How can Parties Fairly and Effectively establish Future Obligations under Long-term Climate Objectives?

Marcel Berk

National Institute of Public Health and the Environment (RIVM), The Netherlands

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BUILDING UPON KYOTO
the long-term prospect of
international climate change policy

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Outline

- Challenges for post-Kyoto architectures
- A quantitative analysis of the implications of some proposals
- Multi-criteria evaluation / Strengths and weaknesses of approaches
- Conclusions and some ideas about the way forward

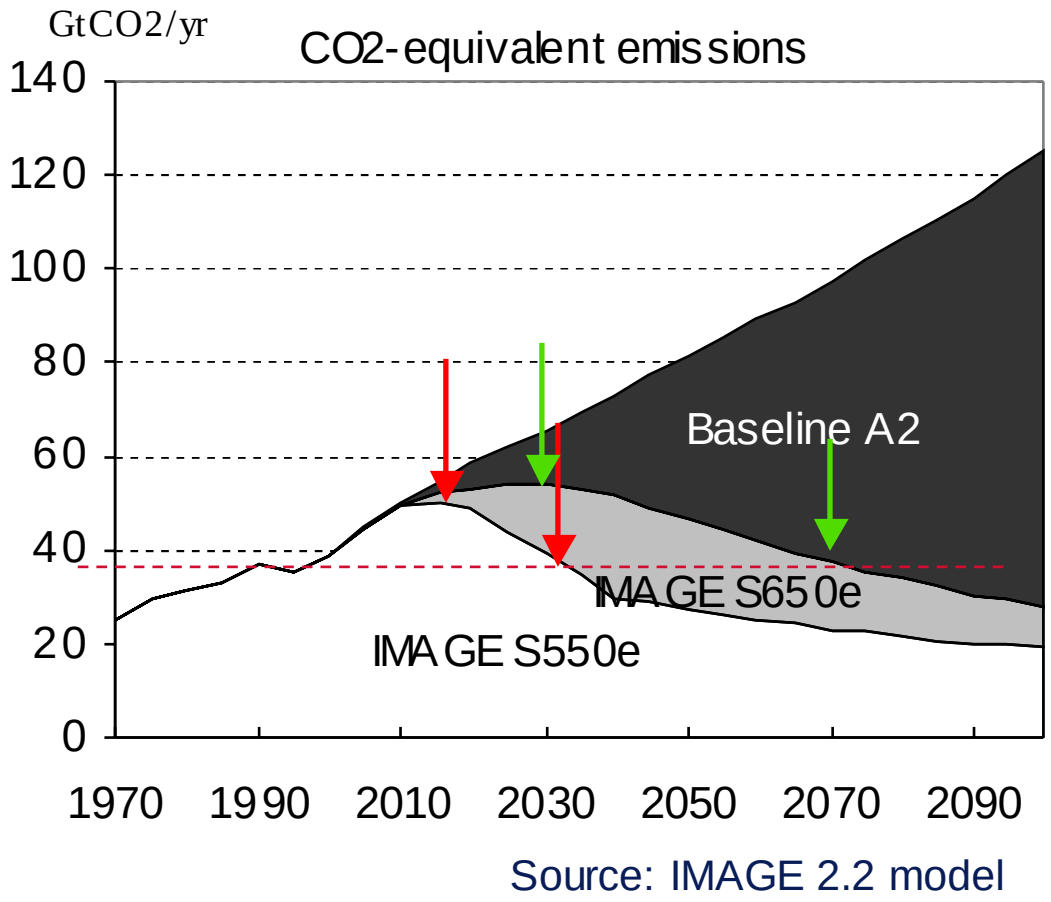
Challenges for Post-Kyoto regimes

- Present situation:
  - Fate Kyoto Protocol uncertain: dependent on Russian ratification
  - Split up of the international regime: USA and Australia outside KP
  - Different USA approach:
    - Domestically: Bush plan - voluntary 18% reduction in GHG intensity economy (2002-2012)+ technology program
    - Internationally: bilateral arrangements
- Future post-Kyoto regime:
  - Likely to be different both with/without KP entering into force
  - Challenges:
    - Bringing both US and (some) developing countries on board at the same time
    - Preserve multilateral approach: develop a regime acceptable to all and with more effective decision making
    - Develop regime for adaptation support and disaster relief
    - Get a regime that has a long-term perspective (to meet Article 2 UNFCCC)

Dimensions of Climate Change Regimes

- **Comprehensiveness / Scope**
  - mitigation only or inclusion of adaptation costs / damage
  - sources / gasses
  - integration with sustainable development policies
- **Stringency of** commitments ("adequacy of commitments")
  - based on LT target or incremental, pledge based; bottom up or top down
  - pre-defined allocation of emission allowances or baseline dependent
- **Coverage / participation**
  - increasing participation or collective regime
  - global or regionally differentiated
- **Equity Principles**
  - equity principles: responsibility, capability, need/right
- **Form of commitments**
  - emission targets or other types of commitments
  - similar or differentiated types; fixed or dynamic targets
  - legal status: binding or non-binding

Implications of stabilizing GHG concentrations: global emission pathways for 550 and 650 ppmv CO2 equivalent (all GHGs)

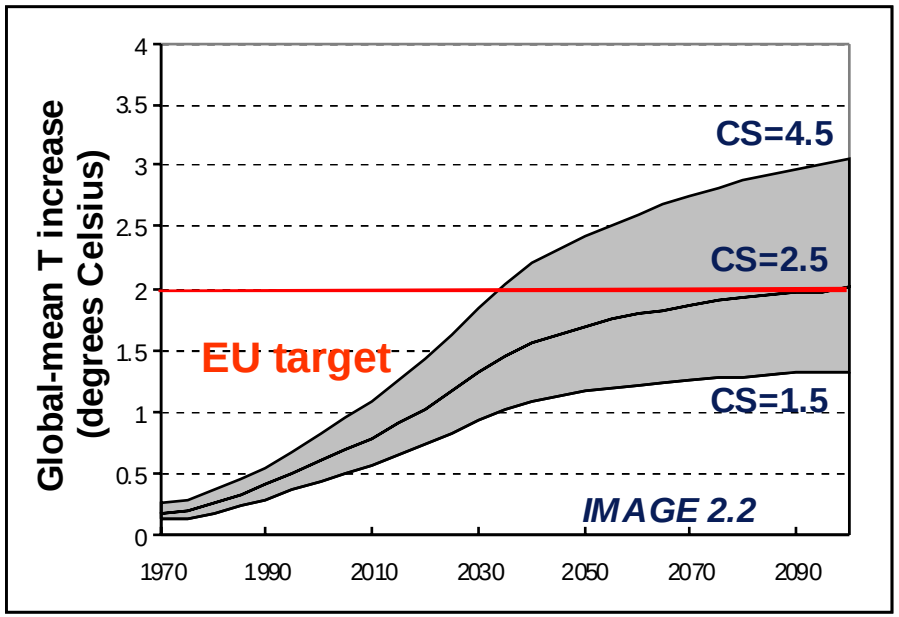


Source: IMAGE 2.2 model

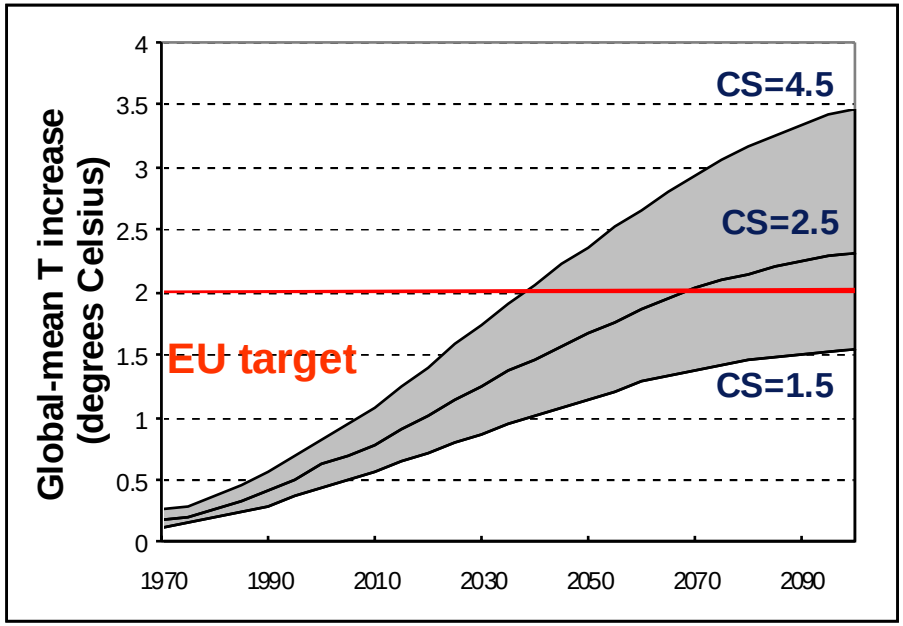
- Stabilizing at 550 implies peaking of global emissions before 2020; back to 1990 levels by 2030
- Stabilizing at 650 implies peaking by around 2030; back to 1990 levels by 2070 (more pathways possible)

Temperature implications of stabilizing at 550 and 650 ppmv CO2 eq.

550 ppmv eq.



650 ppmv eq.



- Stabilizing at 550 ppmv results in a global average temp. increase of 1.4 - 3.1 degrees by 2100; stabilizing at 650 ppmv CO2 eq.: 1.6 - 3.5 degrees
- After 2100 temperature increase continues
- The 550 ppmv CO2 eq. profile meets the EU target of 2 ºC in 2100 for a low to medium climate sensitivity; the 650 ppmv CO2 eq. profile only under a low climate sensitivity.

What equity principles for differentiation of future commitments?

- Often mentioned equity principles in climate change debate:
  - *egalitarian:* people have equal rights to use the atmosphere -> PC distribution
  - *sovereignty / acquired rights:* current emissions constitute a status quo right -> flat rate reduction / grand fathering
  - *horizontal:* countries under similar (economic) conditions should have similar emission reduction commitments -> same targets for similar countries
  - *vertical/capability:* the greater the capacity to act/ability to pay the greater the share in the mitigation / economic burden -> reductions in ratio to PC income
  - *responsibility/polluter pays:* the greater the contribution to the problem the greater the share in the mitigation / economic burden-> reductions in ratio to indicator for contribution (e.g. emissions)
  - *basic needs:* people have equal rights to fulfilling basic needs (development); basic needs have priority (related principles: priority and no-harm) -> distribution of basic emission rights or exemption from commitments

Proposals for Climate Change Regimes - a selection

* = included in FAIR 2.0

- Continuing Kyoto (pledge-based)
- Brazilian Proposal (Brazil / RIVM)*
- Multi-criteria (CICERO)*
- Multi-stage (RIVM)*
- Contraction & Convergence (Global Commons Institute)*
- Global Compromise - Preference Score (Benito Müller)*
- Multi-Sector Convergence (ECN/CICERO)
- (global) Triptych approach (UU)*
- Convergence in Emission-Intensities*
- Emission intensity targets*
- Growth cap index (Ellerman,M IT)
- Jacoby rule (MIT)*
- Soft landing (IEPE)
- Sectoral commitments / sectoral CDM (Figueres)
- (sectoral) Technology standards (Barrett)
- Sustainable Policies and Measures (University of Cape town)

Regime approaches quantitatively explored

1. Brazilian Proposal (Brasil/RIVM)
2. Multi-stage approach (RIVM)
3. Per capita convergence (Contraction and Convergence)(GCI)
4. Emissions intensity approach (global extension of Bush plan)

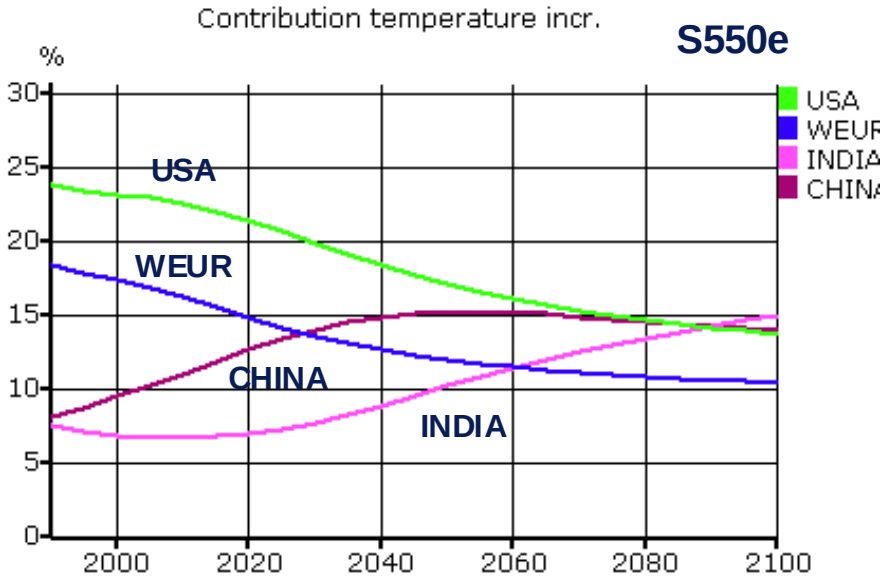
Methodology:

- FAIR 2.0 model
- IMAGE 2.2 A2 baseline scenario
- Multi-gas approach: all GHGs
- Global emission profiles: 550 and 650 ppmv CO2 eq.

Brazilian Proposal

General features:

- allocation of reductions based on (realised) contribution to temp. increase
- originally proposed for burden sharing amongst Annex I;
- global application: threshold for participation
- top-down approach (under global profile)



Parameter settings cases:

	Participation threshold
S550e profile	40% of 1990 Annex I PPP-income* world-average per capita emissions
S650e profile	75% of 1990 Annex I PPP-income 150% world-average per capita emissions

* Average 1990 Annex I PPP income: 1995$ 17.300

Multi-Stage Approach (RIVM)

General features:

- Gradual increase in number of Parties and level of commitment
- Countries over time moving to different stages:
  - 1. Exemption stage: no commitments / CDM
  - 2. Emission limitation stage - emission growth target: GHG intensity target
  - 3. Emission stabilisation stage: no growth of emissions
  - 4. Emission reduction stage: -absolute reduction targets
- various threshold for moving to next stages
- top-down approach

Parameter settings cases:

- burden sharing key for reduction stage: per capita emissions

	First (1) & second (2) threshold	Income-dependent intensity targets
S550e profile	(1) 20% of 1990 Annex I PPP-income (2) 40% of 1990 Annex I PPP-income World-average per capita emissions	Maximum of 3.0%/yr*
S650e profile	(1) 30% of 1990 Annex I PPP-income (2) 75% of 1990 Annex I PPP-income 150% world-average PC emissions	Maximum of 2.0%/yr*

* with maximum de-carbonization rate at 50% of the 1990 Annex I per capita PPP-income

Per Capita Convergence (GCI)

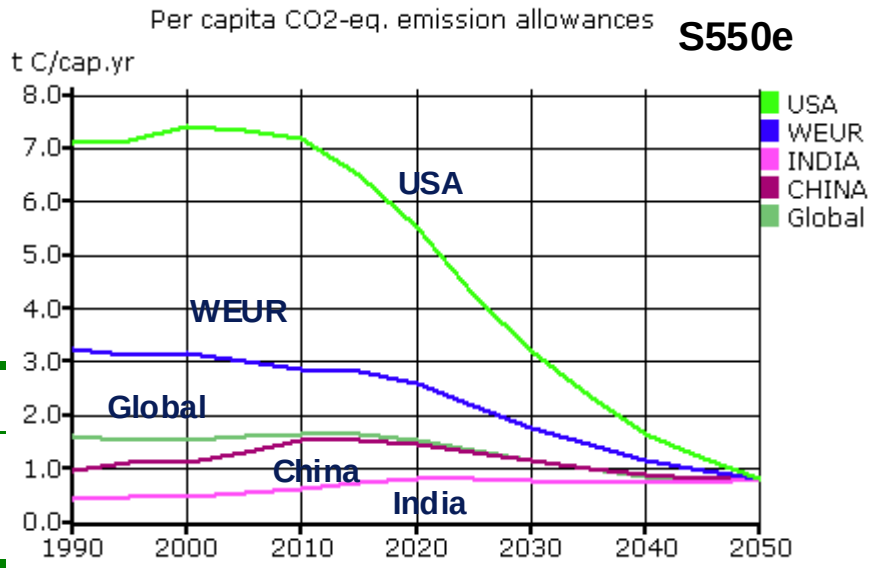
General features

- allocation of global emissions to Parties based on a convergence of PC emissions from present levels to equal levels in convergence year
- all countries participate
- top-down approach

Parameters settings cases:

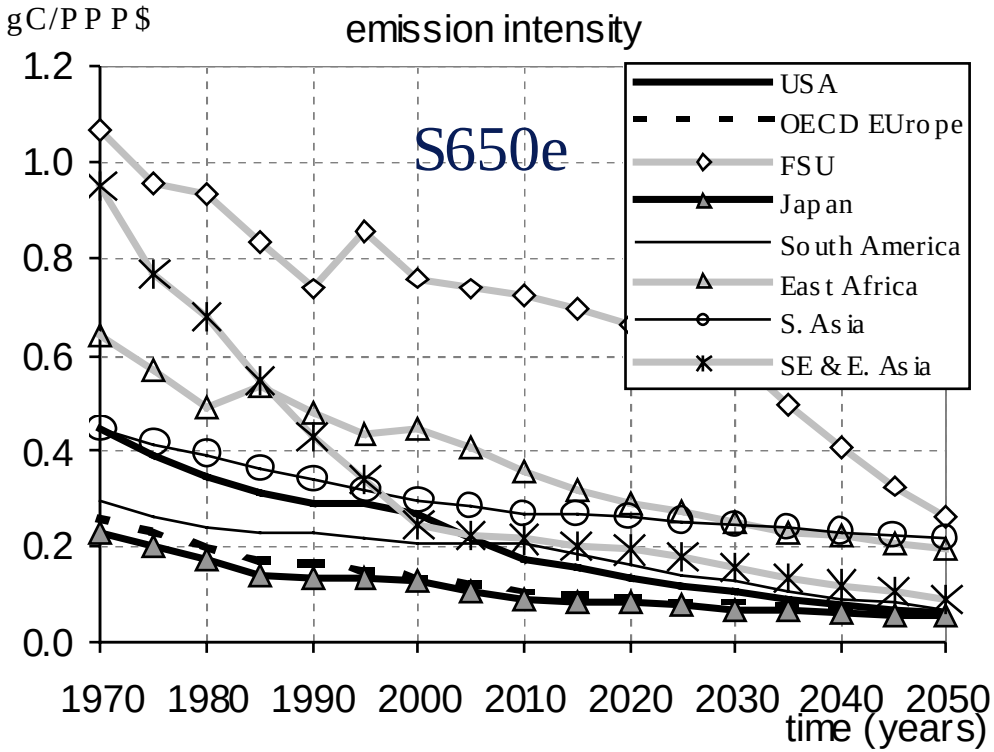
- linear convergence

	Convergence year
S550e profile	2050
S650e profile	2075



Emission Intensity Targets

- General features:
  - Global application of Bush Plan approach
  - Stringency intensity targets related to income;
  - Catching up with EU/Japan
  - Threshold for participation
  - Bottom-up approach

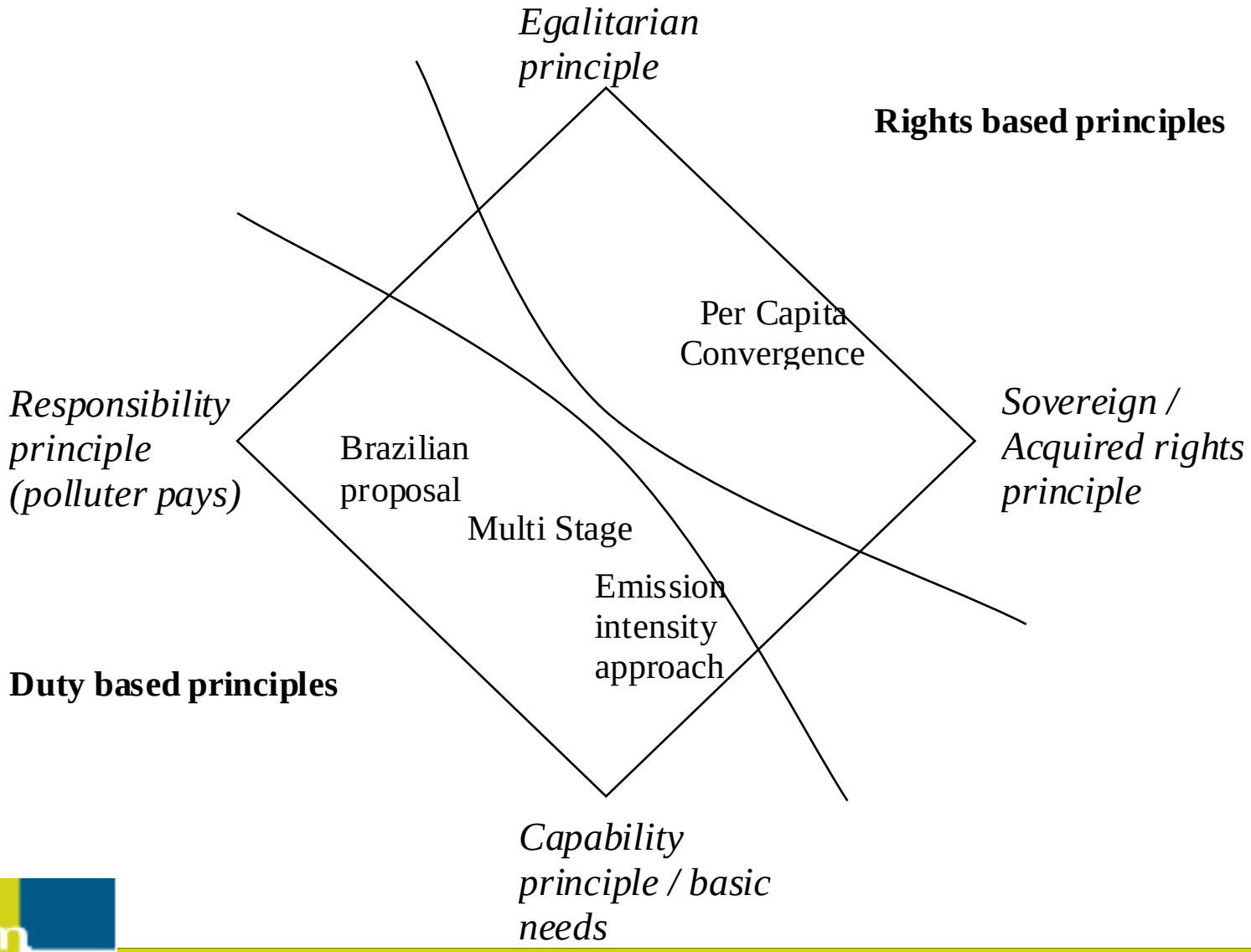


- Parameter settings for cases:

	Participation threshold	Income-dependent intensity targets*
To match S550e profile	20% of 1990 Annex I PPP-income	Maximum rate linearly increases from 3.5%/yr (2012) to 5.0%/yr in 2050
To match S650e profile	40% of 1990 Annex I PPP-income	Maximum rate linearly increases from 2.0%/yr (2012) to 3.0%/yr in 2050

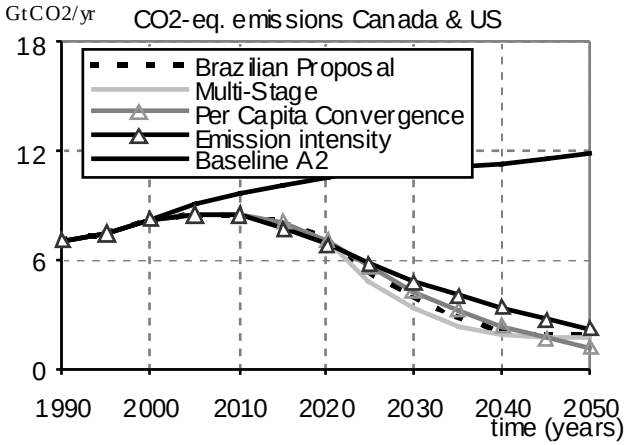
* with maximum de-carbonization rate at 50% of 1990 Annex I PPP-income

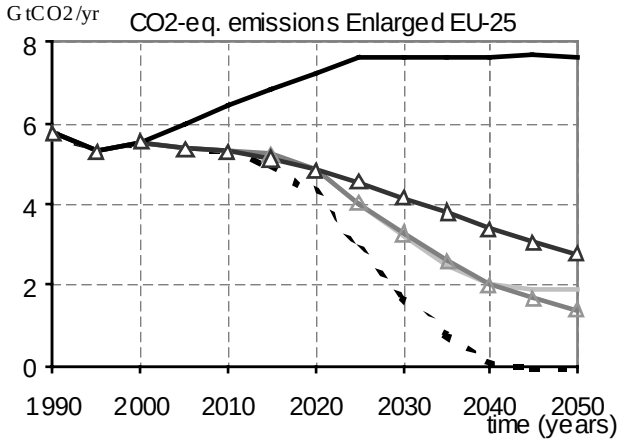
Characterizing the Regime Proposals: Equity Principles



Allowed Emissions up to 2050 for S550e profile

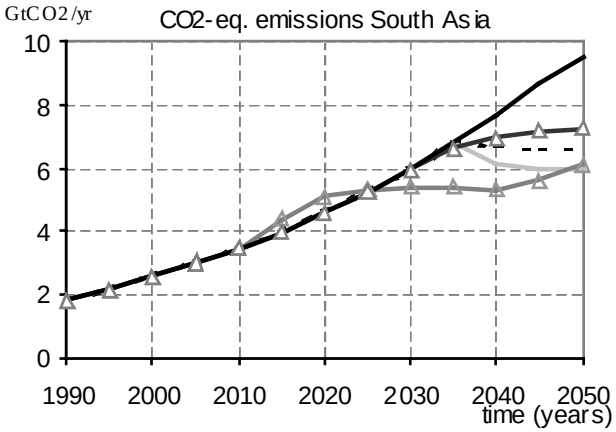
US/CAN

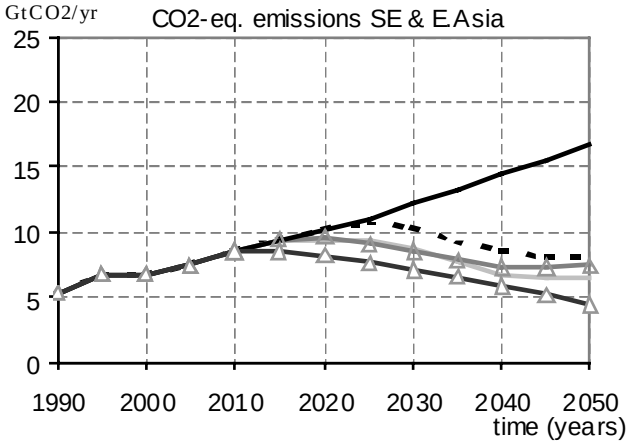




EU-enlarged

"India"





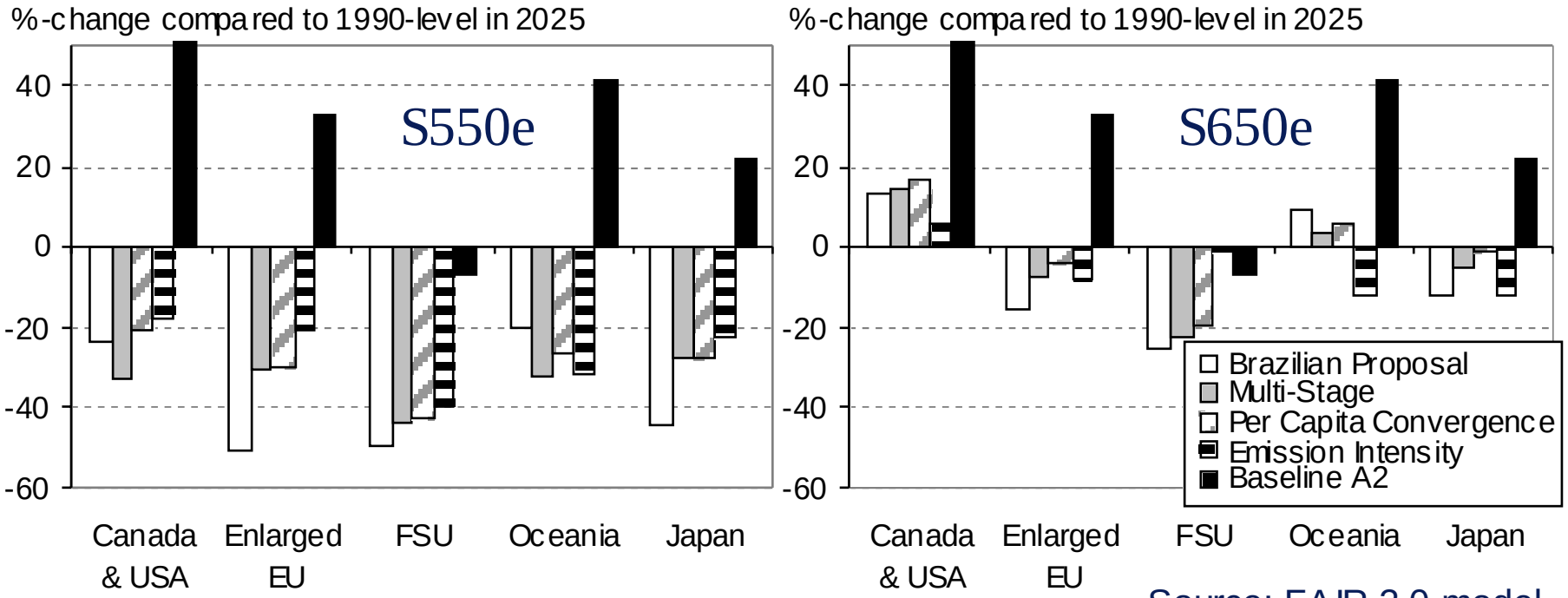
"China"

Source:

FAIR 2.0 model

- Efforts from baseline differ significantly (e.g. USA versus EU)
- Some regions more sensitive for regime choice than others
- Outcomes will differ more on country level
- Short-term implications may differ from long-term (PCC)
- Overall: outcomes sensitive for parameter settings

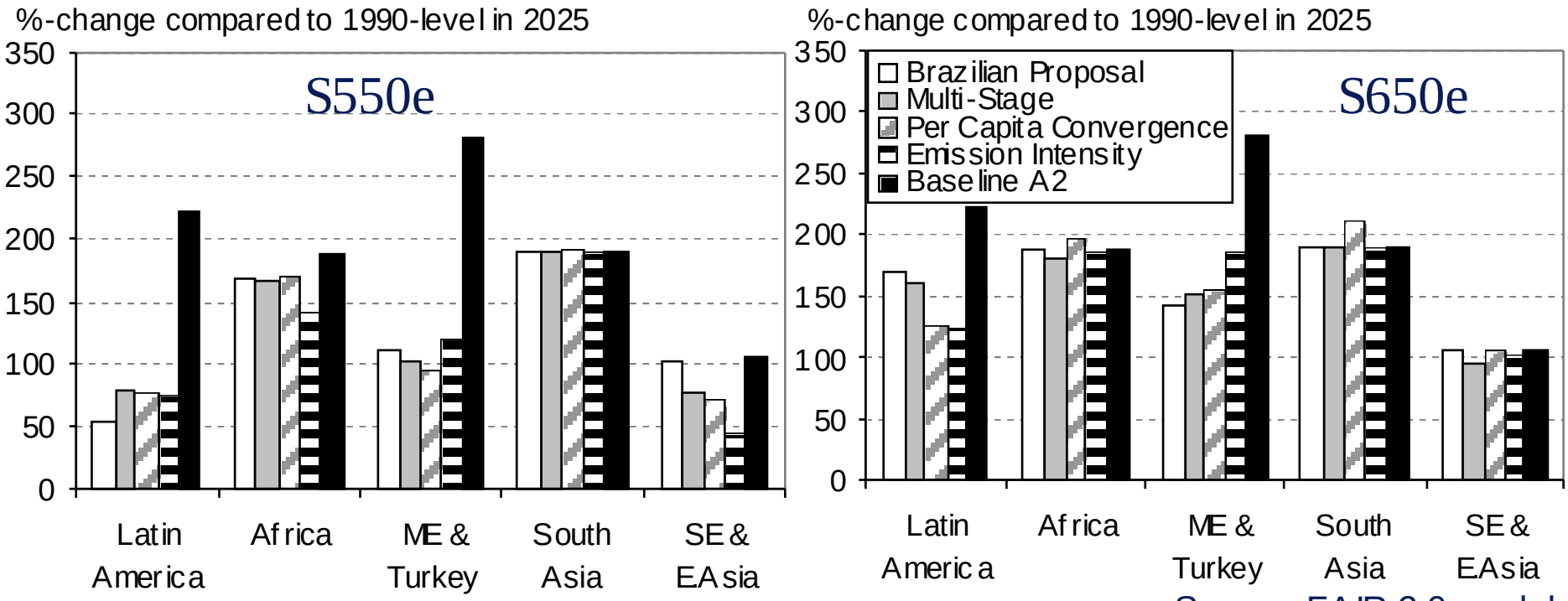
Annex I targets in 2025



Source: FAIR 2.0 model

- Influence of profile larger than choice of regime
- Range of reductions for S550e in 2025: 20-50 % below 1990 level
- Reductions in 2050: 40-90% (BP even 80-100%)
- Outcomes PCC and MS comparable (exept USA); BP largest reductions (EU/Japan/FSU); EIT generally smaller reductions for Annex I

Non-Annex I targets in 2025



Source: FAIR 2.0 model

- S550e requires substantial reductions from baseline by middle income non-Annex I regions by 2025 already
- By 2050 Middle income non-Annex I Regions allowances near 1990 levels
- Differences between outcomes approaches limited on short term, but large on long term (2050)

Multi-criteria evaluation of regimes

Regime / Criteria	Brazilian Proposal	Multi-Stage	Conver-gence	Emission intensity
Environmental criteria	**+**	**+**	**+/++**	**-**
environmental effectiveness	+	+	++	-
incentives for developing country action	0/+	- / +	-	- -
Political criteria	**-**	**+**	**0**	**0**
Comprehensiveness equity principles	0	++	+	-
acceptability for key countries	- -	0/+	-	-/0
Room for negotiation	-	+	- -	+
supportive to trust building	+	+	++	-
Economic criteria	**--**	**0**	**-**	**+**
cost-effectiveness	+	+	++	+
certainty about costs	- -	0	- -	+
accounting for different national circumstances	- -	0	-	+
Technical and institutional criteria	**0**	**+**	**0/-**	**0/-**
compatibility with the KP and UNFCCC	+	++	-	0
simplicity of the negotiation process	-	0	++	0
Ease of implementation	0--	0/-	- -	-

Strengths and Weaknesses regime approaches

	Strengths	Weaknesses
Brazilian Proposal	• Originates from DC	• Focus on responsibility only • Technical concept • Extreme results for some Annex I • Inflexible (in original form)
Multi-stage	• Covers different equity principles • Flexible concept • Compatible with UNFCCC /KP	• Intensity targets reduce certainty about environmental effect • Per capita BS key hits some of Annex I strongly
Per Capita Convergence	• Certainty about DC participation • Certainty about envir. effect. • Simple concept • Allows for full ET	• Hits some of Annex I strongly • Extra costs / large financial flows due to excess emissions • Large Impl. Problems in LDCs
Emission Intensity Targets	• Reduces uncertainty about costs (if clauses for econ. recession)	• Uncertainty about environmental effect. • Lack of clear criteria for differentiation of targets • Complicates KMs

Prospects for regime options

- Parties have different perspectives on weight of various criteria / strengths and weaknesses, e.g:
  - EU: priority for environmental effectiveness (2 degree target)
  - US+FSU: priority for economic implications
  - DC: priority for economic development and equity
- Our assessment:

	Brazilian Proposal	Multi-Stage	Per Capita Convergence	Emission Intensity Targets
EU	-	+	+ /-	-
FSU	-	-	-	-
US	+/-	+/-	-	+
Middle-Income Dev. Countries	+/-	+	+/-	+/-
Least Developed countries	+	+/-	+	+/-

Conclusions from the assessment

- Long-term stabilisation targets:
  - Stabilizing at 550 ppmv CO2 eq. will require earlier peaking (<2020) of global GHG emissions and deeper reductions thereafter than 650 ppmv CO_2 eq.
- Annex I:
  - In 2025 all approaches result in Annex-I reductions of 20-50% below 1990-levels to achieve 550 ppmv. For 650 ppmv: +15 to -20%
  - Choice of S550 or S650 eq. profile has more influence than regime choice
- Non-Annex I:
  - For stabilizing at 550 ppmv Middle Income non-Annex I regions need to participate in emission reductions before 2025; for 650 ppmv before 2050
  - Non-Annex I regions are generally more sensitive to regime approach choice
  - In choice of regime interests of LDCs and Middle income DC differ
- Regimes:
  - quantitative outcomes dependent on parametisation, and do not account for all relevant policy considerations
  - All regimes evaluated have strength and weaknesses (options for redemies)
  - Multi-stage approach seems most generally acceptable approach, but will have to beter accomodate key countries interests

The way foreward - some additional thoughts

- Importance of taking LT perspective to development of CC regime
  - Incremental pledge based approach (like KP) is likely to put low stabilization levels out of reach
  - To promote investments in LT solutions -> define provisional LT targets
- Importance of multilateral and rule-based approach
  - To enhance building trust between developed and developing countries (e.g. to overcome current Annex I - non Annex I split)
  - To avoid vulnerable countries to be left without support
- To bridge US - EU/Japan position: idea of complementary dual “push and pull approach” to mitigation commitments:
  - Targets and time tables, and
  - Technology oriented commitments
  - Multilateral technology transfer fund for DCs taking on commitments
- Japan a broker between US - EU (?)

More information:

- Michel den Elzen and Marcel Berk (2003): 'How can Parties Fairly and Effectively establish Future Obligations under Long-term Climate Objectives?", In: David Michel (ed.). Climate policy for the 21st Century - Meeting the Long-term Challenge of Global Warming, Center for Transatlantic Relations, Washington DC, USA.

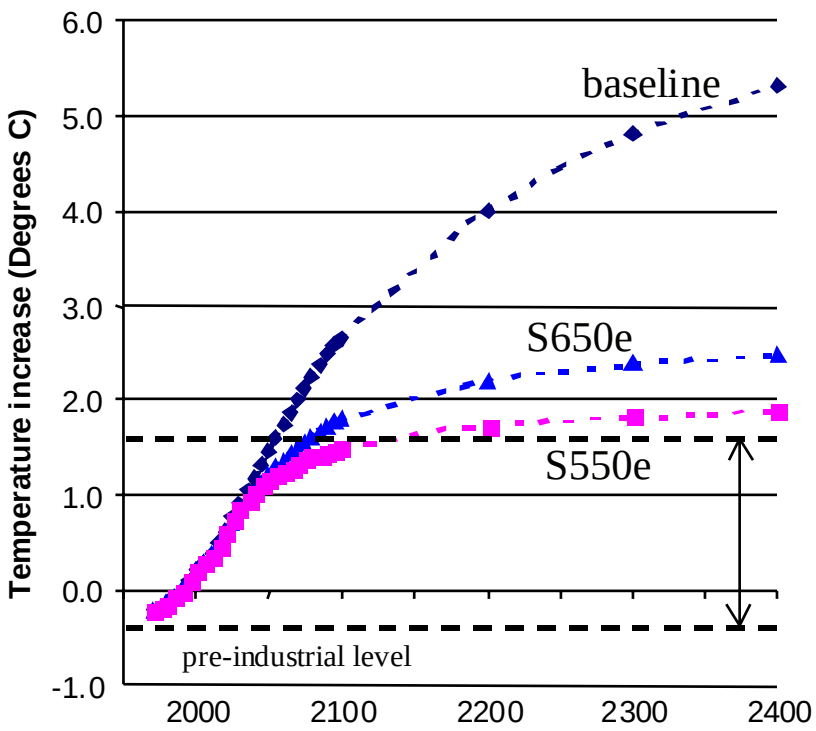
- Michel den Elzen et. al (2003). 'Exploring climate regimes for differentiation of commitments to achieve the EU climate target', RIVM-report no. 728001023/2003, RIVM, Bilthoven, The Netherlands.

- Detlef van Vuuren et al. (2003): 'Regional costs and benefits of alternative post-Kyoto climate regimes', RIVM-report no. 728001025/2003, RIVM, Bilthoven, The Netherlands

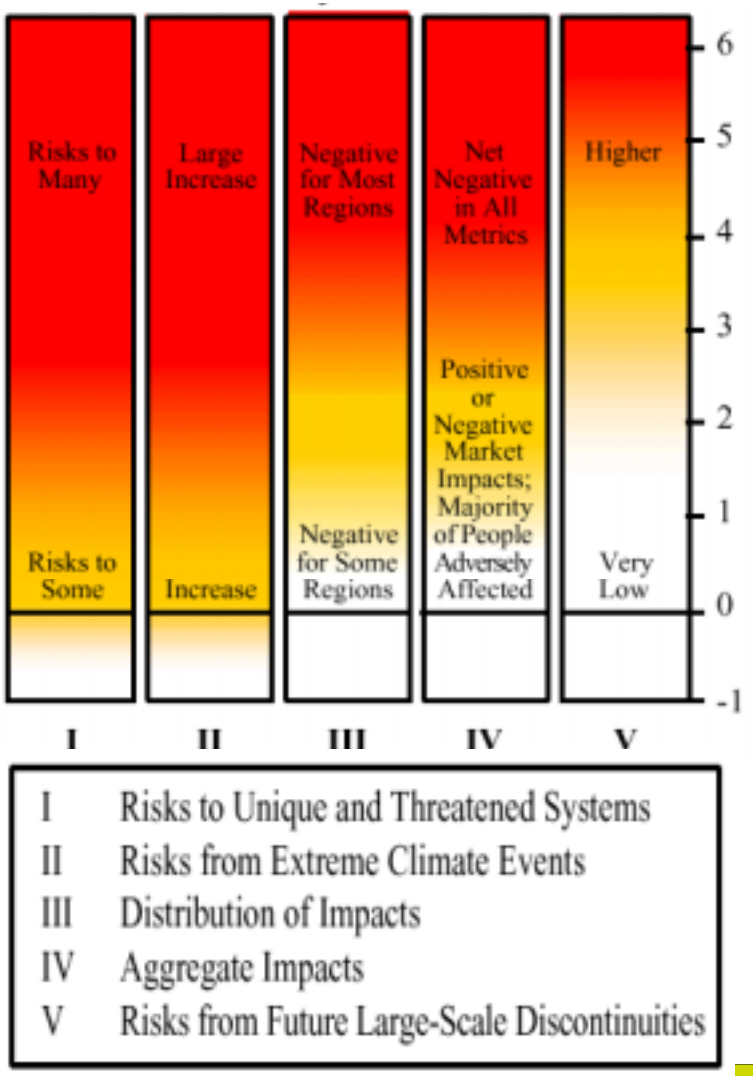
- All RIVM-reports available at: **http://www.rivm.nl/ieweb**

Temperature change and risks

Temperature increase



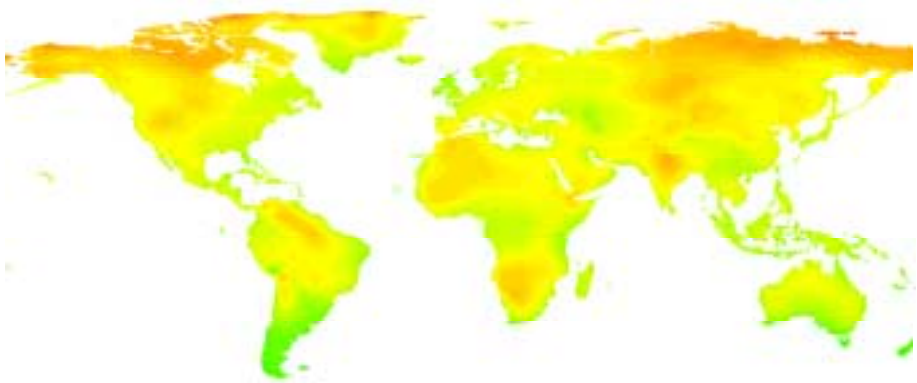
IPCC Reasons for concern



Temperature change 550 vs. 650 CO2-eq. stabilisation

Global temp. 2100: +1.6 (1990)

S550e



Global temp. 2100: +1.9 (1990)

S650e

Temperature increase above 1990 levels

-4.0 -3.0 -2.0 -1.0 0.0 1.0 2.0 3.0 4.0

Equity principles in the Climate Change Convention

- The Parties should protect the climate system for the benefit of present and future generations, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities, …" (Article 3.1) (allocation based)

- need to avoid "disproportionate or abnormal burdening from climate policies" for some (developing) countries (proportionality principle) (outcome based))

- "(..) taking into full account the legitimate priority needs of developing countries for the achievement of sustained economic growth and eradication of poverty (…)" (no-harm principle; room for fulfilling basic needs)

Abatement costs

Methodology in FAIR 2.0 model:

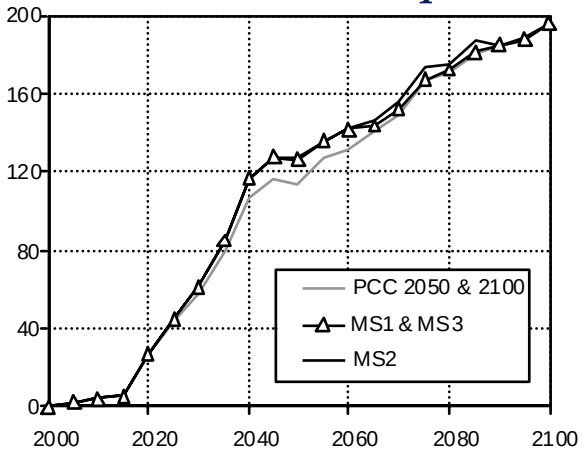
- aggregated Marginal Abatement Cost curves (MAC): 6 GHGs, 11 sectors and 17 world regions
- MAC curves change in time (technological improvements and inertia in energy system)
- MAC curves only represent direct costs, there is no direct link to GDP losses
- Cost (and gains) are given as percentage of GDP.
- GDP is calculated in Purchase Power Parity rates, since most of the reductions are done domestic.

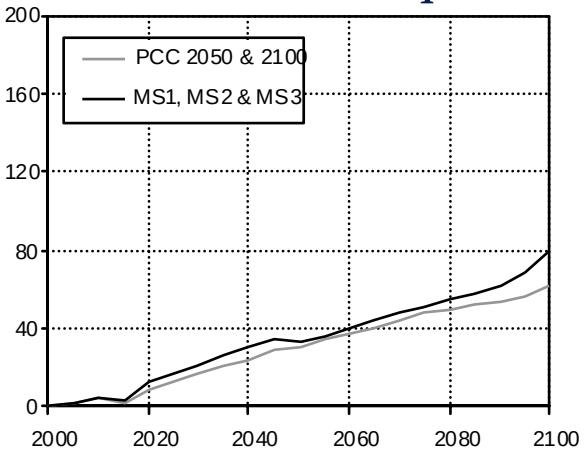
Abatements costs and stabilization profiles

550 CO2-eq

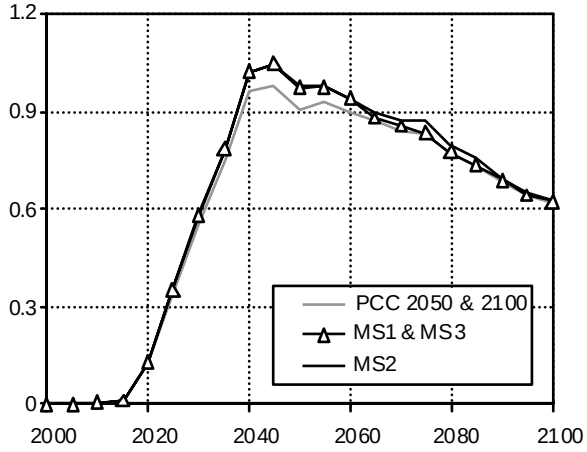
650 CO2-eq

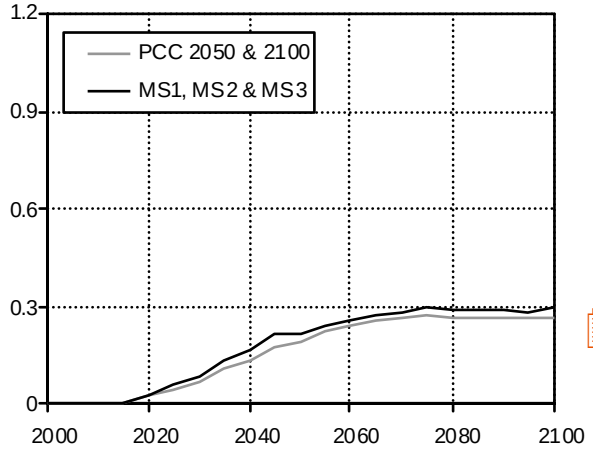
Carbon price





Costs as % of GDP

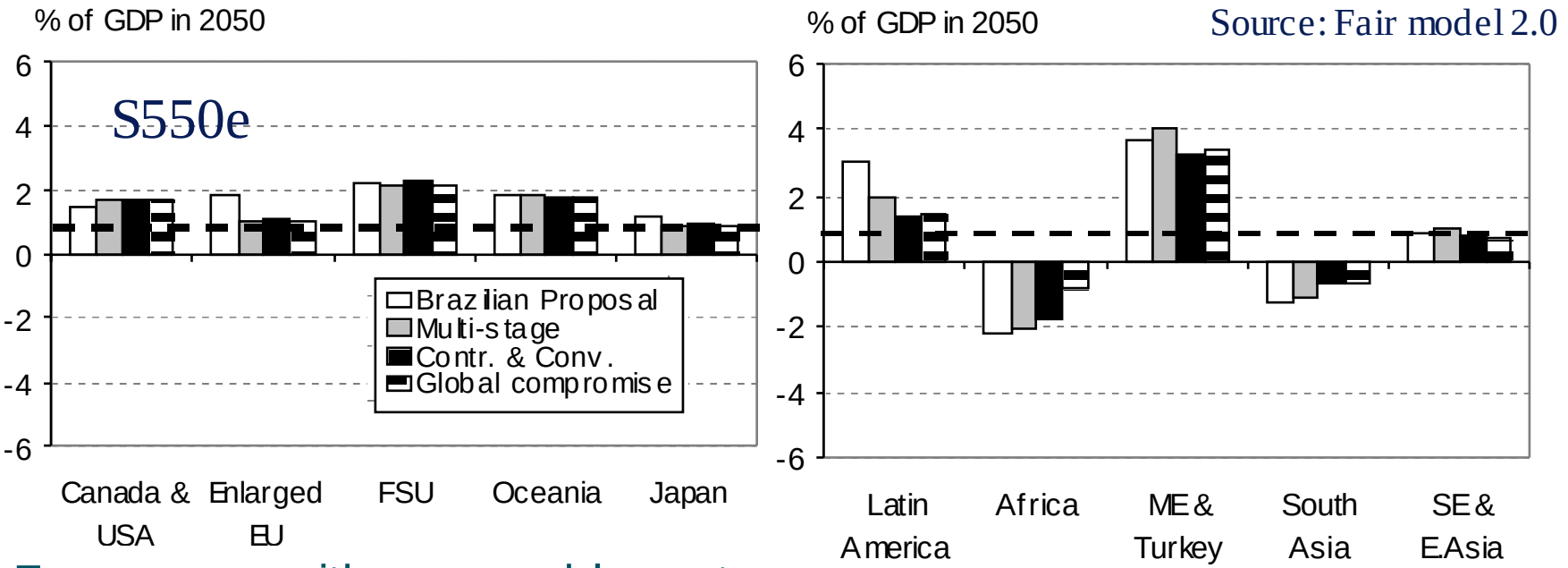




- Global costs and international permit hardly depend on regime
- Restricting emissions to S550e leads to higher abatement costs than the S650e (equivalent to 1.0% versus 0.2% of world GDP in 2050)
- Costs are subject to considerable uncertainty

Source: van Vuuren et al, 2003 (RIVM report)

Regional abatement costs



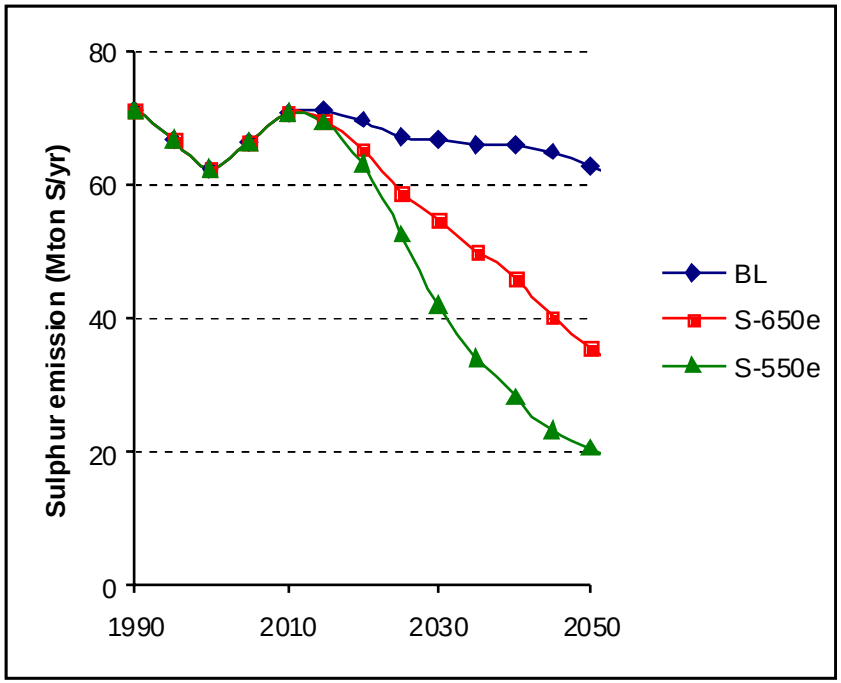
Source: Fair model 2.0

Four groups with comparable costs:

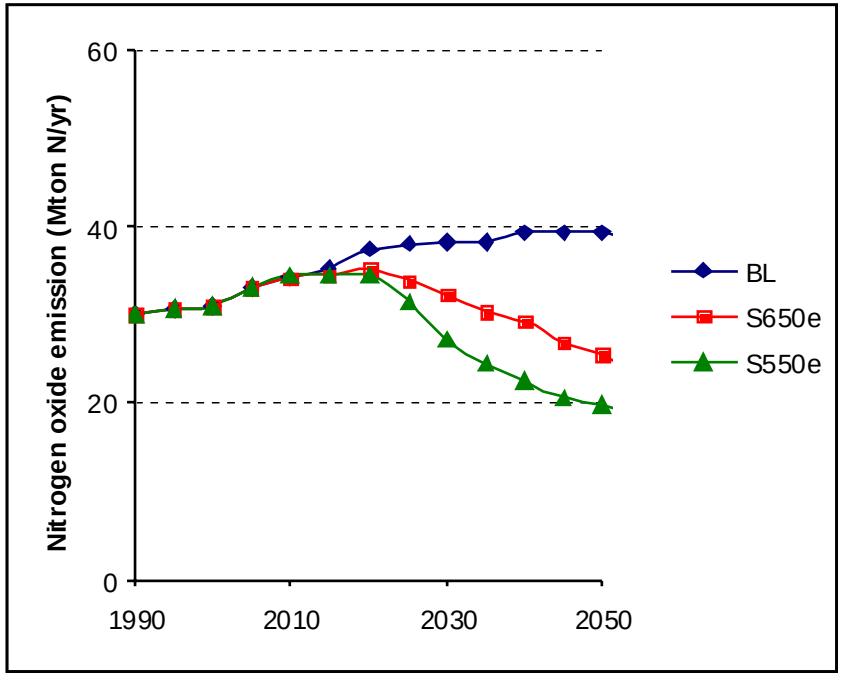
1) Regions with high income and high per capita emission
   - average costs compared to other regions (Annex I excl. FSU);
2) Regions with medium to high per capita emissions but medium income
   - highest costs (Middle East, FSU, and to a lesser extend Latin America)
3) Regions with low to medium income levels and per capita emissions
   - low to average costs; (South-East & East Asia)
4) Regions with low per capita emissions and a low income
   - net gains from emissions trading (Africa and South-Asia)

Co-benefits - Change in Global Sulfur and Nitrogen oxides emissions

Global sulphur emissions

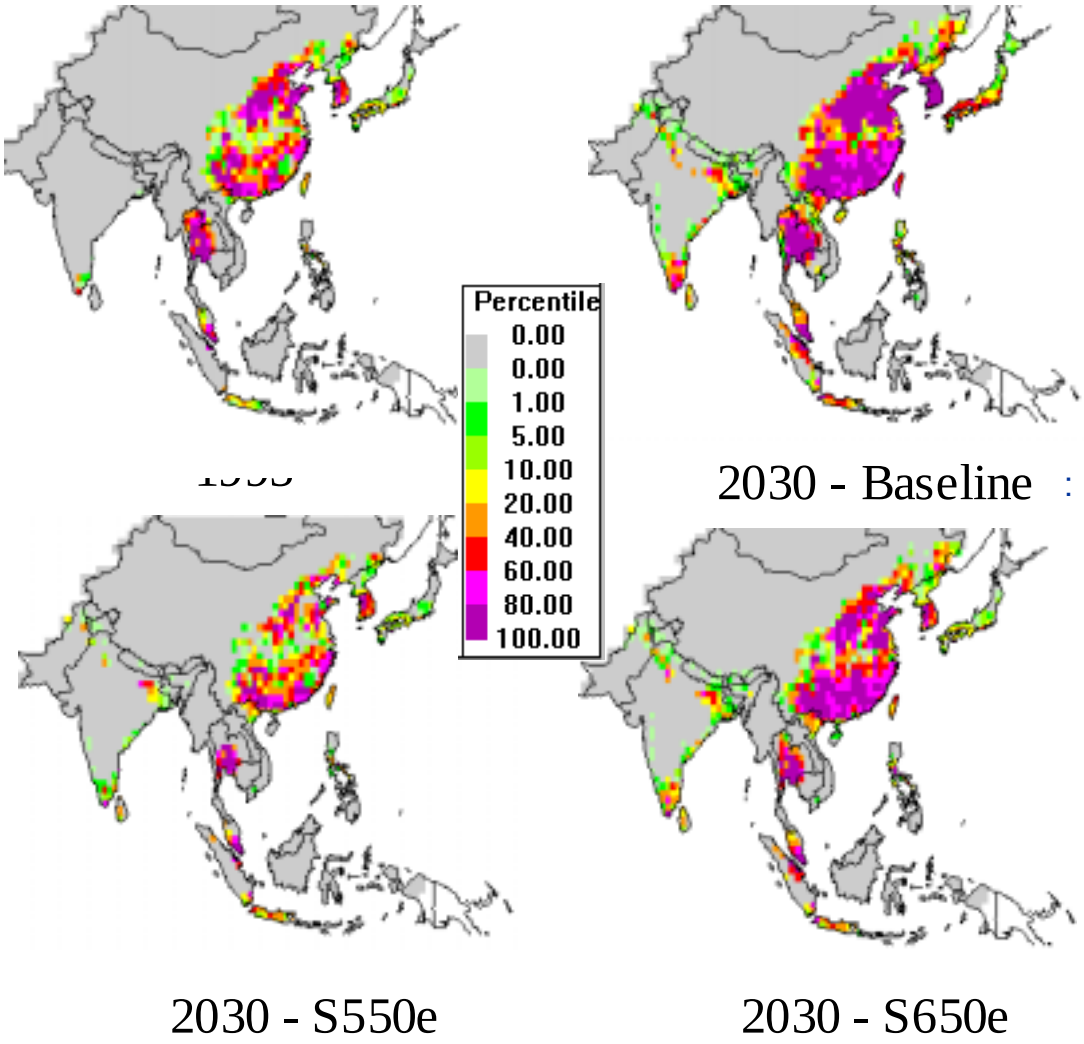


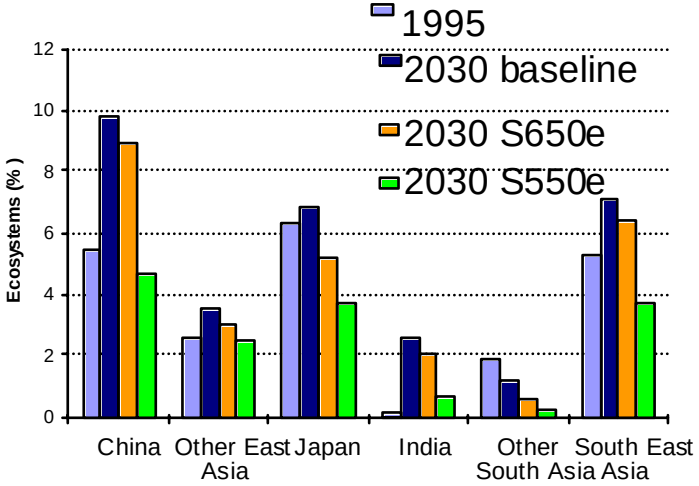
Global NOx emissions



- Both climate policies for meeting S550e and S650e result in substantial reductions of sulphur and Nitrous oxide emissions: resp. 70% and 50% for S550e and 50% and 35% for S650e by 2050

Co-benefits : Change in exceedance of critical loads for acidification in Asia





- The 550 ppmv-eq scenario can limit the exceedance of critical loads in 2030 in the total region by on average 50%.
- The co-benefits of the 650 ppmv-eq scenario are smaller. Here, most co-benefits can be expected after 2030.

Source: TIMER (RIVM) / RAINS -ASIA (IIASA)