Greenhouse gas Reduction Pathways in the UN-FCCC process up to 2025

Partners:

LEPII-EPE (coord.)

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Study performed for DG Environment

Greenhouse gas Reduction Pathways

- The GRP study, contents
- Two long-term GHG reduction scenarios
- Key options for the design of an International Climate Regime
- “Per Capita Convergence” and “Multi-Stage” two approaches for in-depth assessment
- Main outcomes of the economic assessment

GRP: Key words and contents

- *Rationale for further action:* the need for advances in international climate policies and emission reduction scenarios
- *Architecture:* a review of the key options in the design of international climate regimes
- *Assessment:* the use of models for an initial quantification of endowments and costs
- *Co-benefits:* examples of how climate policies may ease the solution of other crucial environmental problems

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GRP: the need for further action

- World greenhouse gas emissions, if unconstrained, will lead to high levels of atmospheric concentrations
- Over the second half of the next century, the Reference Projection results in emissions of the 6 "Kyoto basket" gases *(i.e. CO_2, CH_4, N_2O, HFC, PFC and SF_6)* that are equivalent to 70-75 Gt of *CO2* (GtCO2e) each year
- This represents a doubling, from world current 6 GHGs emissions, 37 GtCO2e/yr in 2000
- These emission levels would induce concentration levels of more than 900 ppmv CO2e in 2100

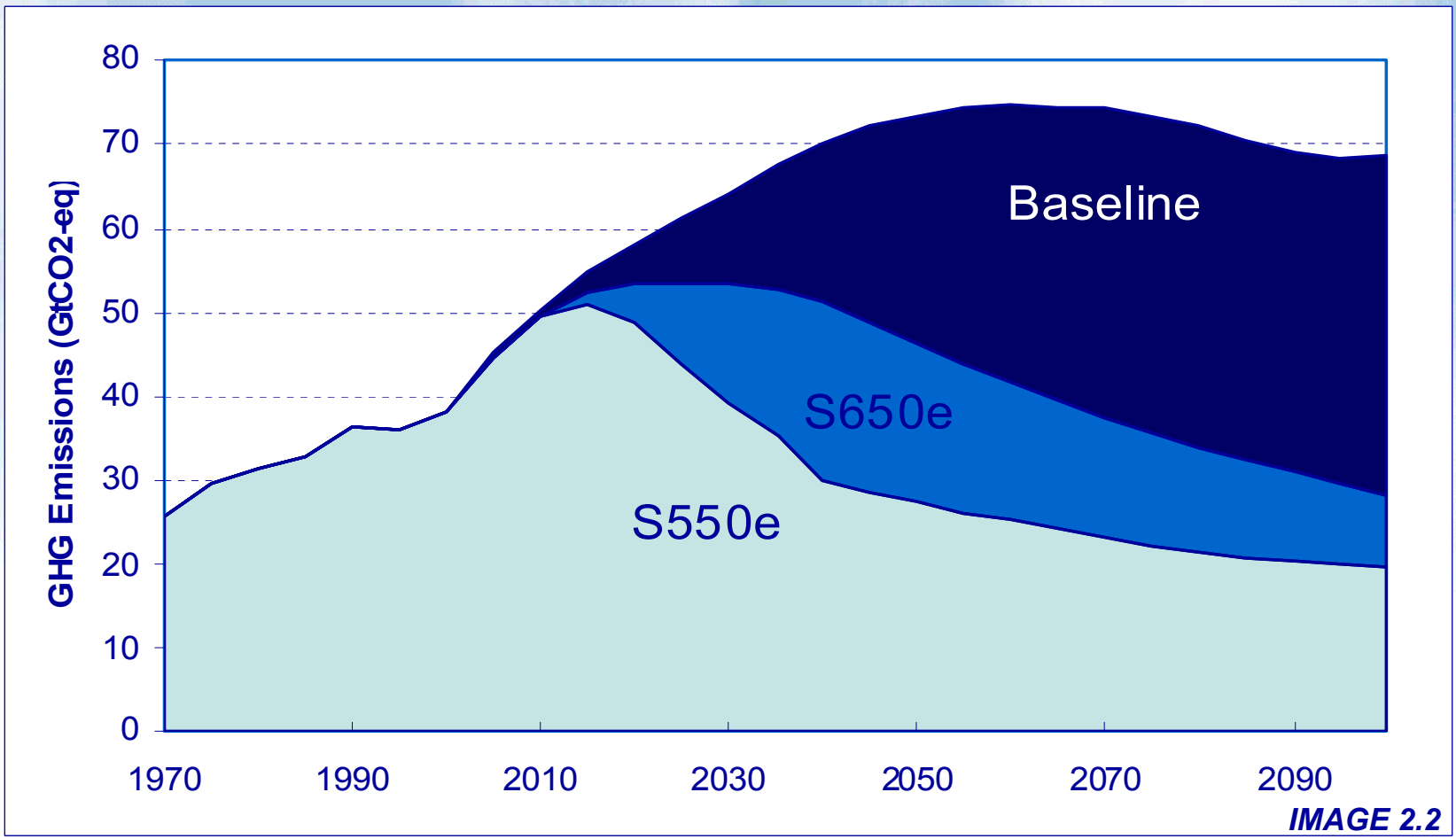
GRP: goals and corresponding scenarios

- **The EU goal of limiting average temperature increase to *"less than plus 2°C, compared to pre-industrial level"* can be translated into emission profiles …**
- **but these depend on the uncertainties concerning the climate system, which are synthesized in IPCCs' *climate sensitivity factor***
  (i.e. temperature increase for a doubling of concentrations)
- **Two "reduction profiles" have thus been defined, for the set of 6 Kyoto gases:**
  - S550e for a stabilization of concentrations at 550 ppmv CO2e for the 6 Kyoto GHGs (corresponding to 450 ppmv for CO2 only),
  - and S650e for a stabilization at 650 ppmv CO2e

GRP: goals and corresponding scenarios

- The "S550e" scenario will meet the *"less than plus 2°C"* target for a low-to-median value of the *climate sensitivity*
- The "S650e" scenario will meet the target only if the *climate sensitivity* is low

GRP: the S550e and S650e profiles



- By 2025, global reductions of 15 to 30 % from baseline are required, respectively in S650e and S550e
- By 2050, these reductions reach 35 to 65 %

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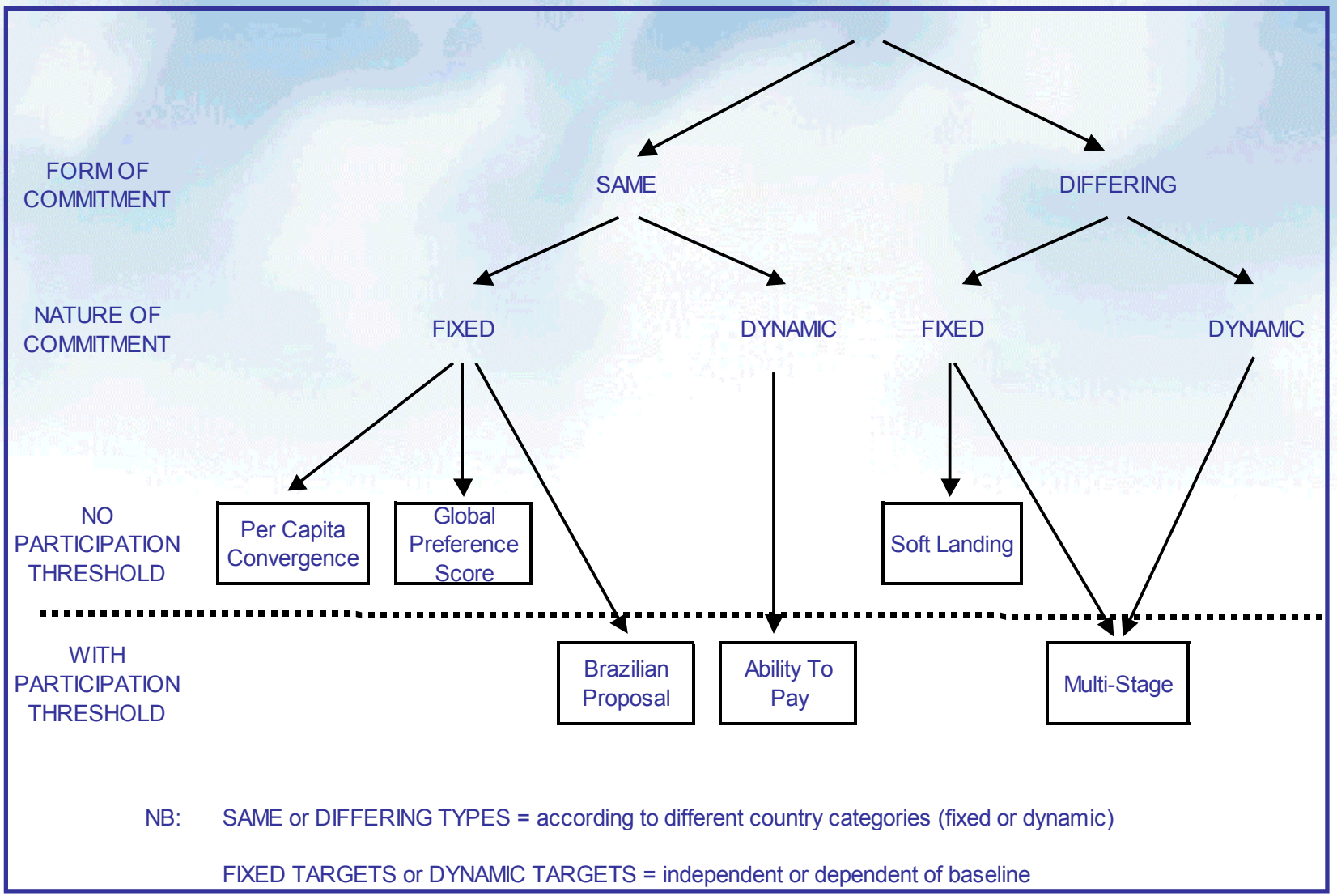
GRP: the possible architectures

- **Emission reduction targets can be defined either:**
  - through a *global emission profile* (top-down)
  - or *individual targets* for the different parties (bottom-up)
- **The form and timing for participation can be *identical* for all Parties or with *differing* targets or time-horizons**
- **The type of commitment can be defined in *absolute* or *dynamic* terms (intensity targets)**
- **Different equity principles can be used: *egalitarian, acquired rights, responsibility, capability***

GRP: a typology of architectures



GRP: profiles and architectures

- **While many options for the design of a climate architecture can be explored …**
- **the commitments for the different regions basically depend on:**
  - the choice of the long term emission profile
  - decisions made on the type of participation for non-Annex I countries
- **This is why the diversity in options can be subsumed though the use of a limited number of generic models**

GRP: the possible architectures

- **First, six approaches to reduction targets have been reviewed:**
  - *Per Capita Convergence*
  - *Soft Landing in emission growth*
  - *Global Preference Score*
  - *Historical Contribution (Brazilian proposal)*
  - *Ability to Pay*
  - *Multi-Stage*
- **Then, two approaches have been selected as sufficiently generic and robust**

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GRP: The Per Capita Convergence scheme

- The *Per Capita Convergence* is a "full-participation" scheme, with a simultaneous definition of future endowments for all Parties
- A global emission profile is first defined (e.g. S550e or S650e)
- Then a date is set for the convergence in per capita emissions
- In the GRP study two end-dates for convergence have been chosen:

  2050 and 2100

GRP: the Multi-Stage scheme

- ***Multi-Stage* is an "increasing participation" scheme, with Parties progressively entering into different stages:**
  - in *Stage 1* Parties have no quantitative commitment
  - in *Stage 2* they have to comply to dynamic "intensity targets"
  - in *Stage 3* they comply to absolute emission targets, as resulting from the global profile
- **In GRP, three Multi-Stage schemes have been defined, according to the type of threshold in the transition from one stage to the other**

GRP: The three Multi-Stage in GRP

- Transition from Stage 1 to Stage 2 in all cases depends on a:

  Capacity-Responsibility index

  (see Art. 3.1. of UN-FCCC)

- This index is defined as the sum of per capita GDP and per capita emissions of each Party

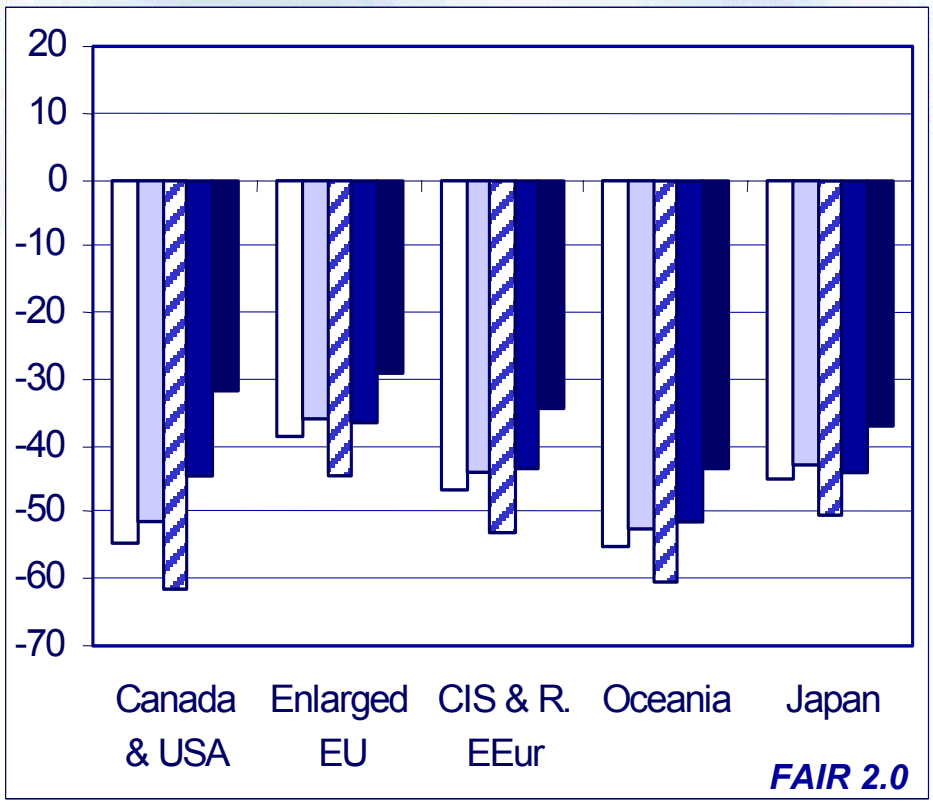
2000	pc GDP (1000€)	pc emiss. (tCO2e)	Cap-Resp index
USA	32	26	58
EU (enl.)	19	10	29
China	4	4	8
India	2	2	4

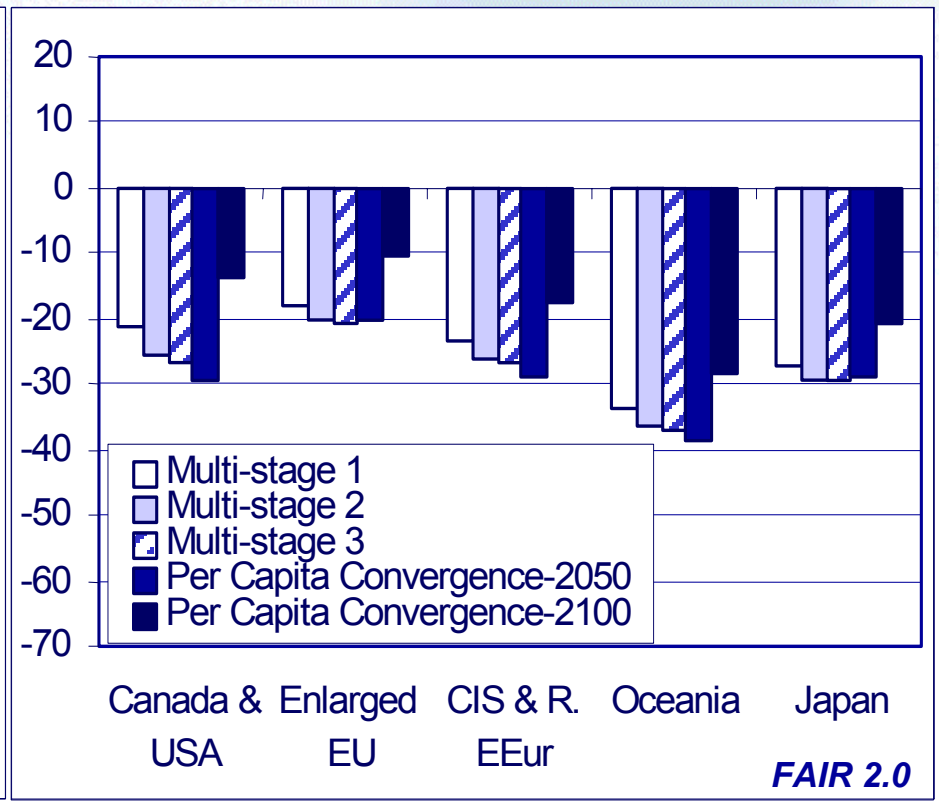
GRP: The three Multi-Stage in GRP

- **Transition from Stage 2 to Stage 3 is defined either through:**
  - A threshold expressed as “average word per capita emissions” MS-1
  - A threshold expressed again as a Capacity-Responsibility index (about twice as high as the first CR threshold) MS-2
  - A stabilisation period defined as the time necessary to bring emission growth to zero MS-3

GRP: Annex I targets in 2025

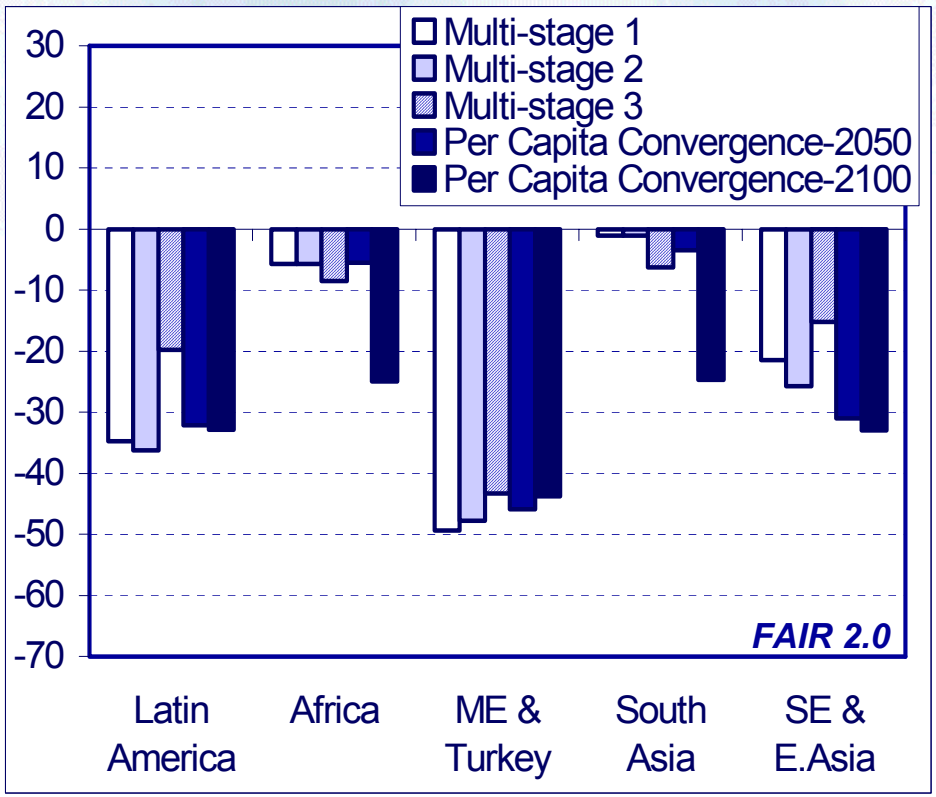
- **S550e: in MS-1, MS-2 and PCC-2050, reductions from Baseline amount to 40 % in Europe and Japan, 50 % in North America and Oceania**
- **S650e: reductions are less pronounced, amounting to 20-30 % in all schemes, except PCC-2100**



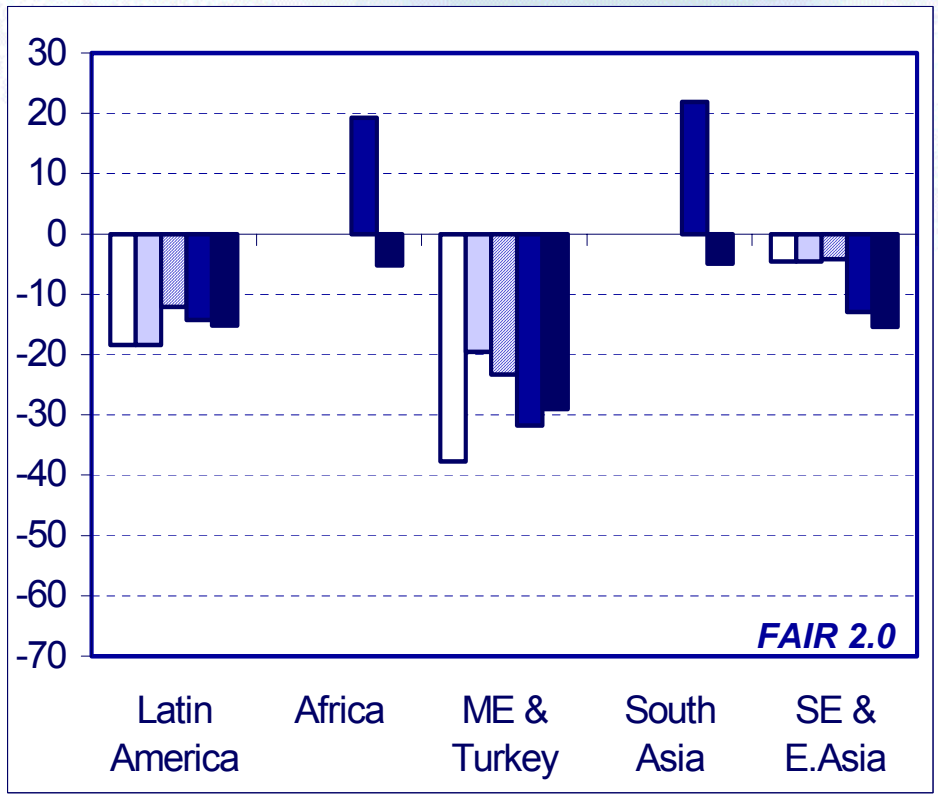


GRP: non-Annex I targets in 2025

- **S550e: non Annex I regions have to reduce emissions, but to a limited degree for the low income Africa and South-Asia regions, except in PCC-2100**



- **S650e: the low income regions either do not participate or benefit of "excess emissions", reductions are limited to 10-20% in Latin America and South-East and East Asia**



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GRP: Highlights from economic assessment - 1

- Economic assessment is performed under the assumption of international emission trading schemes …
- that allow for least-cost options to be implemented in all parts of the world
- The resulting world emission trading volume varies considerably according to the profile and endowment scheme
- It is up to 8 times higher in S550e (400 to 800 bio.€/yr in 2025) than in S650e (60 to 100 bio.€/yr)

GRP: Highlights from economic assessment - 2

- The ratio of direct (sectoral) abatement costs to GDP provides a good indication of the "rate of effort" for each region
- In most Annex I regions and in 2025, this rate of effort represents 0.5 to 1% of GDP in S550e and 0.1 to 0.2% of GDP in S650e
- Low-income regions receive a net benefit from emission trading …
- while intermediate income or high per capita emission developing regions incur net costs

GRP: Highlights from economic assessment - 3

- The General Equilibrium approach also allows to account for indirect macroeconomic costs
- For each region, the impacts on welfare are strongly correlated to emission trading
- Except for fossil fuel exporting regions, which are also affected by changes in their exports
- In 2025, the total cost of achieving reductions represents 0.7-0.9% of world GDP in S650e and 1.9-2.8% in S550e

GRP: Co-benefits from GHG abatement

- Climate policies induce significant changes from baseline for sulphur and nitrogen oxydes emissions
- They may thus bring substantial co-benefits in terms of reduced regional air pollution and improved human health
- The positive impacts are particularly noticeable for the “low-income but rapidly growing” regions of the world, i.e. mainly Asia
- GHG abatement policies may for instance significantly reduce the probability of exceeding NOx standards in Asia in 2050

GRP: Conclusions

- **The GRP study is only a first step in a continuous effort that will have to combine climate studies, economic analyses and international debate**
- **It shows however that:**
  - meeting the EU climate objective will require a peak in world emissions within a few decades
  - the taking into account of a global profile is probably a condition for attaining this target
  - the possible architectures are many, but simple schemes can be designed, with reasonable properties in terms of international equity and acceptability
  - global abatement policies may even be beneficial to the low-income regions of the world, in particular when environmental co-benefits are taken into account