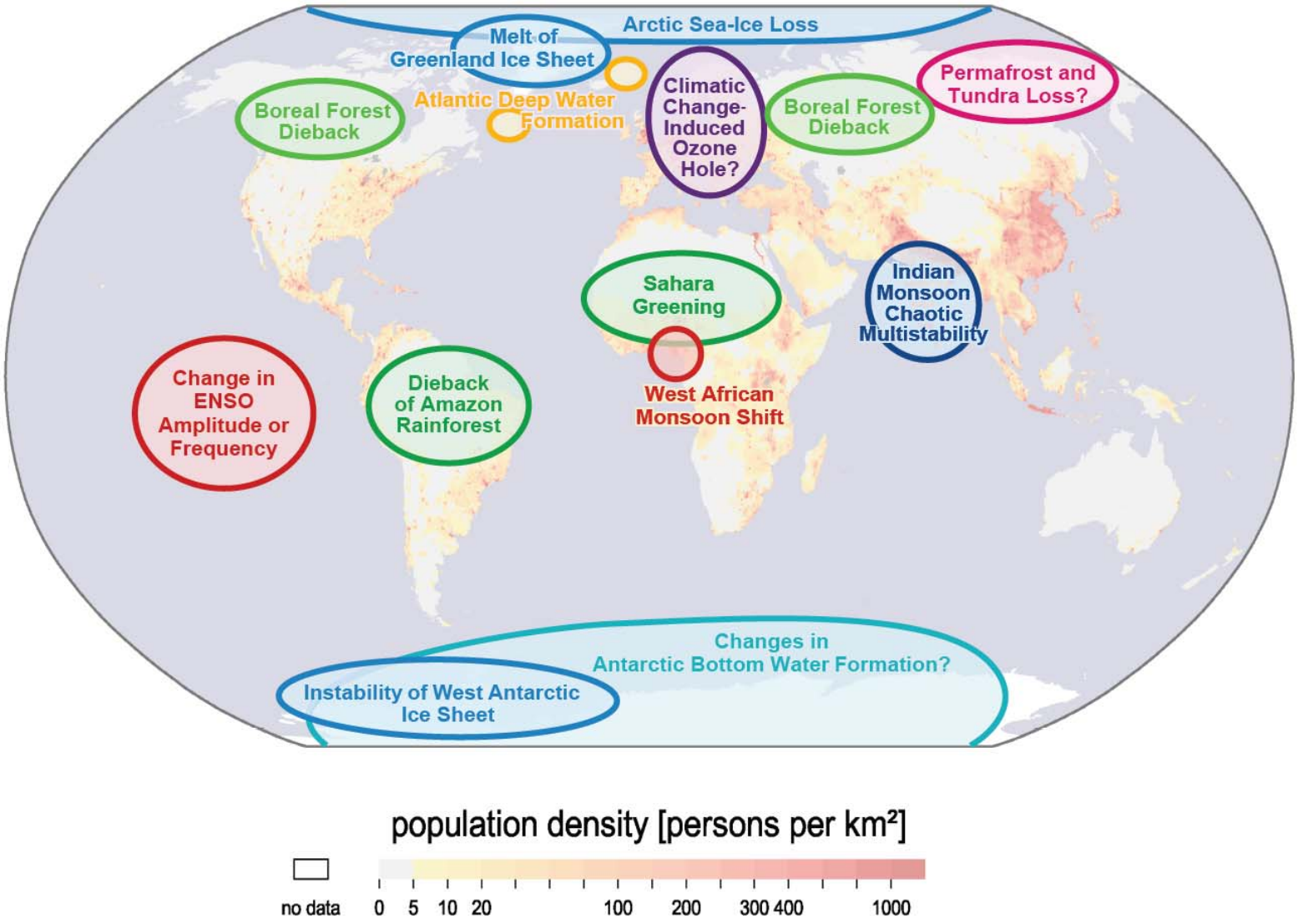
Oldenburg ISEE 2010, 23 August 2010

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Working Group III
Mitigation of Climate Change

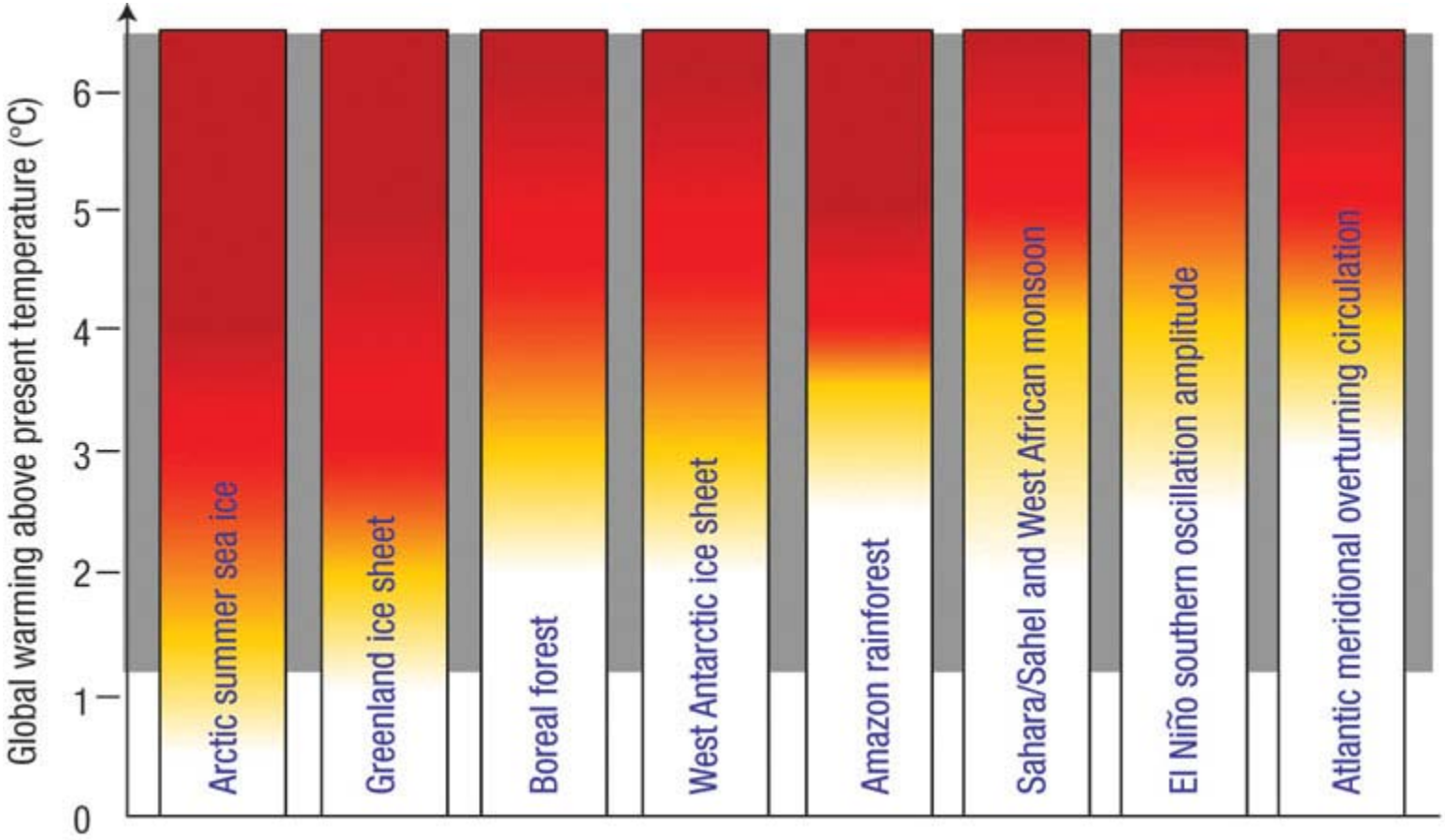
Technische Universität Berlin

Tipping Points in the Earth System



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

Burning Embers

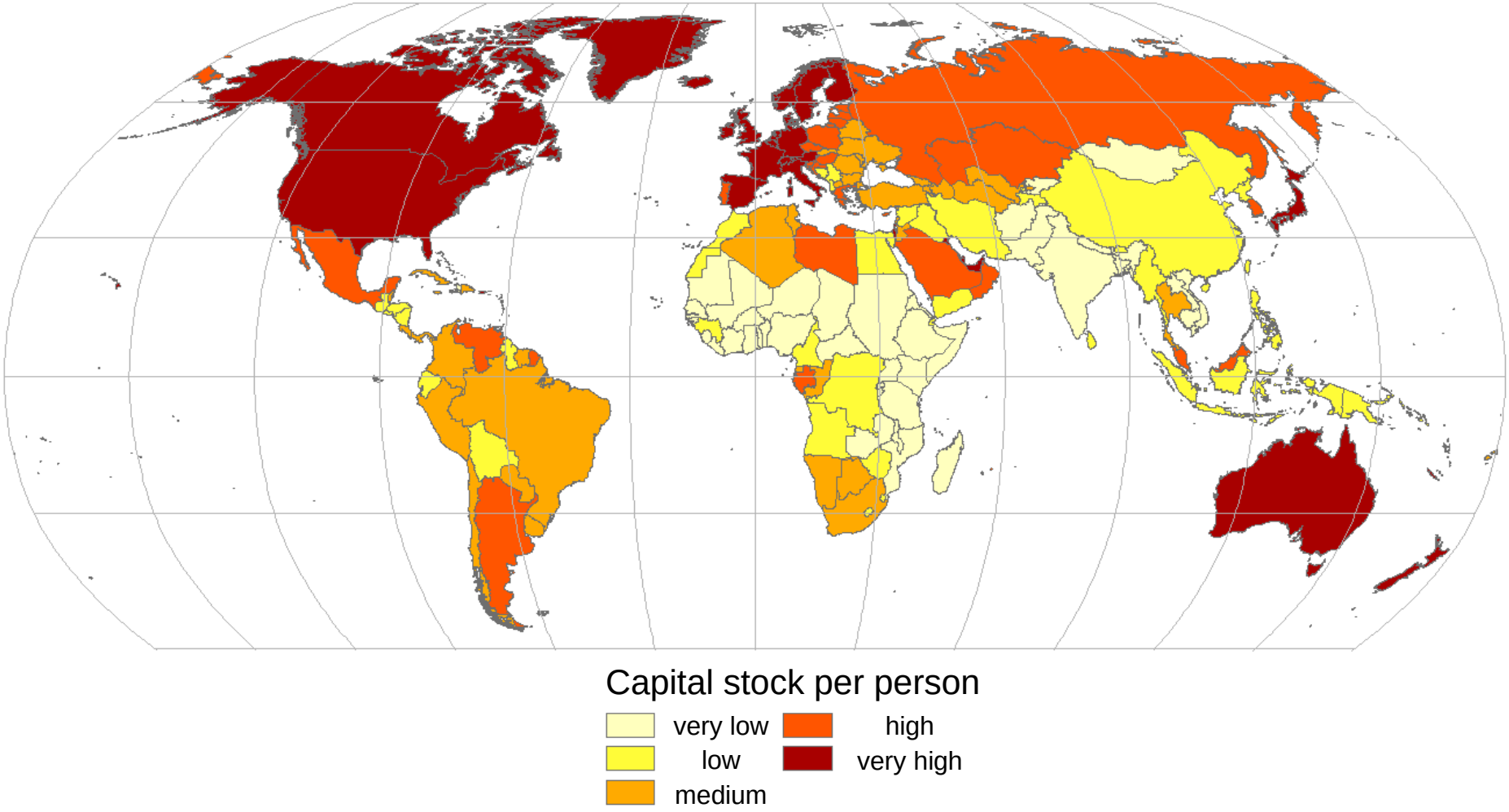


Year 2100 range (IPCC 2007)

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.

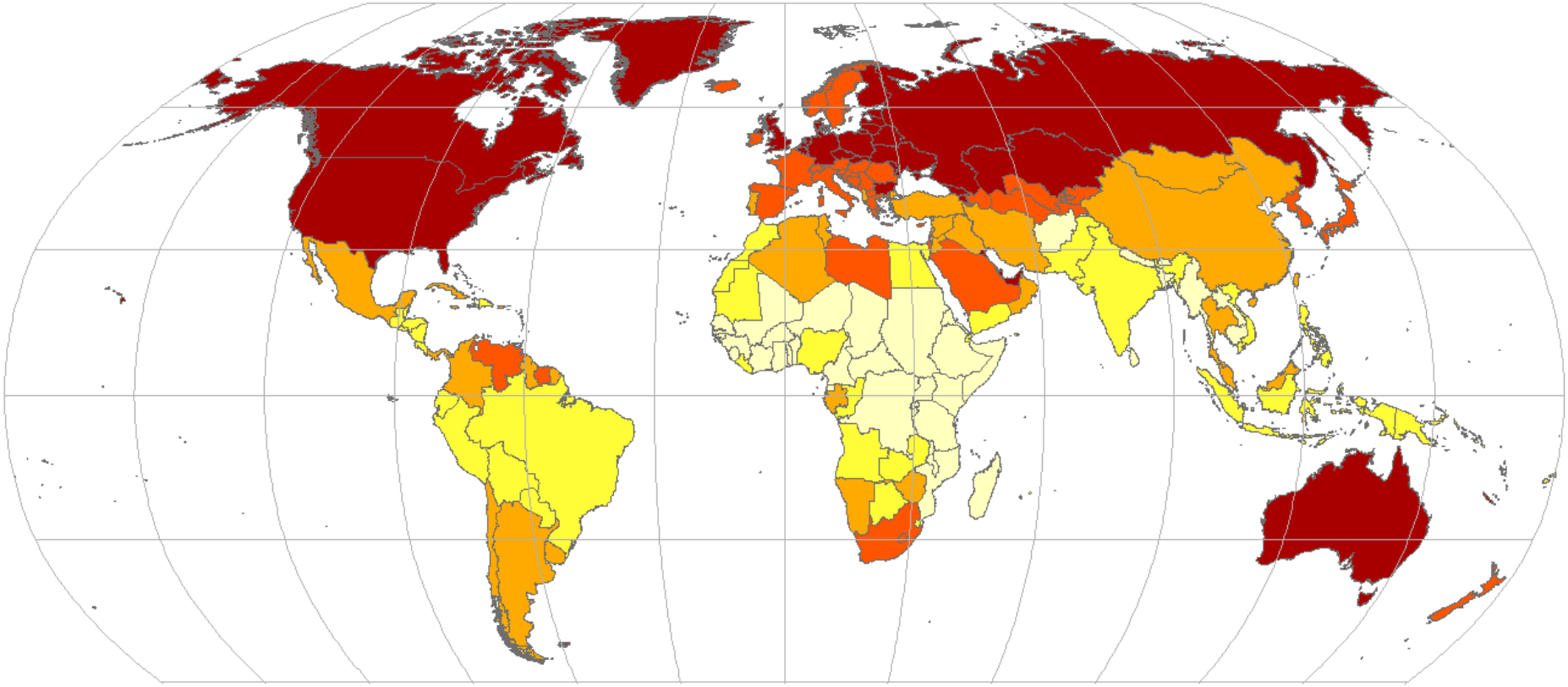
T. M. Lenton & H. J. Schellnhuber (Nature Reports Climate Change, 2007)

World Map of Wealth



Source: Füssel (2007)

World Map of Carbon Debt

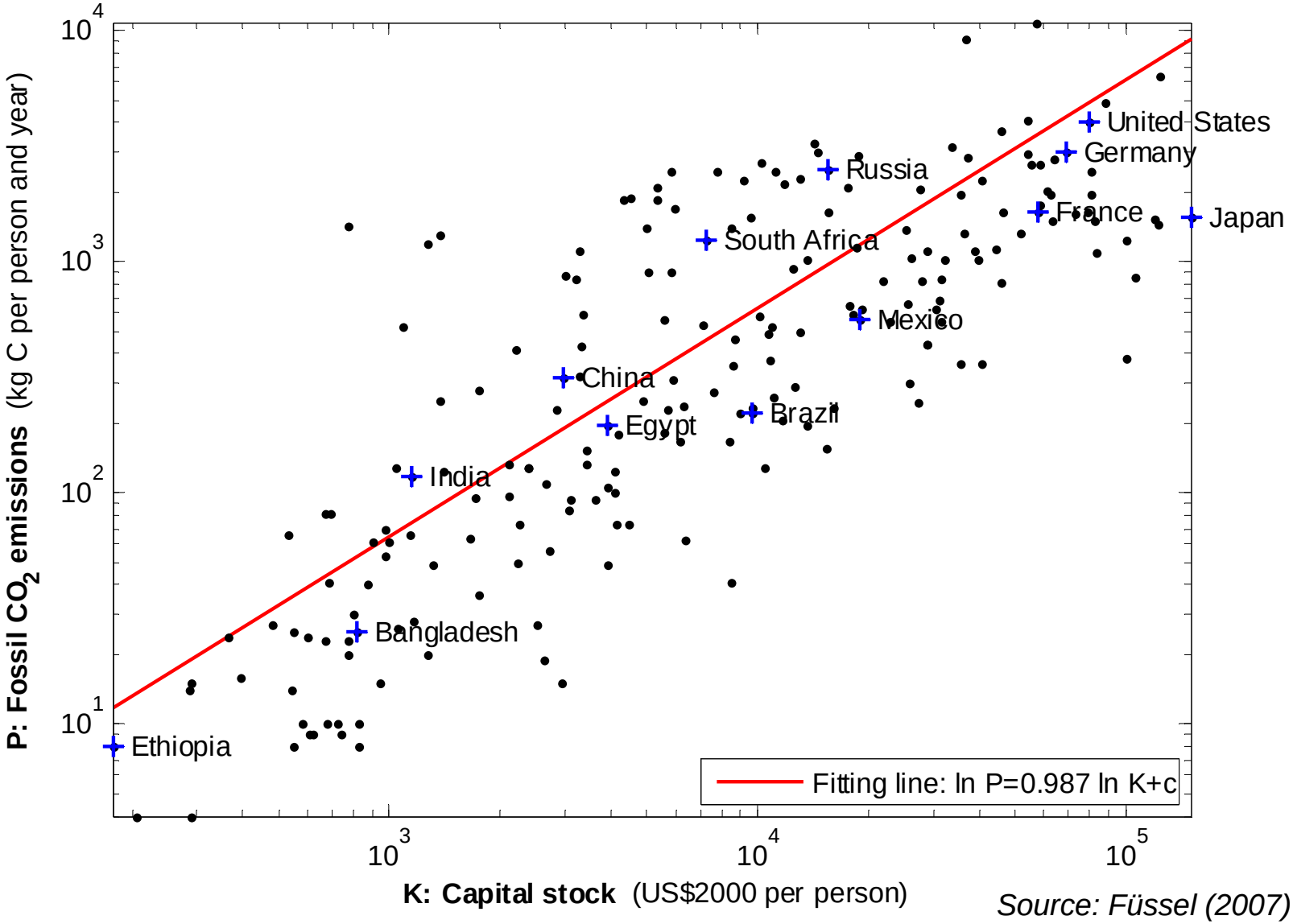


Carbon emissions per person from fossil fuel burning (1950-2003)

very low
low
medium
high
very high

Source: Füssel (2007)

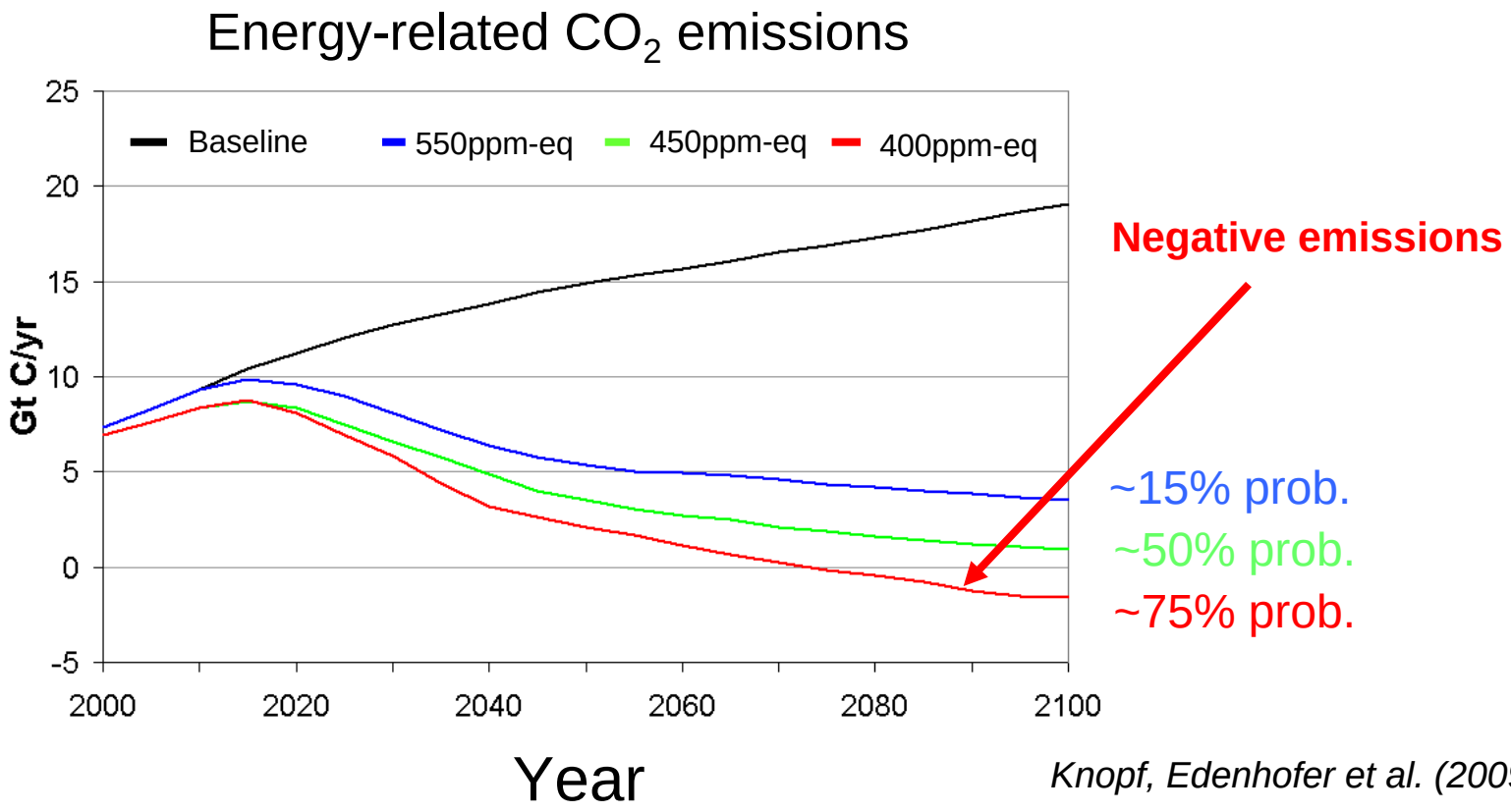
Carbon Dept and Wealth



Source: Füssel (2007)

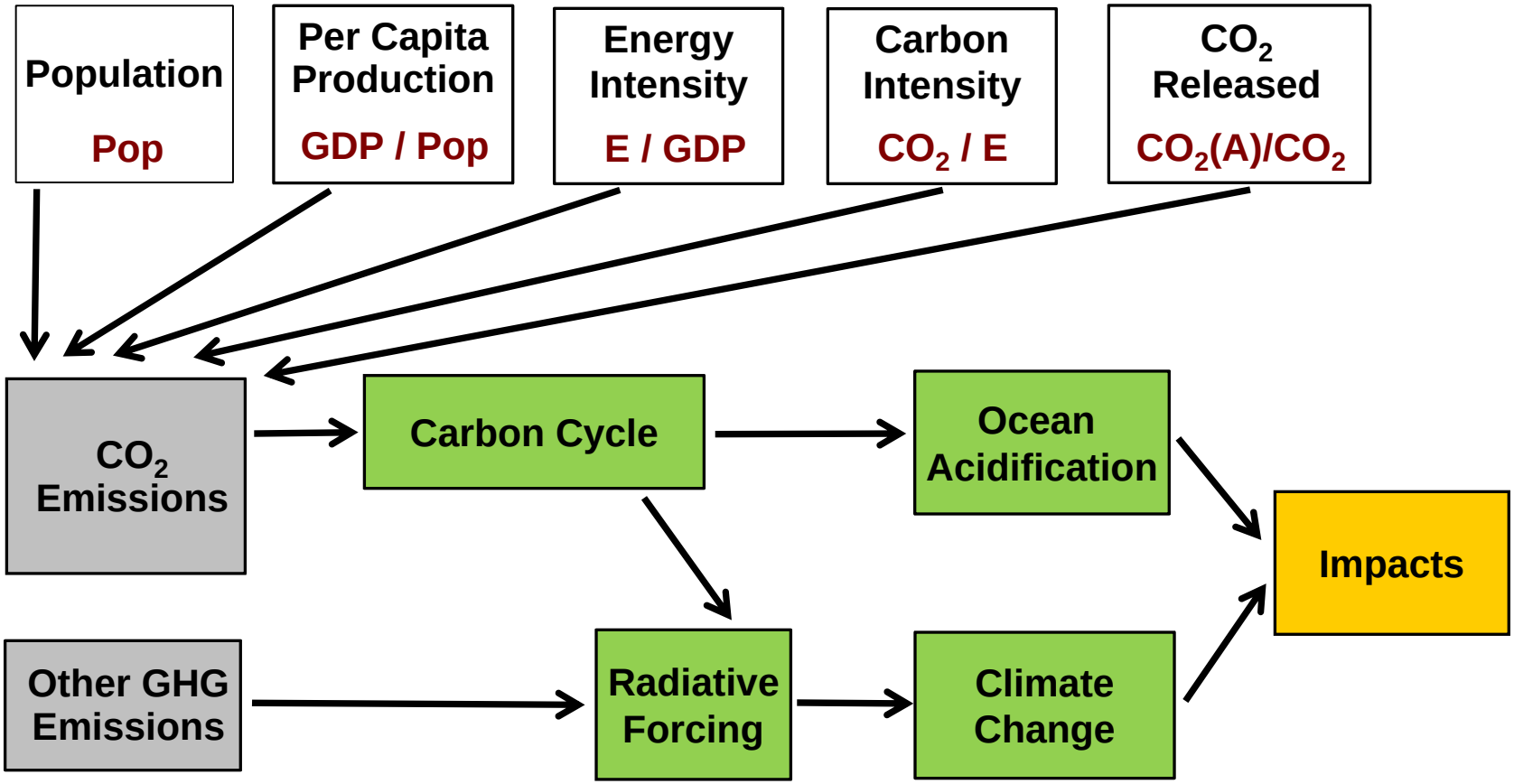
The Economics of Atmospheric Stabilisation

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

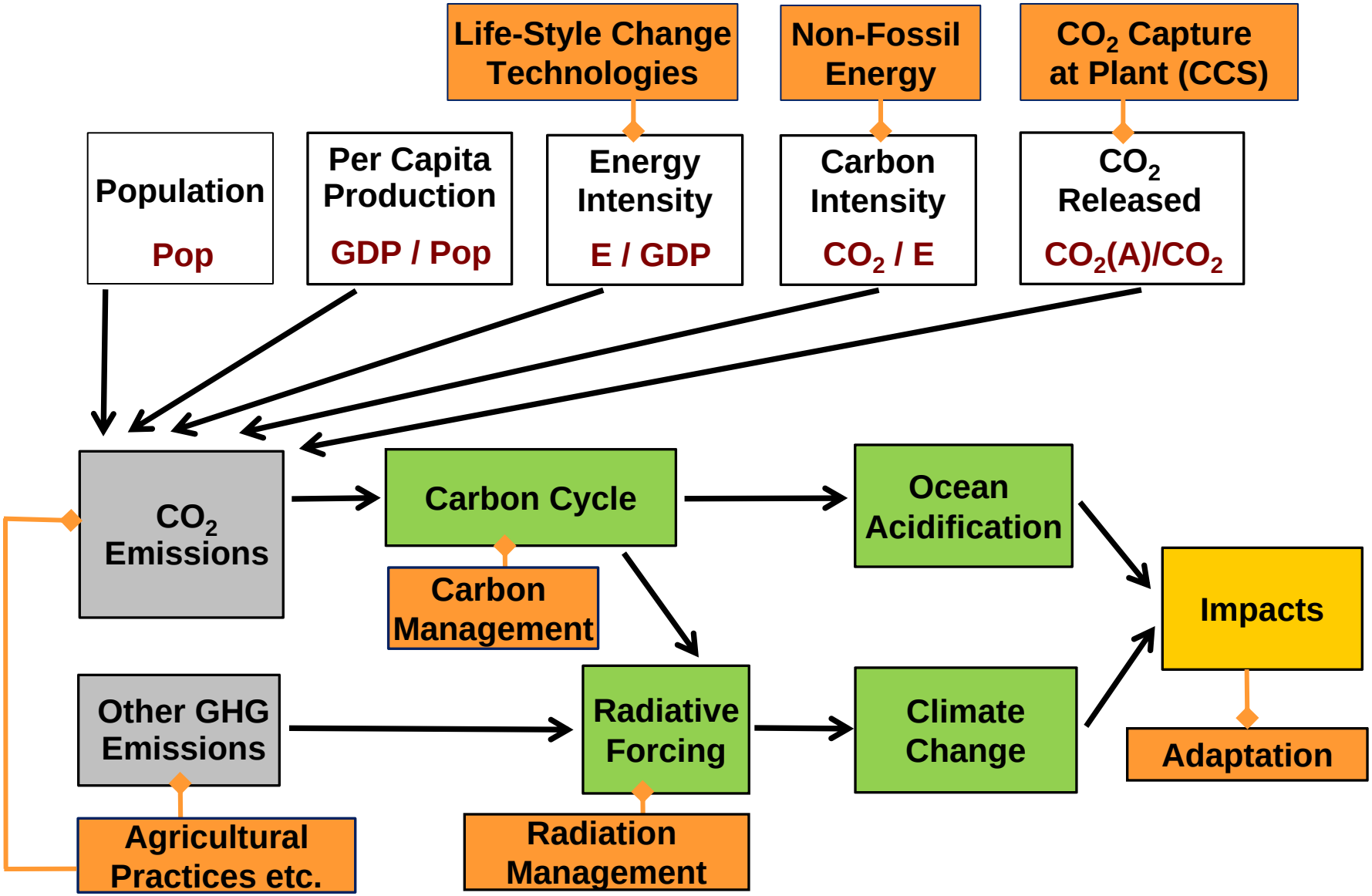


Knopf, Edenhofer et al. (2009)

Driving Forces



Assessing the Solution Space



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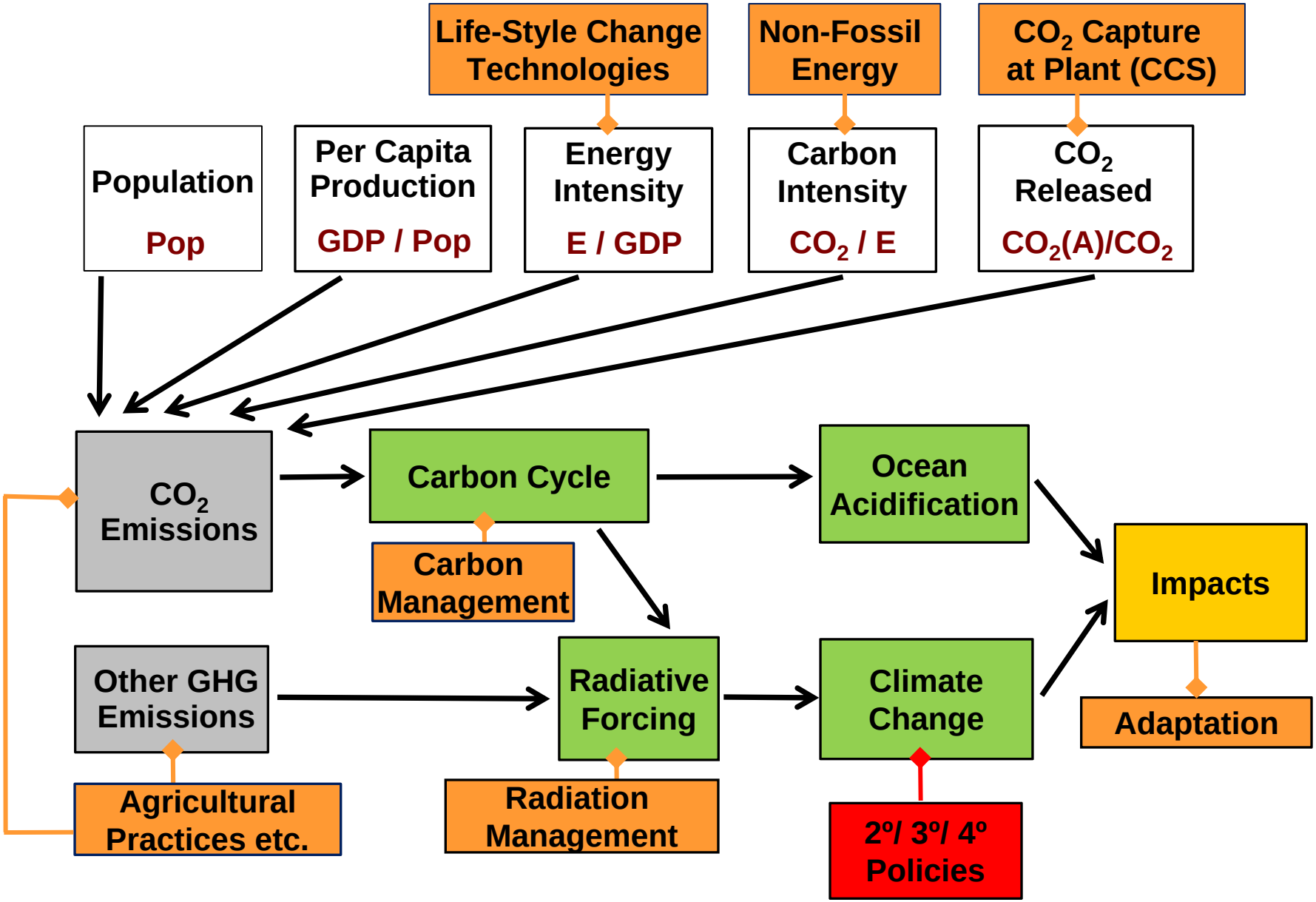
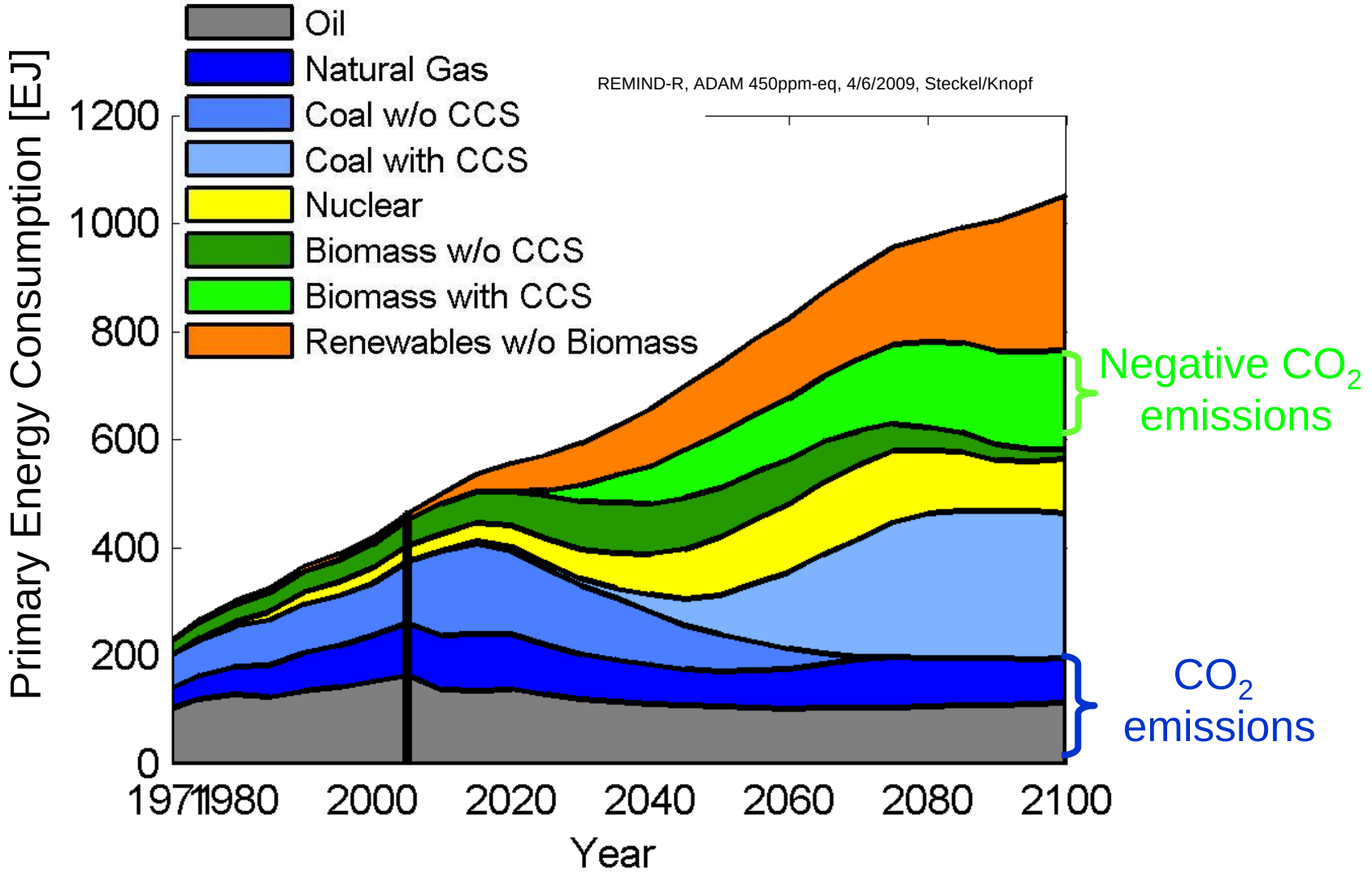


The Great Transformation



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

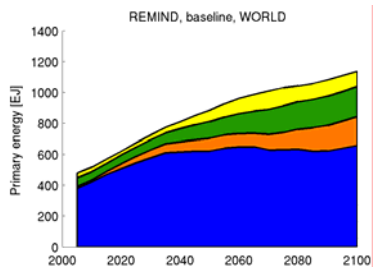
There is more than one path towards a carbon-free economy

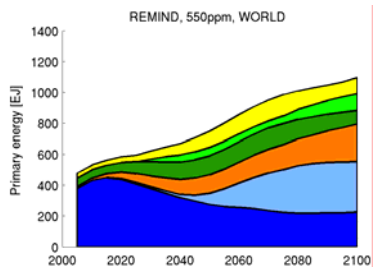
MERGE TIMER POLES REMIND E3MG

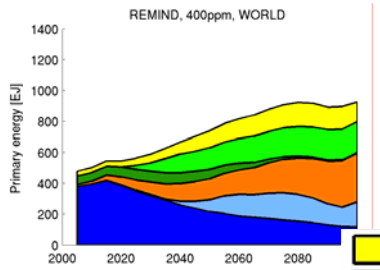
baseline

550 ppm

400 ppm

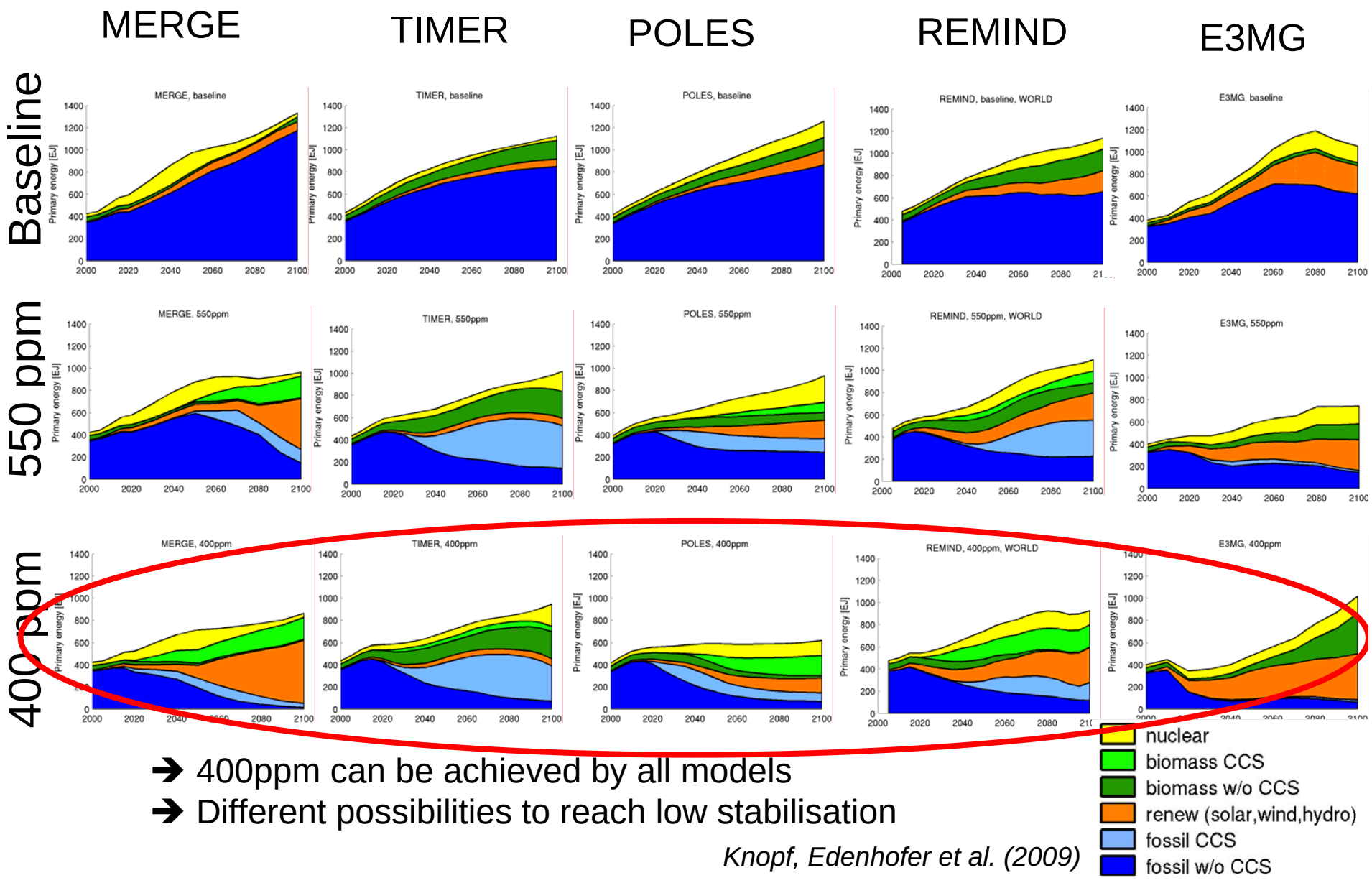






Knopf, Edenhofer et al. (2009)

There is more than one path towards a carbon-free economy

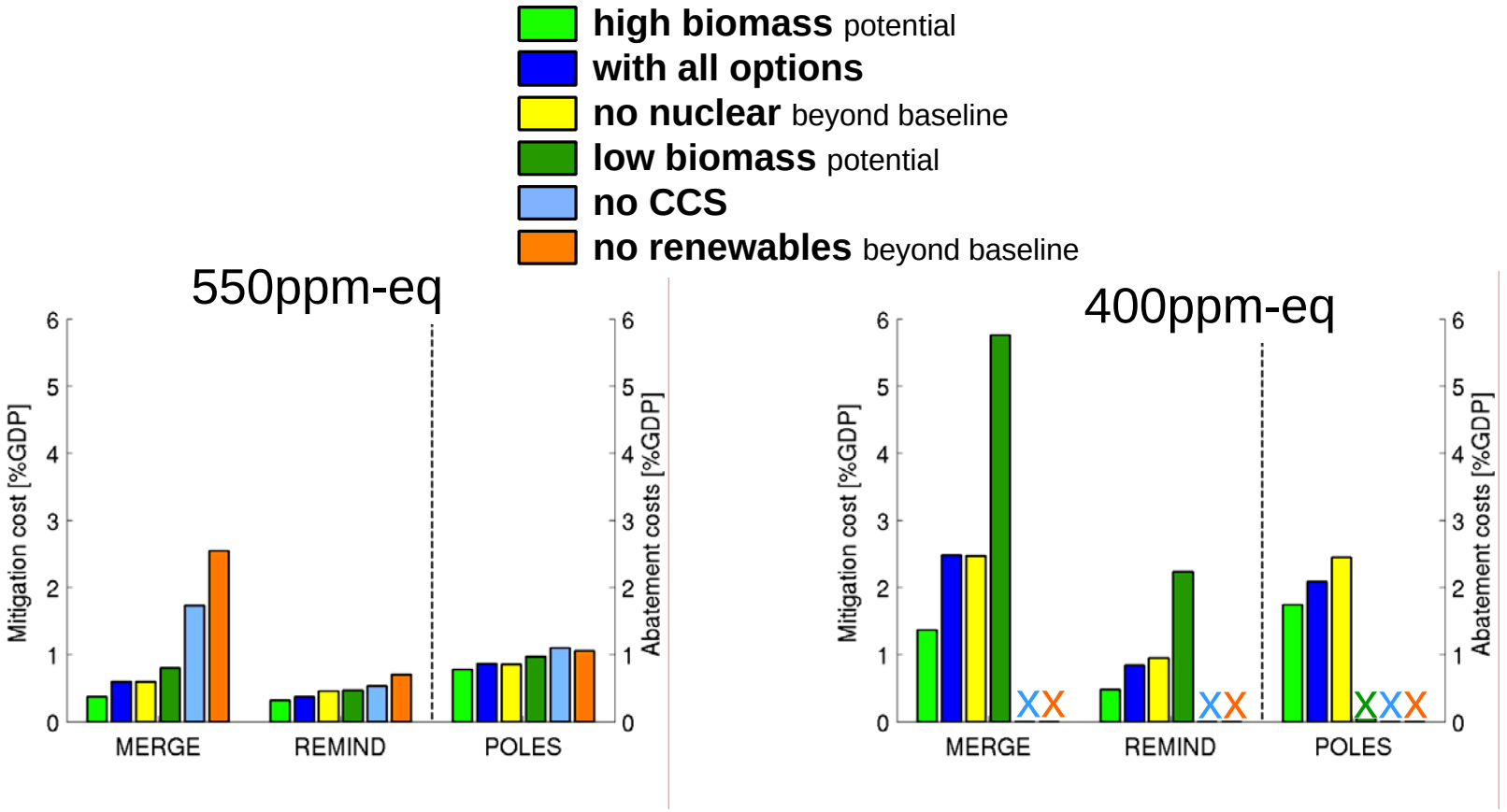


➔ 400ppm can be achieved by all models

➔ Different possibilities to reach low stabilisation

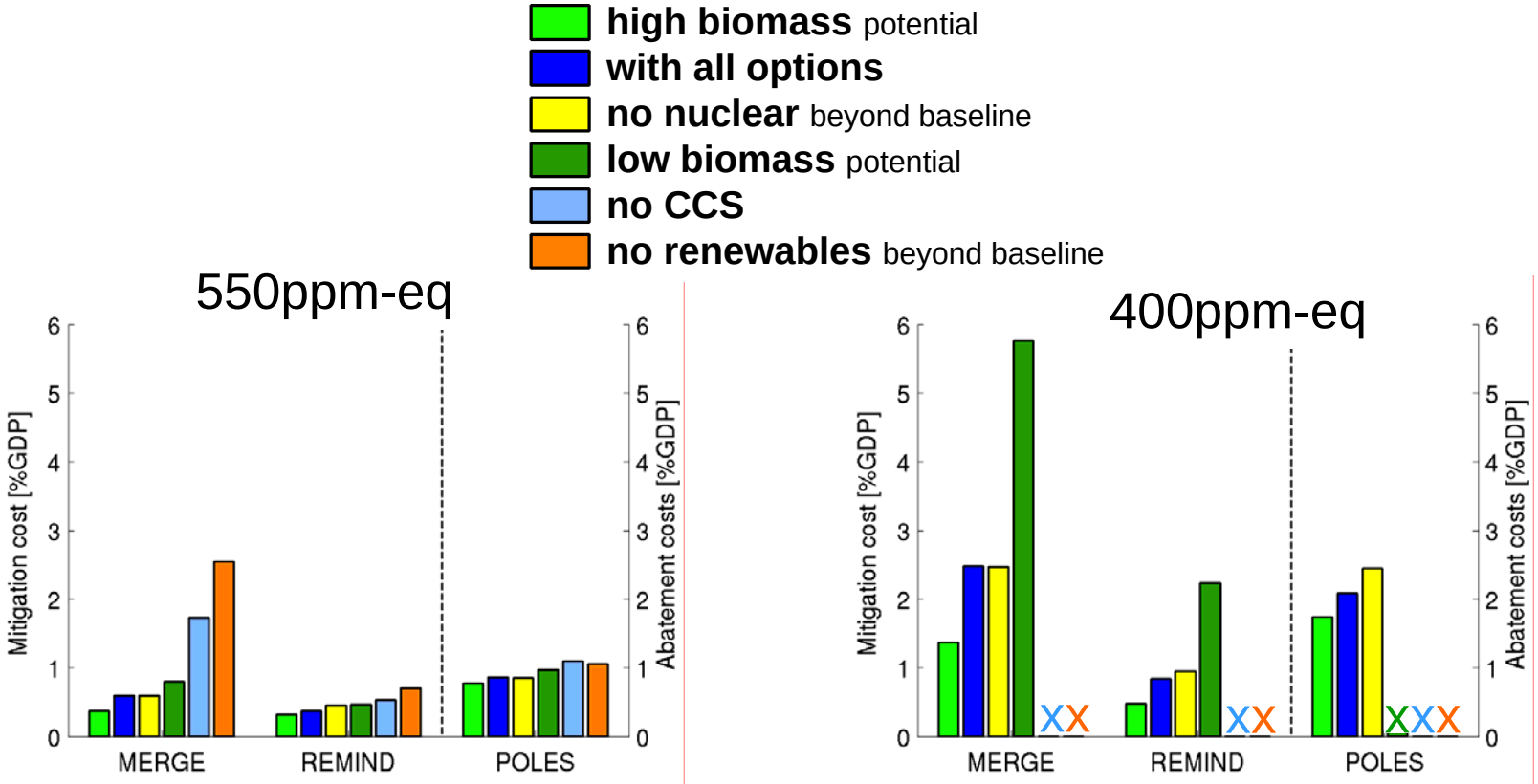
Knopf, Edenhofer et al. (2009)

Technology Options for Low Stabilisation



Knopf, Edenhofer et al. (2009)

Technology Options for Low Stabilisation



Knopf, Edenhofer et al. (2009)

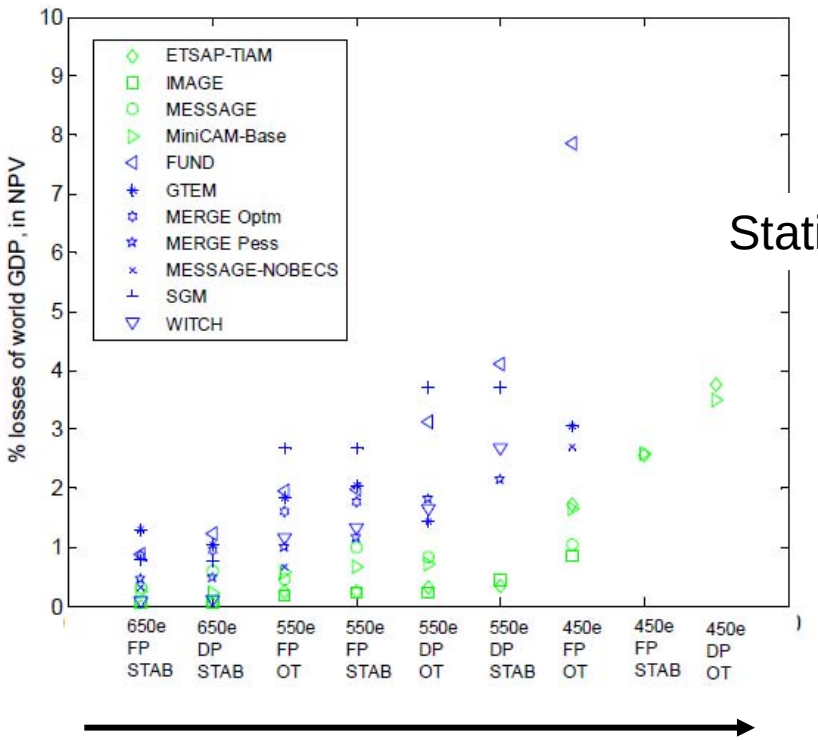
➔ 400 ppm neither achievable without CCS nor without an extension of renewables

➔ Biomass potential dominates the mitigation costs of low stabilisation

➔ Nuclear is not important beyond its (high) use in the baseline

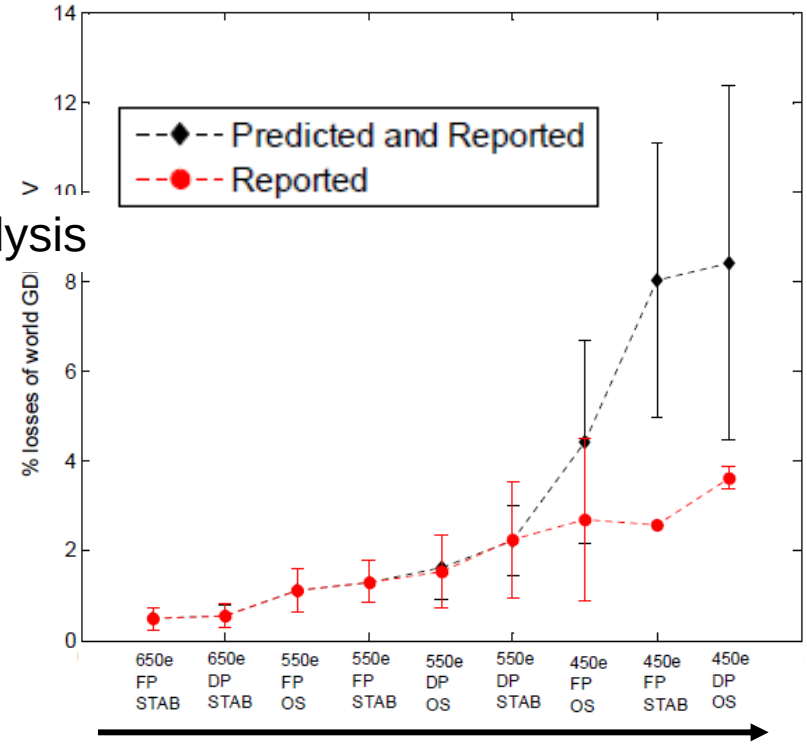
Statistical Analysis for Assessing Second Best Worlds

Green: with BECS
Blue: w/o BECS



Increasing strictness of target

Statistical Analysis



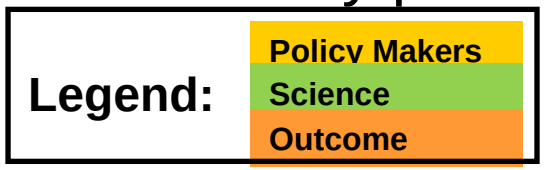
Increasing strictness of target

Tavoni and Tol (2010)

The Technocratic Model

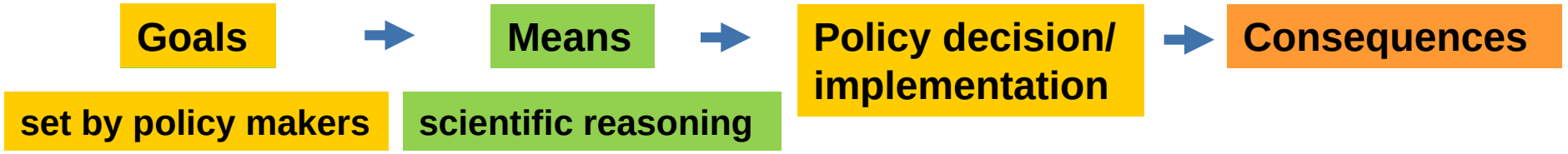
- The technocratic model:

- Max Weber predicts that this model will abolish democratically legitimized policy making. (Policy makers ask for practical constraints, science offers inherent necessities to legitimize policy making.)
- What does consensus among WGI, II, and III relate to respectively?
- Question not answered in technocratic model, consensus is mostly pretended.

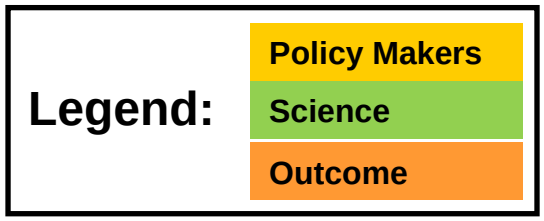


The Decisionistic Model

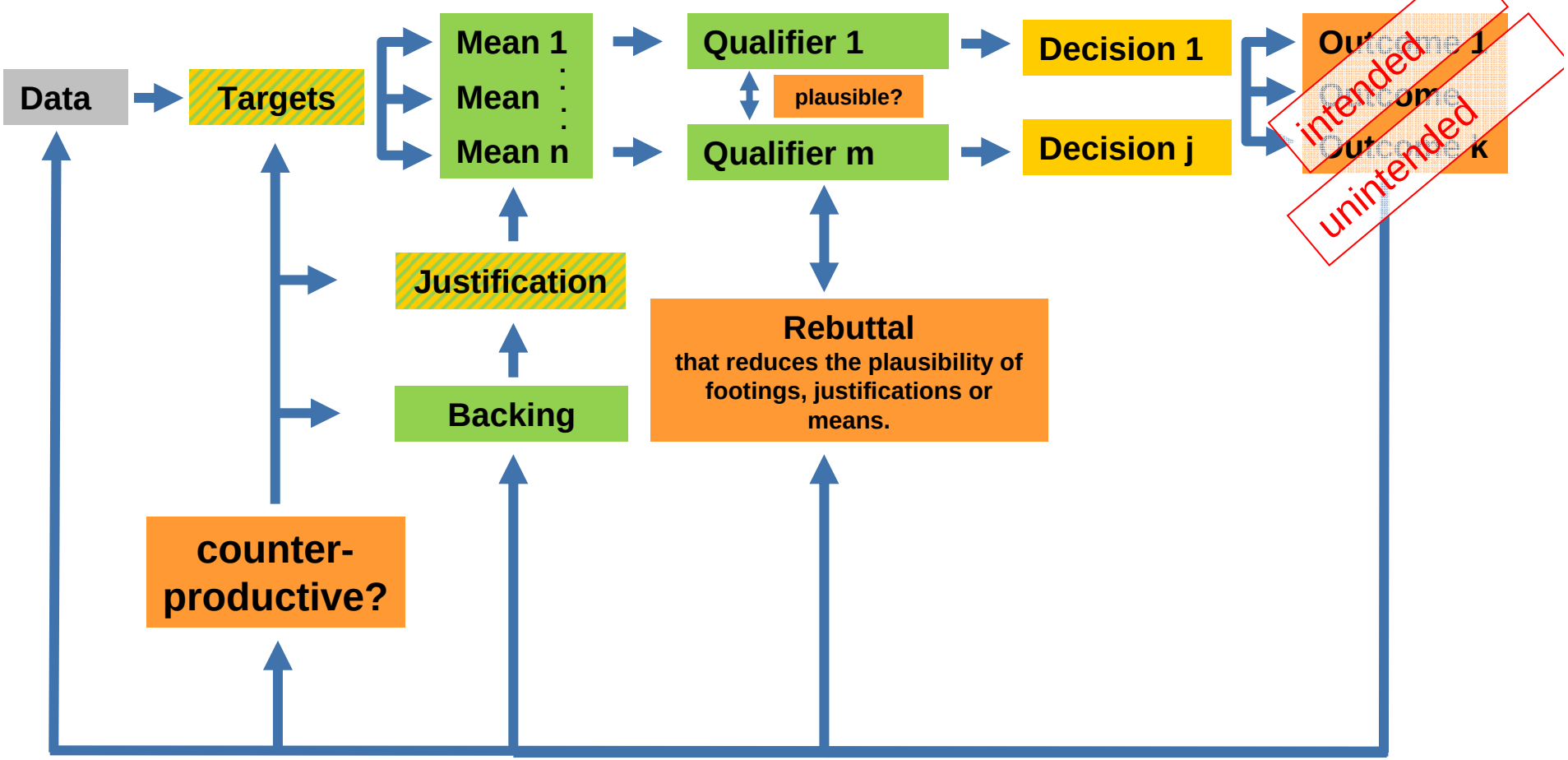
- The decisionistic model:



- This devision of labour presumes: *Distinction of facts and values and of targets and means always feasible.*
- Goals and possible conflicts and synergies among them are usually re-assessed ex-post in the light of their intended and unintended consequences. This requires a continued dialogue between science and policy makers.



The Pragmatic-Enlightened Model



Legend:

- Policy Makers
- Science
- Outcome

“Policy relevant but not policy prescriptive“

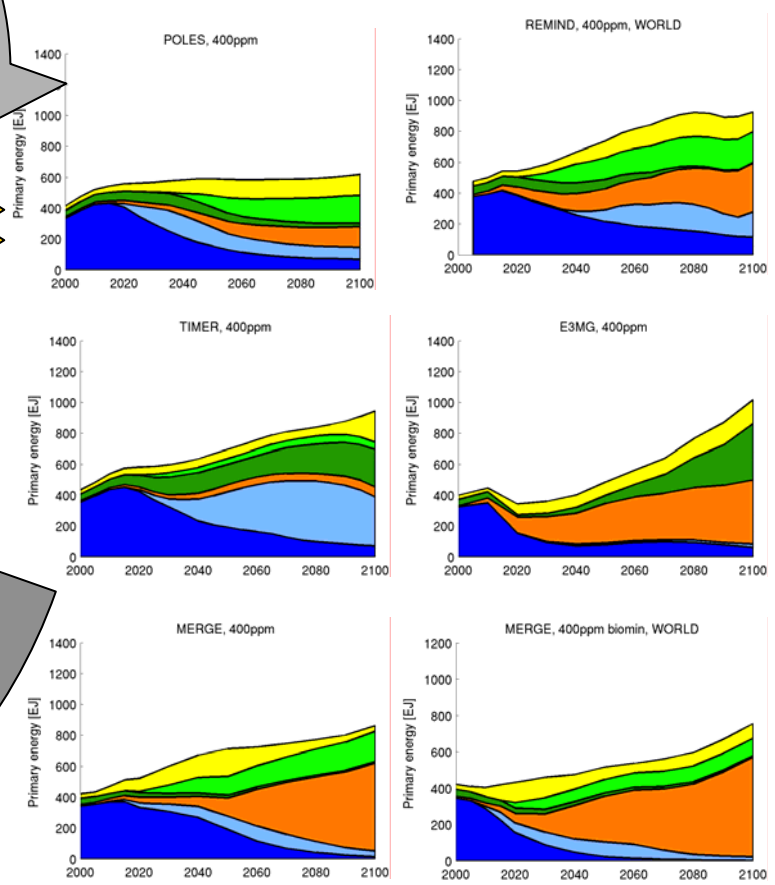
Science

Goal-setting by politics

Data

2°C Target

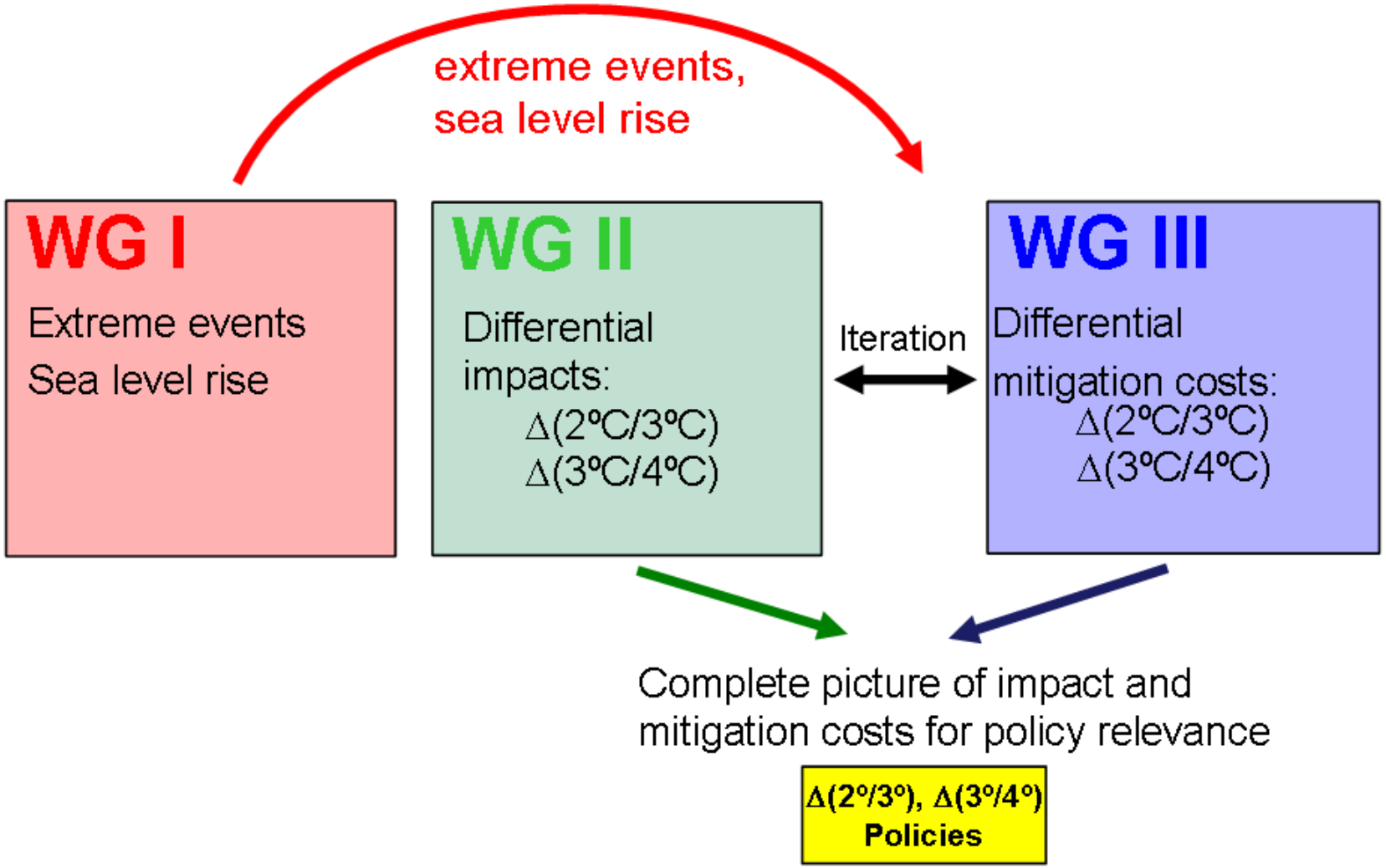
Science: Scope of options



Such as impacts from excessive use of biomass or geoengineering

Consideration of unintended side-effects of BECS / Geo-engineering

Implications for the Scenario Process



International Environmental Agreements

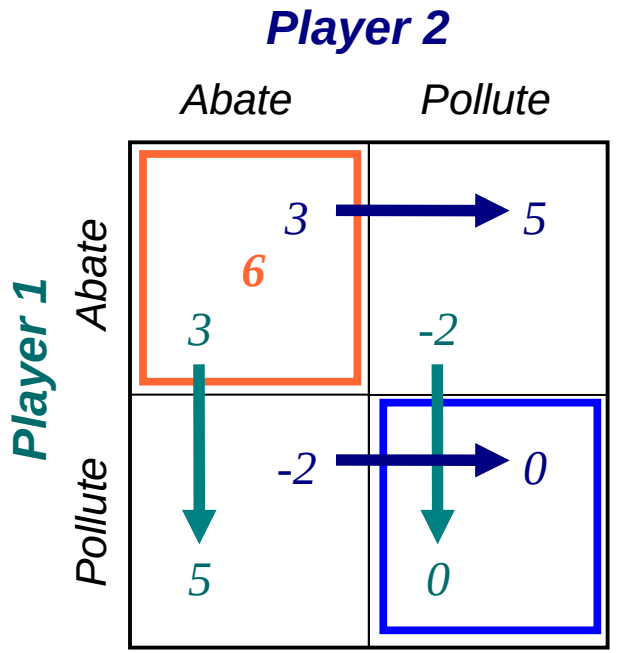
- In many cases global climate policy implicitly assumes full international cooperation
- In reality: lack of a global authority
  instead: international environmental agreements (IEA)
- Participation is low whenever IEA (Barrett 1994) actually achieve something

Bali 2007

Public Good Provision as a *Prisoners' Dilemma*

- Provision of a Global Public Good:
  - (Same) benefits for everyone, say e.g. *5* (*per contributing party!*)
  - (Same) costs to contribute, say e.g. *7*

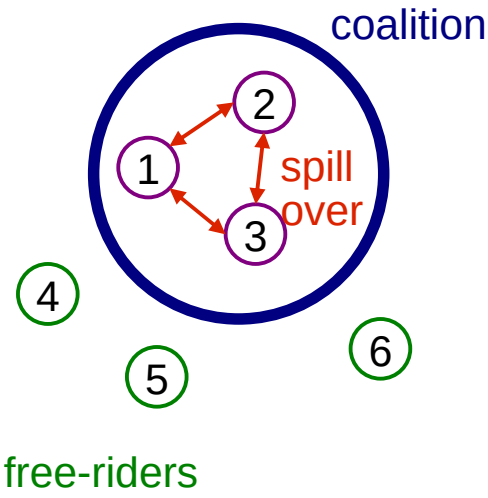
- Game Structure of the ***Prisoners' Dilemma:***
  - Individual rationality for players to act selfishly
    - → Incentive to *free-ride*
    - → *Suboptimal outcome*

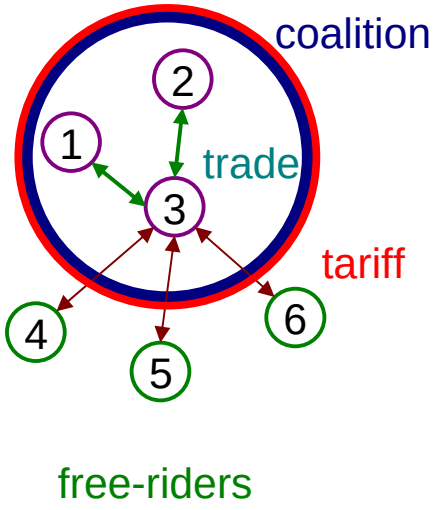


- If abating global warming resembles a Public Good, then climate negotiations will face a Prisoners' Dilemma

Reward: Technology Cooperation and Punishment: Import Tariffs

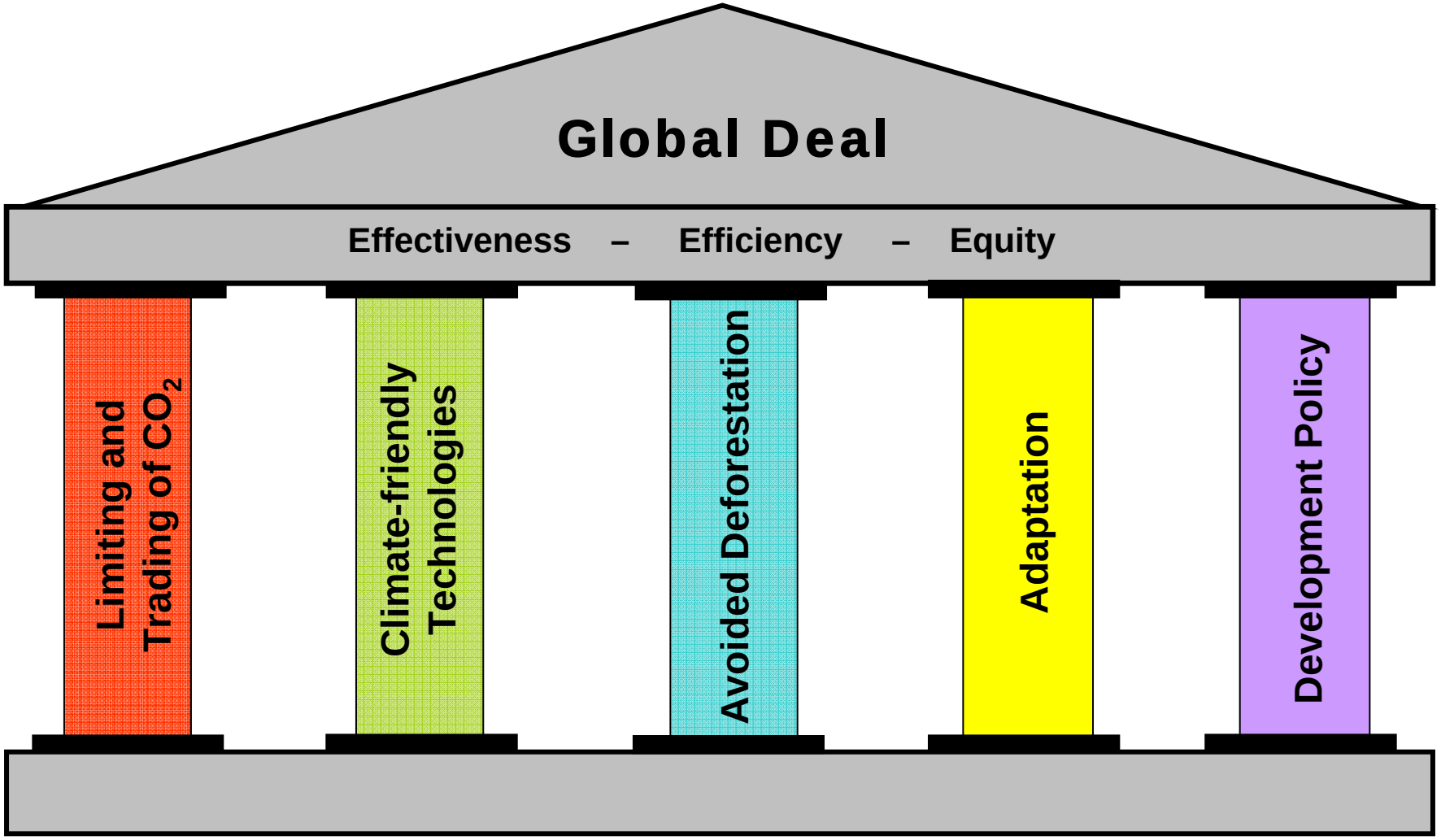
- Tuning incentives by treaty design:
  - Positive incentive: *Research Cooperation*
    - R&D spill-over within coalition
    - Participation rises with spill-over intensity
    - Improving *productivity* by R&D shown to be a stronger incentive than improving *abatement*
  - Negative incentive: *Import Tariffs*
    - Coalition levies tariffs on imports from free-riders
    - Tariffs induce up to full cooperation
    - Tariffs are individually + socially rational
- Polycentric Governance





For details see

- Lessmann et al. (2009), Economic Modelling
- Lessmann and Edenhofer (2010), Resource and Energy Economics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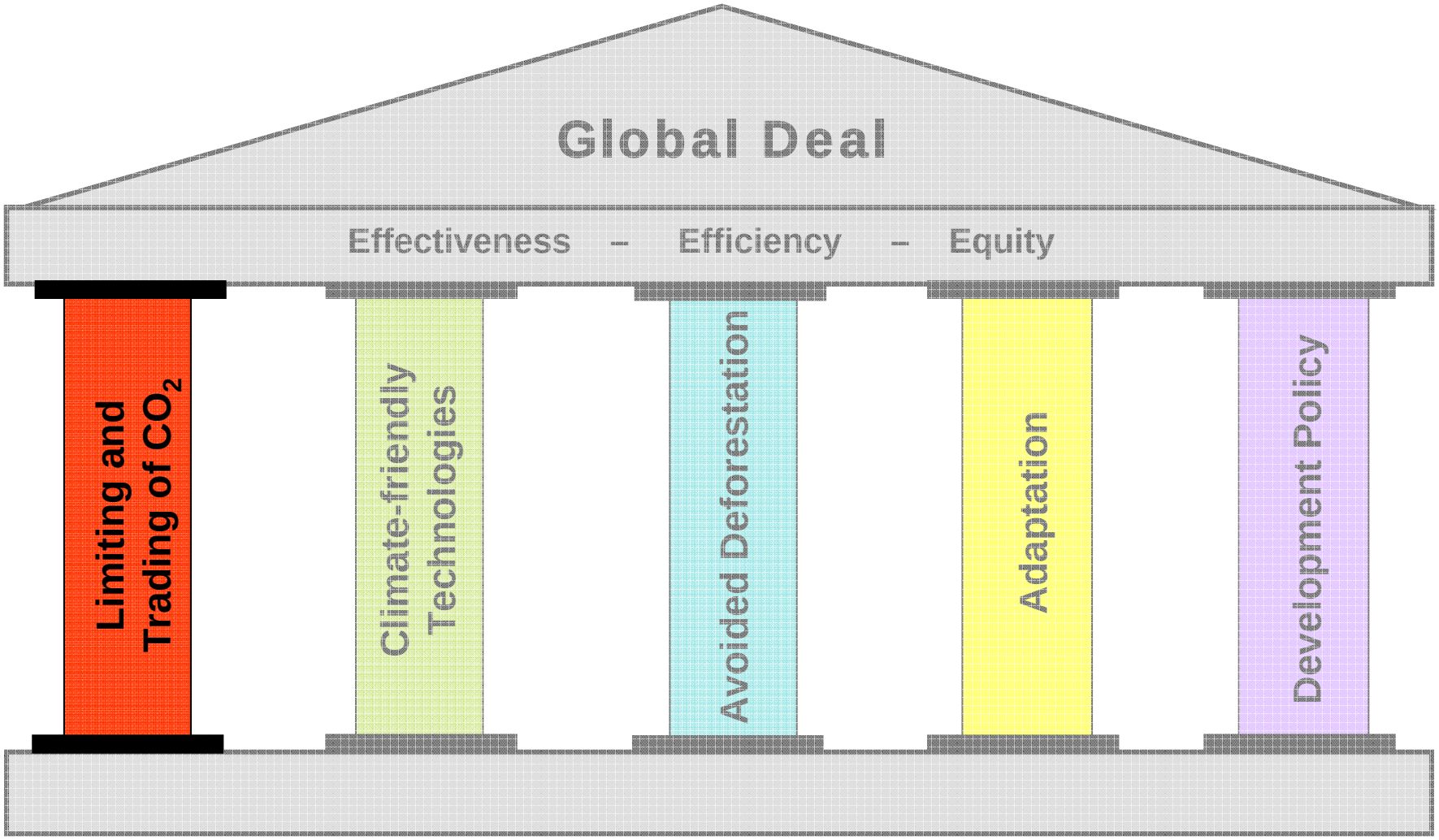
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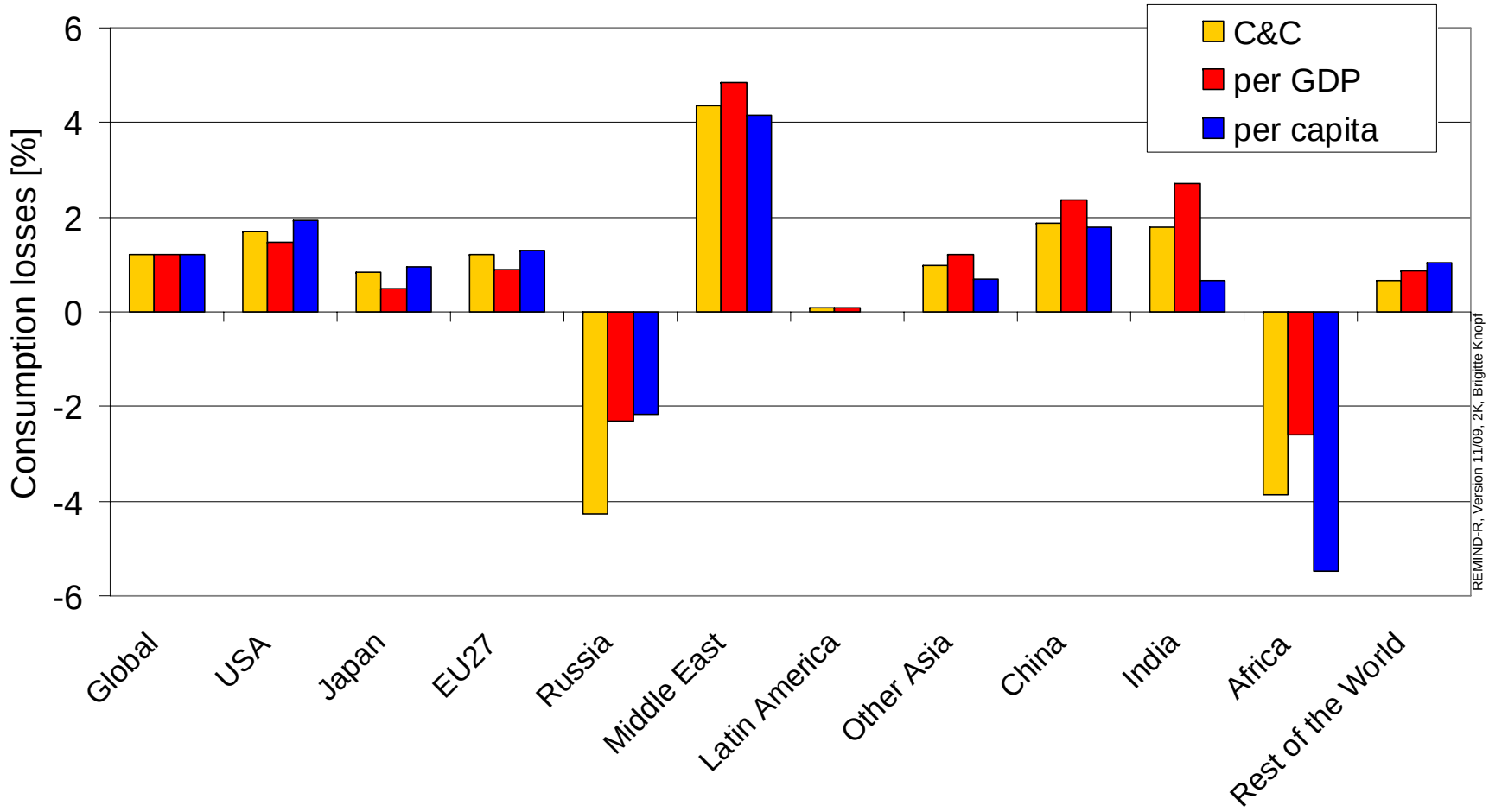
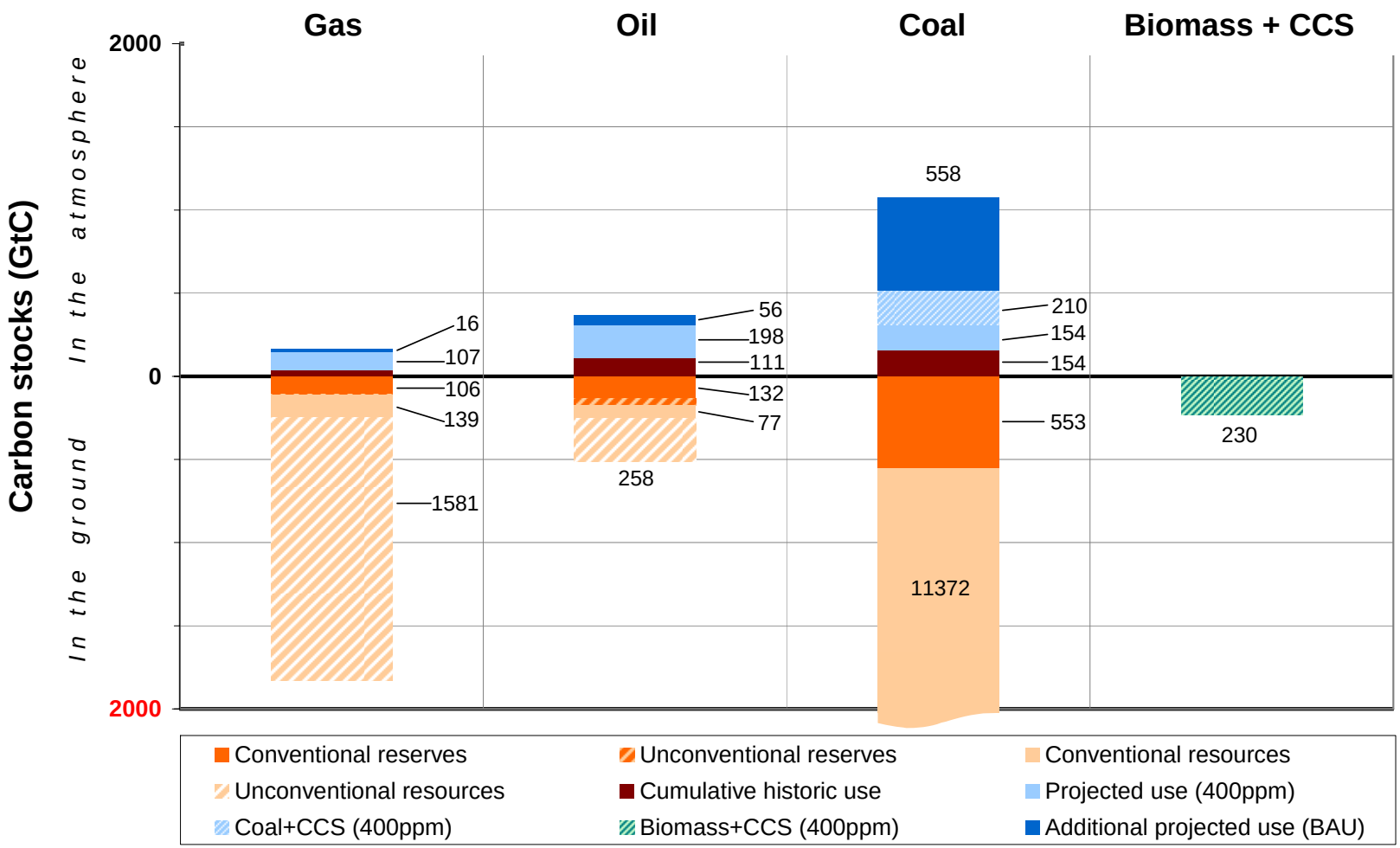
Regional Mitigation Costs: Winners and Losers



Edenhofer et al., 2009

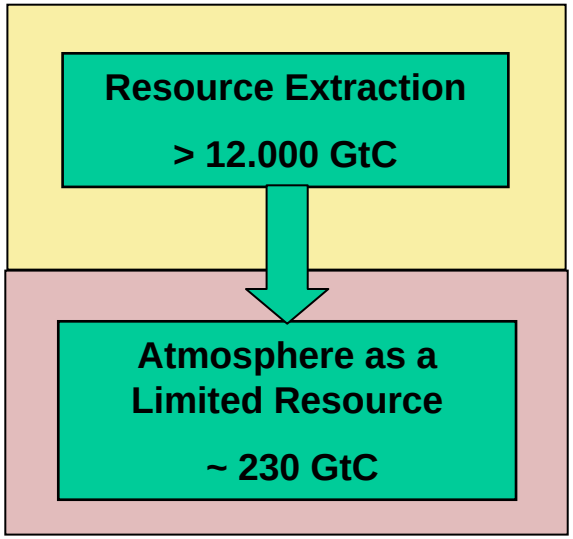
The Supply-side of Global Warming



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_2-eq. scenario

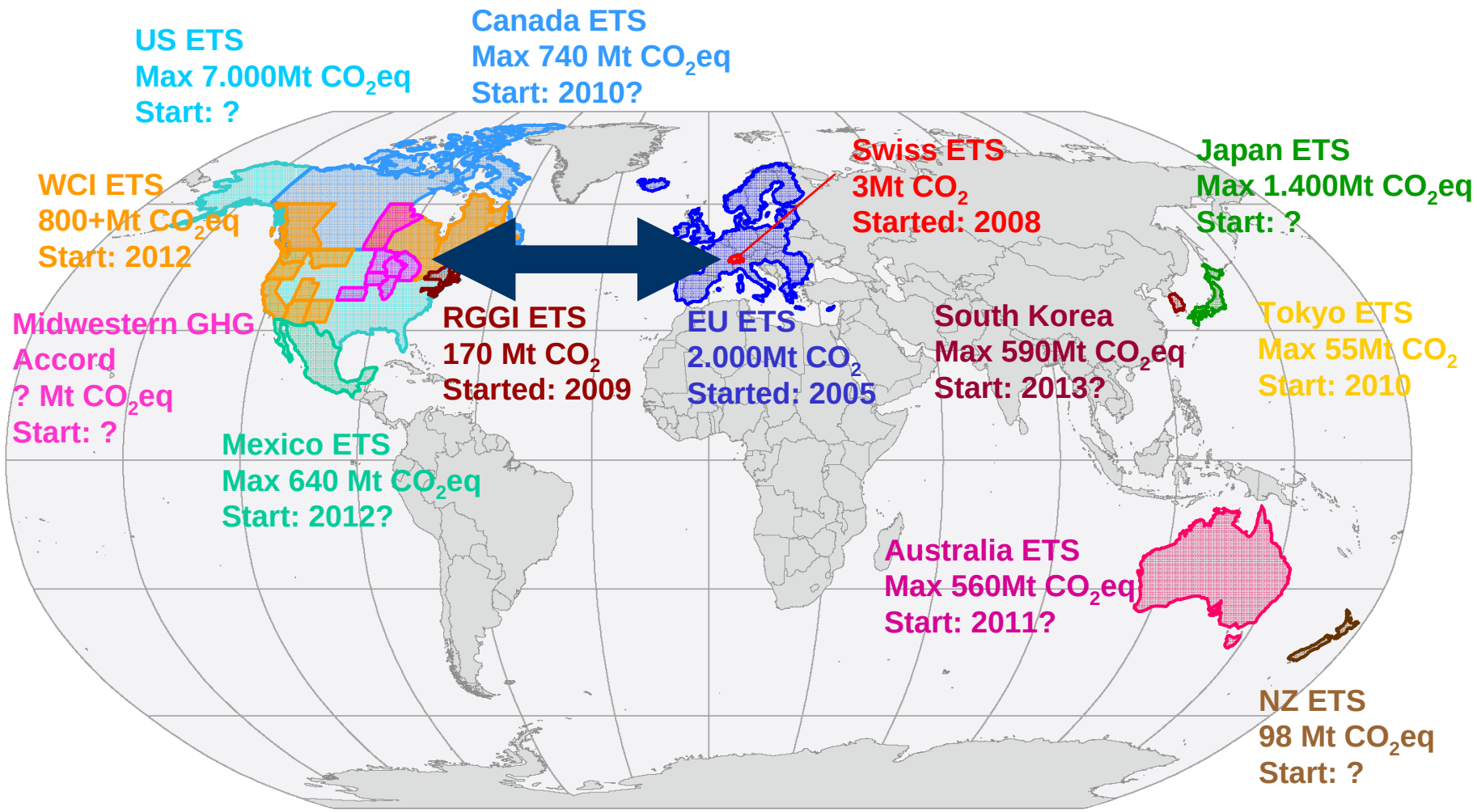
Source: Kalkuhl, Edenhofer and Lessmann, 2009

The Supply-side of Global Warming



- Atmosphere is a scarce resource – fossil carbon is not
- Economic approach to deal with scarcity in an efficient way:
  - Establish prices on scarcities
- Who should determine scarcity prices?
  - Regulator (establish prices on the use of scarce resources – carbon tax)
  - Market (assigning property rights according to the scarcity of the atmosphere – ETS)

Domestic Cap and Trade: Linking Emerging CO_2-Markets



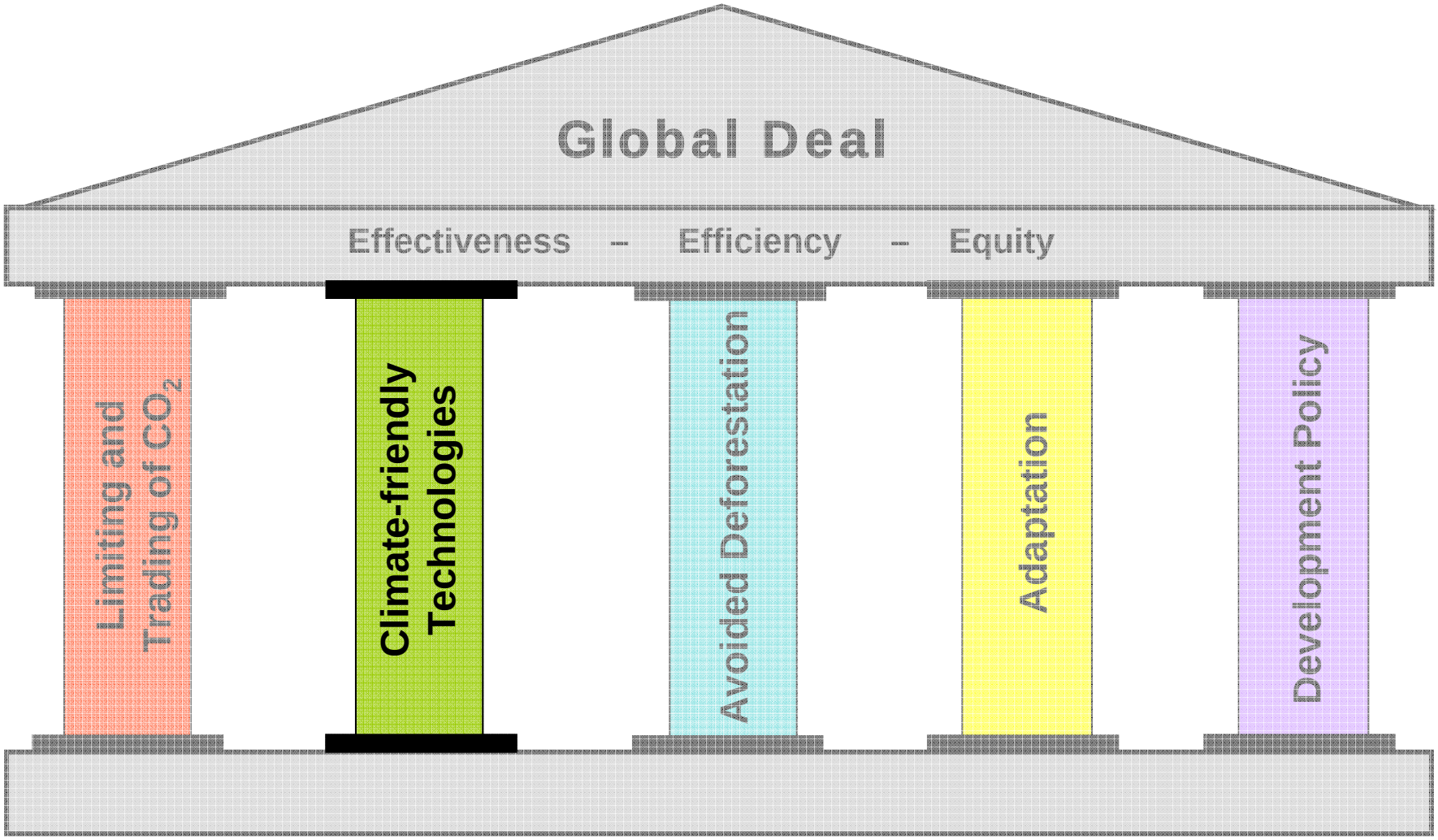
"The European Commission is preparing to call on the United States to create a trans-Atlantic system of carbon trading"

- Herald Tribune, Friday, January 23rd, 2009

Source: Flachsland (2009)

The Representative Clients of AR5 in WG III

- International level: Negotiators, NGO‘s
- National Policies: Parliaments, governments, national agencies
- Regions: e.g. EU
- Sub-National Level: Cities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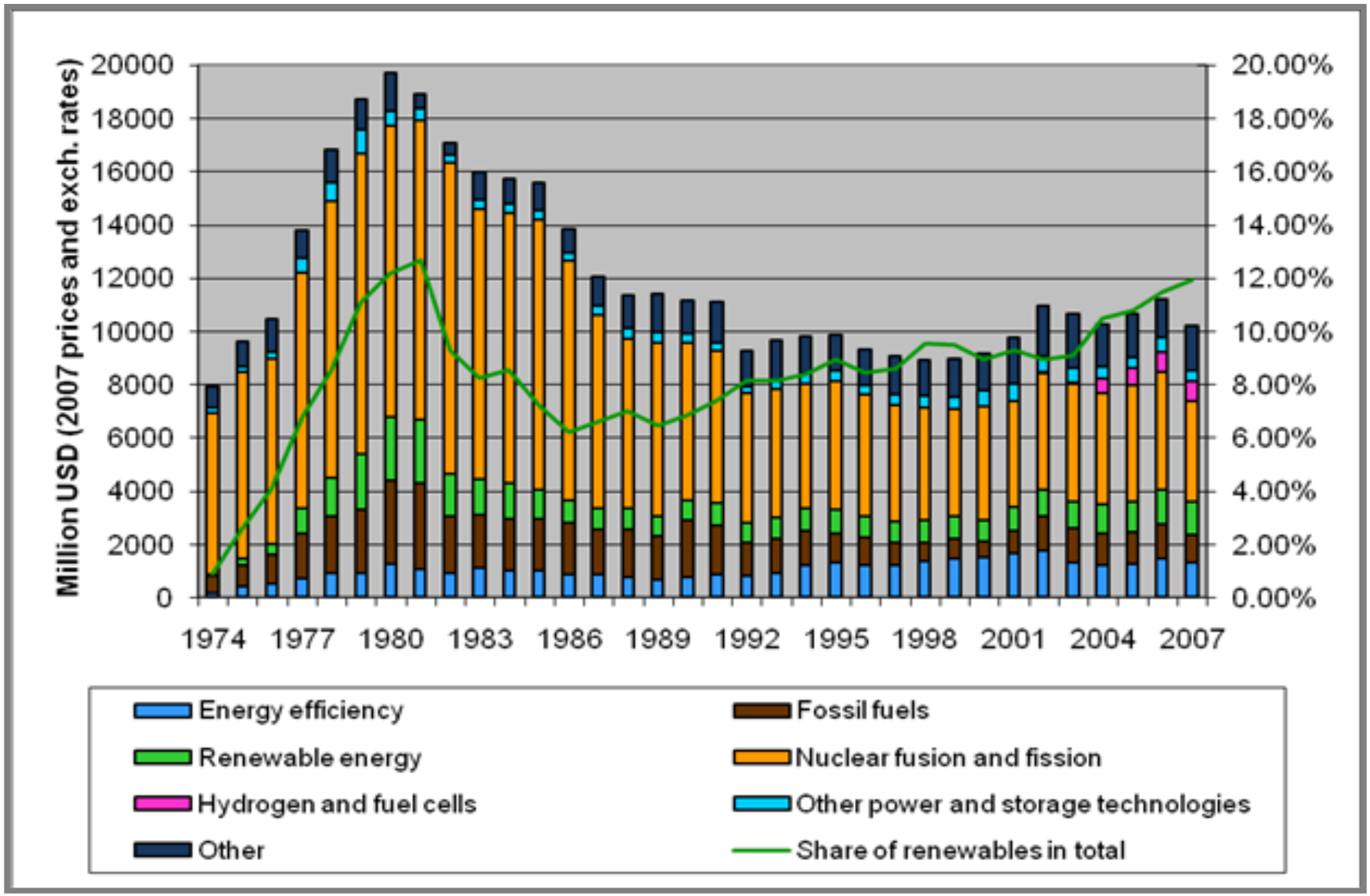
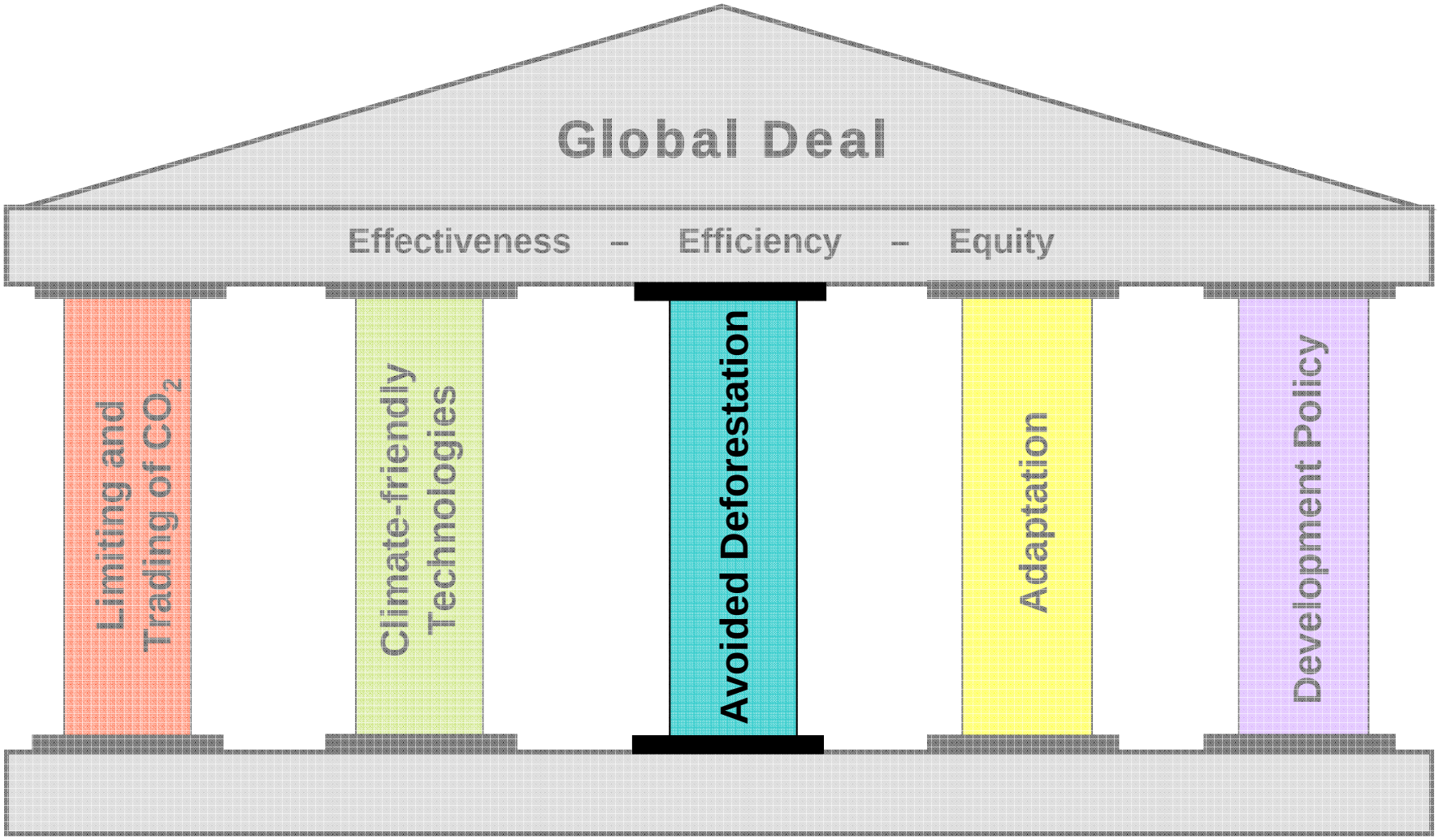
R&D-Investment in Energy Technologies



Source: Updated version of IPCC (2007), AR4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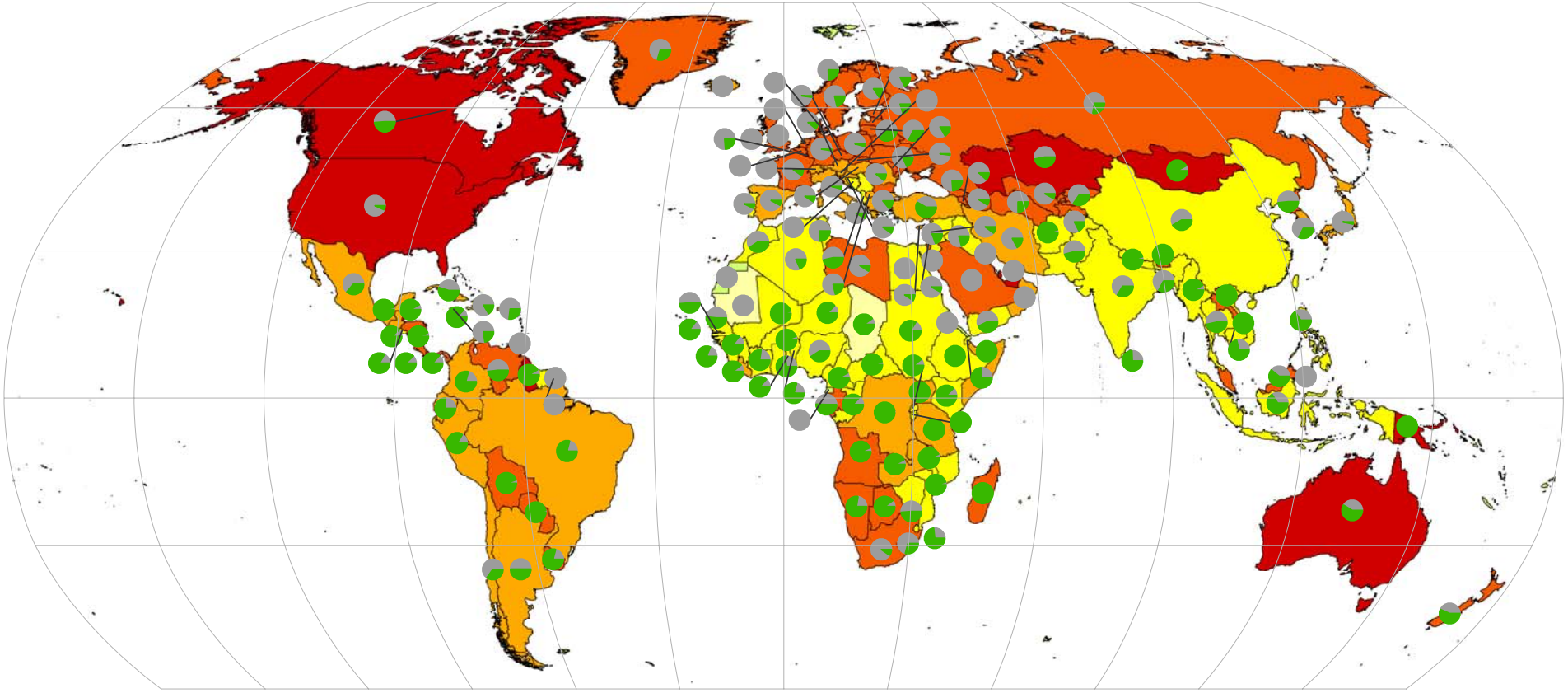
Reducing Deforestation: Fossil vs. LUCF CO_2 Emissions

CO_2 emissions per person and year, 1950 - 2003



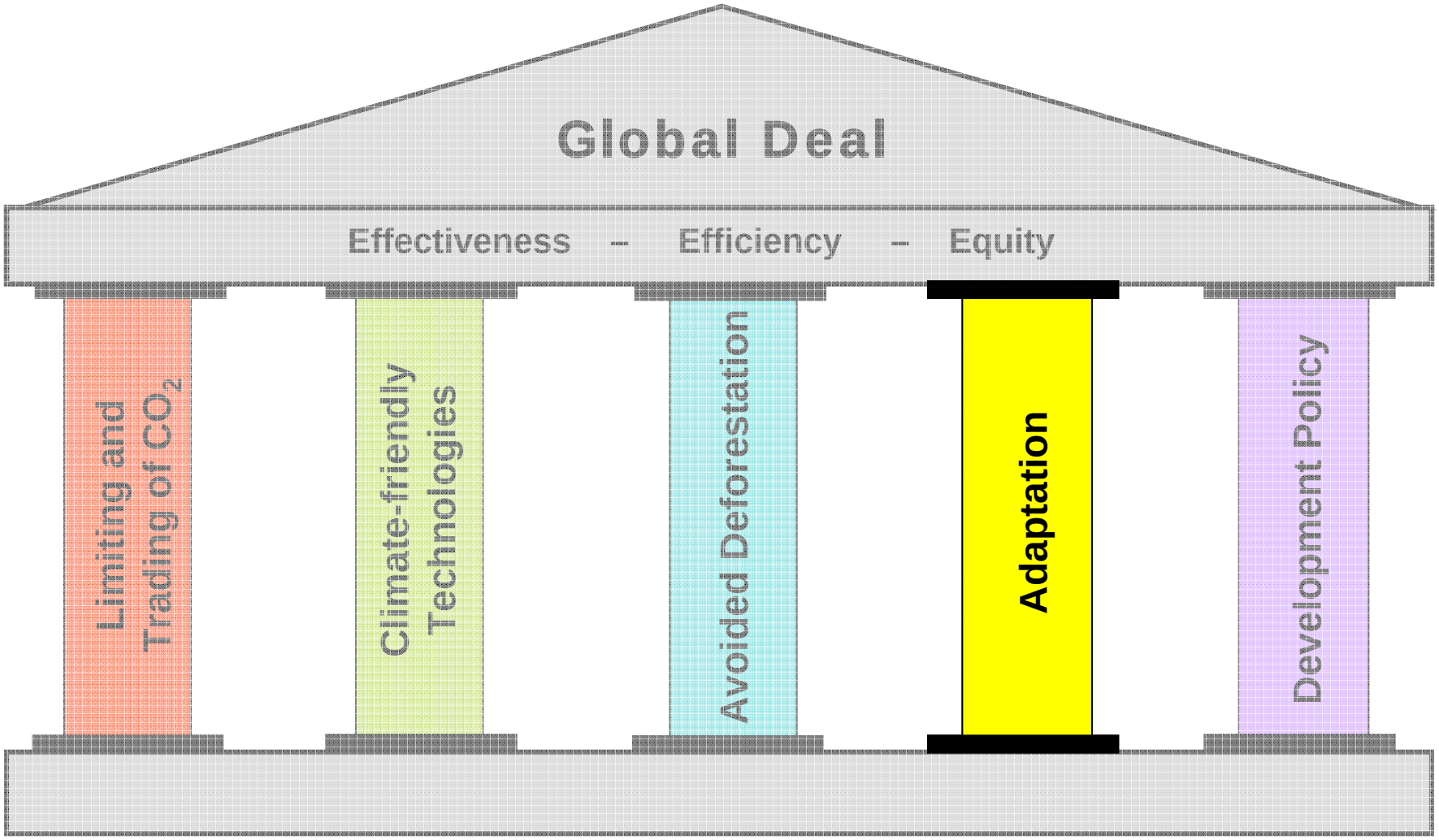
CO_2 emissions from fossil fuel combustion and cement production, and including land use change (kg C per person and year from 1950 - 2003)

-1000 - 0	1000 - 2000
0 - 100	2000 - 5000
100 - 1000	5000 - 15000

Ratio

Emissions per year from fossil fuel combustion and cement production

Emissions per year from land use change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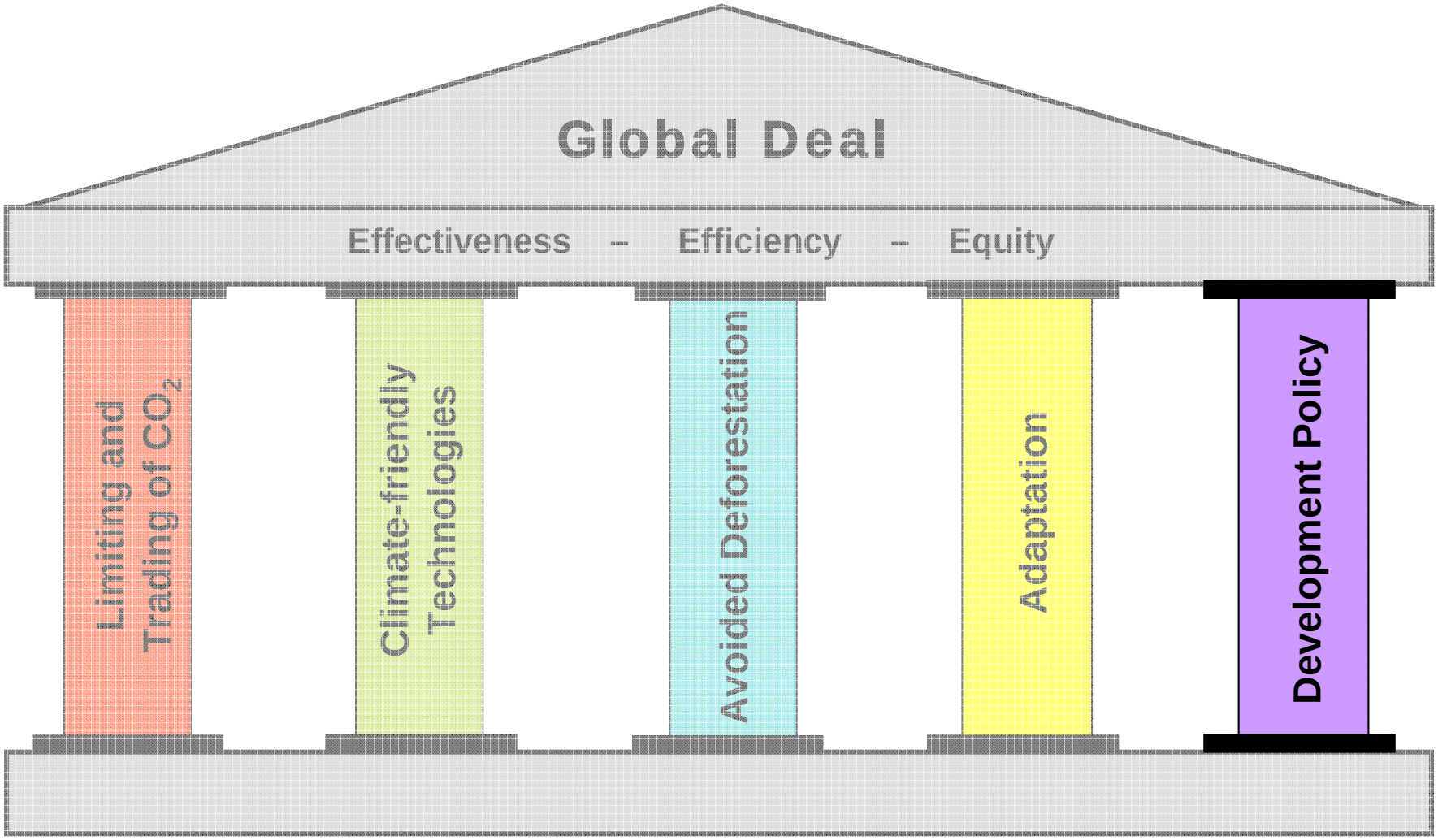
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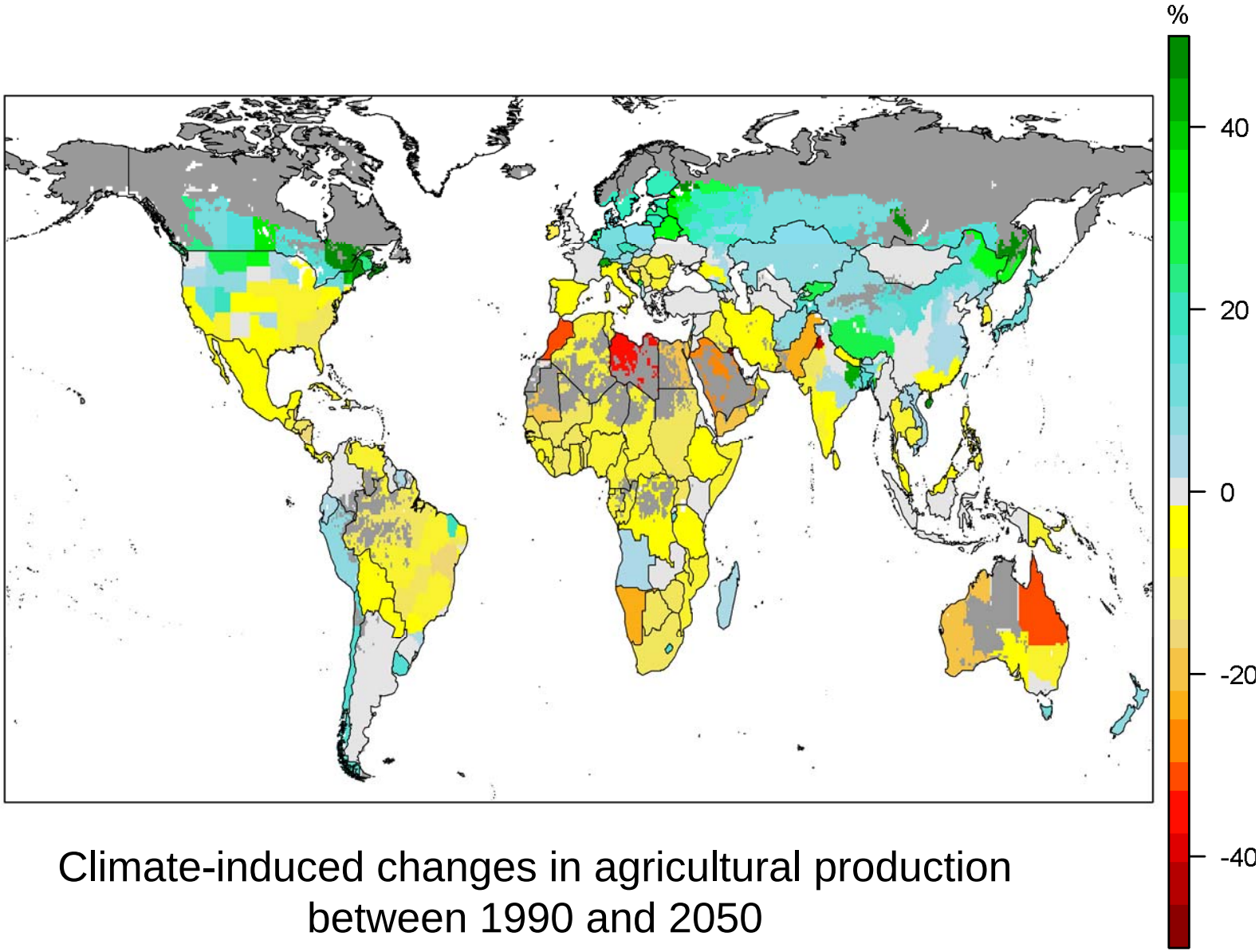
Change in Agricultural Production



Climate-induced changes in agricultural production between 1990 and 2050

Füssel et al., 2010

Multilevel and polycentric governance