Achieving Climate Stabilization Targets by efficient v. fragmented coalitions, with ETSAP-TIAM

Richard Loulou (with Maryse Labriet & Amit Kanudia)
(Resp. McGill U. & KANLO, CIEMAT & KANLO, KanORS)
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Key Characteristics of approach

- Model: ETSAP-TIAM (TIMES Integrated Assessment Model)
- Inter-temporal partial equilibrium (max. total surplus by Linear Programming)
  - Driven by ~50 energy service demands (elastic to own price)
- Regions: 15 regions, soon to be 16
  - Endogenous trade of all energy forms and emissions
- Horizon: 2005-2100, in 9 variable length periods
- Technologically detailed: extraction, processing, conversion, end-uses of energy + industrial processes (~1000 tech & ~100 commodities per region)
- Agriculture and Land-use change: simplified representation (under revision)
- Climate Module
  - CO2 (3 layers), N2O, CH4 (1-box each) cycles and forcing equations
  - Additional exogenous forcing from other non modeled substances
  - Temperature change equations in two layers

Departures from guidelines for discussion

- In scenario 2: when a region enters the coalition, we assume that it enters with the full carbon price. Two reasons:
  - The coalition's GHG price is computed endogenously by TIAM, thus, price cannot be determined beforehand
  - If a region enters coalition with a different GHG price, at what price will it trade emissions?

- We used the following slightly different forcing targets:

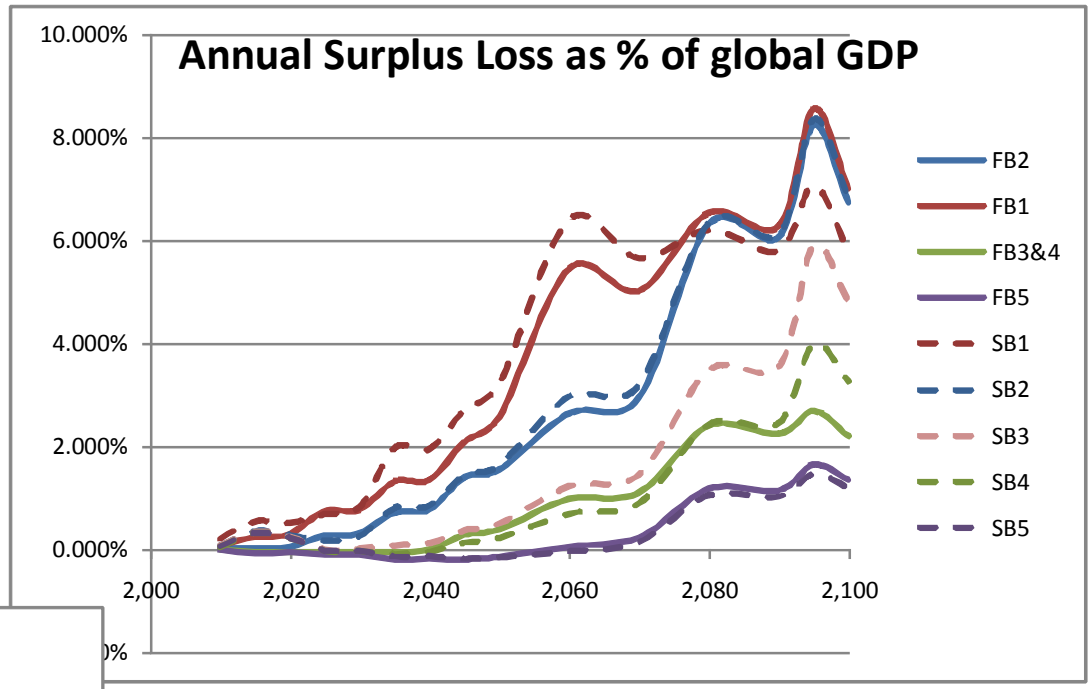
  For 450 ppm: 2.63 W rather than 2.6;

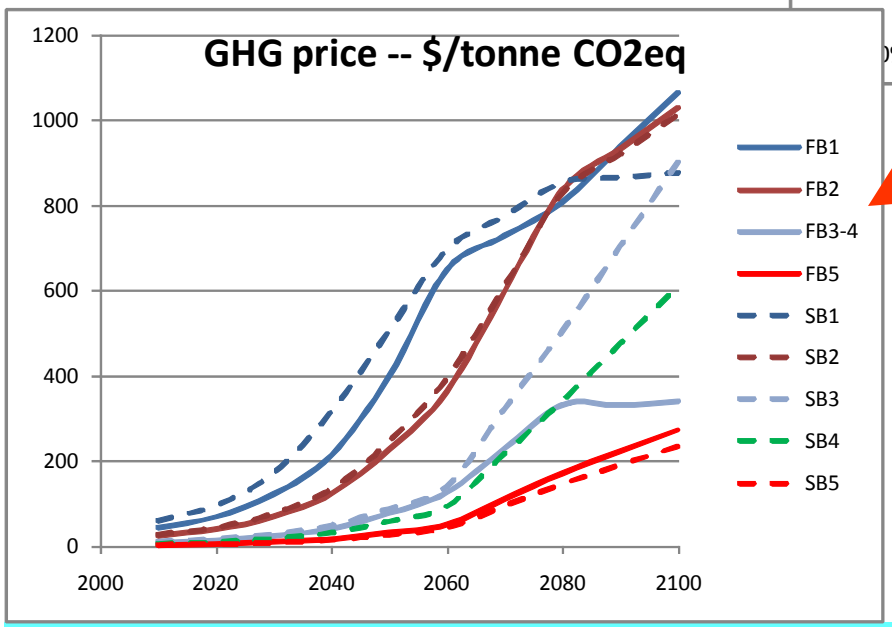
  For 550 ppm: 4.6 W rather than 4.5

- OPEC's oil strategy: we have determined oil quotas that optimize OPEC's oil profits (roughly 80% of equilibrium levels). This is a departure from a competitive equilibrium.

I. Cost Story (as proxy for scenario severity)

- Second Best global costs are moderately higher than First Best costs
- Regional costs cannot be computed until permit allocations are defined





- Second Best GHG prices are moderately higher than First Best prices

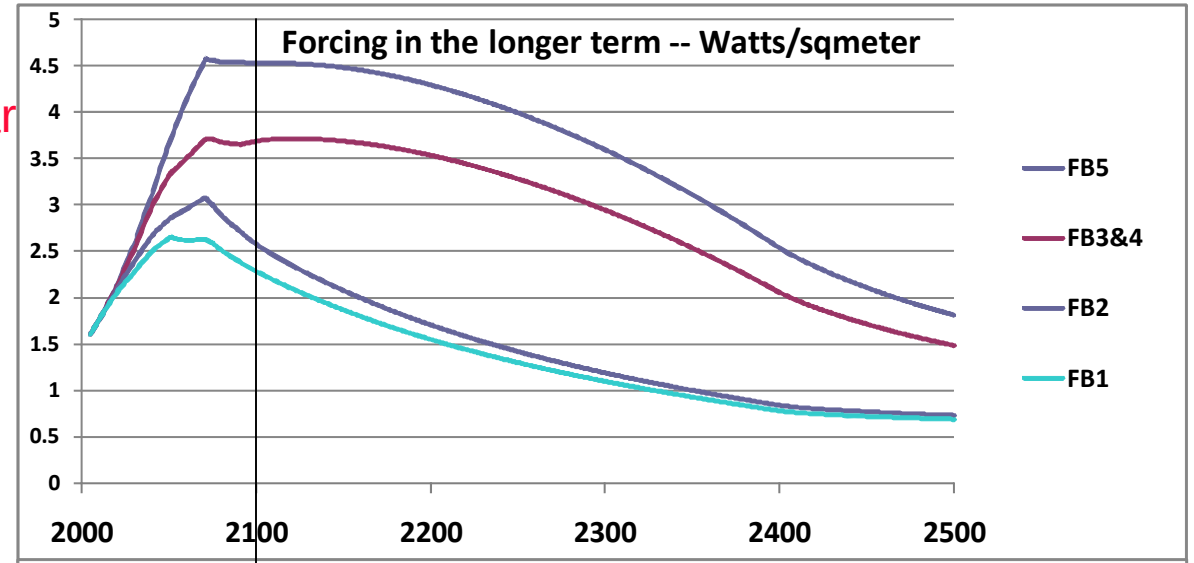
<u>Conclusion</u>: Late entry in coalition is not a huge impediment to attaining the climate targets

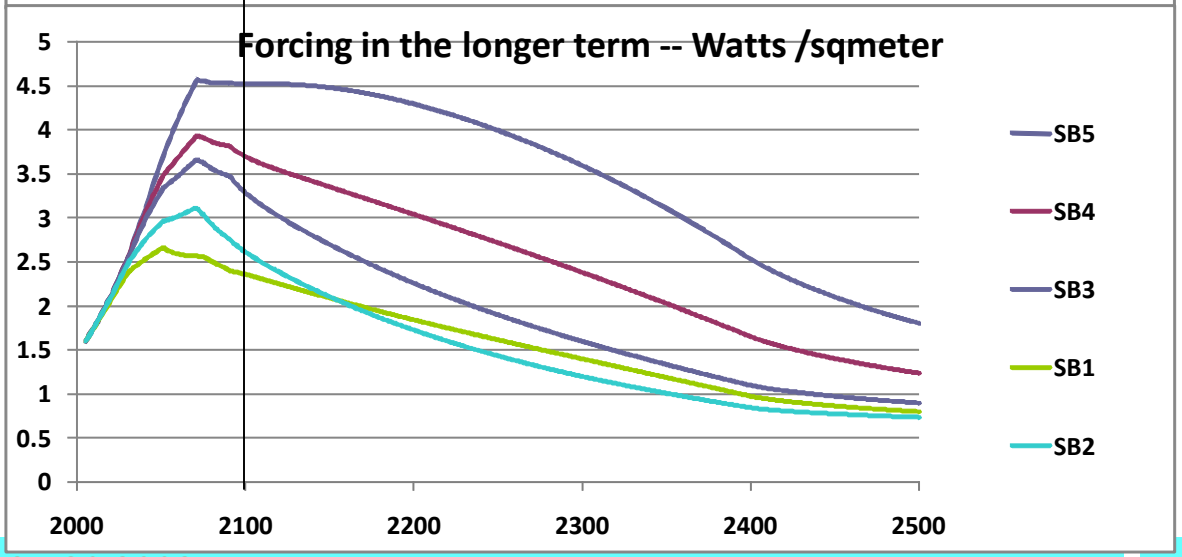
II. Long term Story (to year 2500)

- Beyond 2100, an assumption on emissions is needed in order to calculate future forcing (and forcing peak).

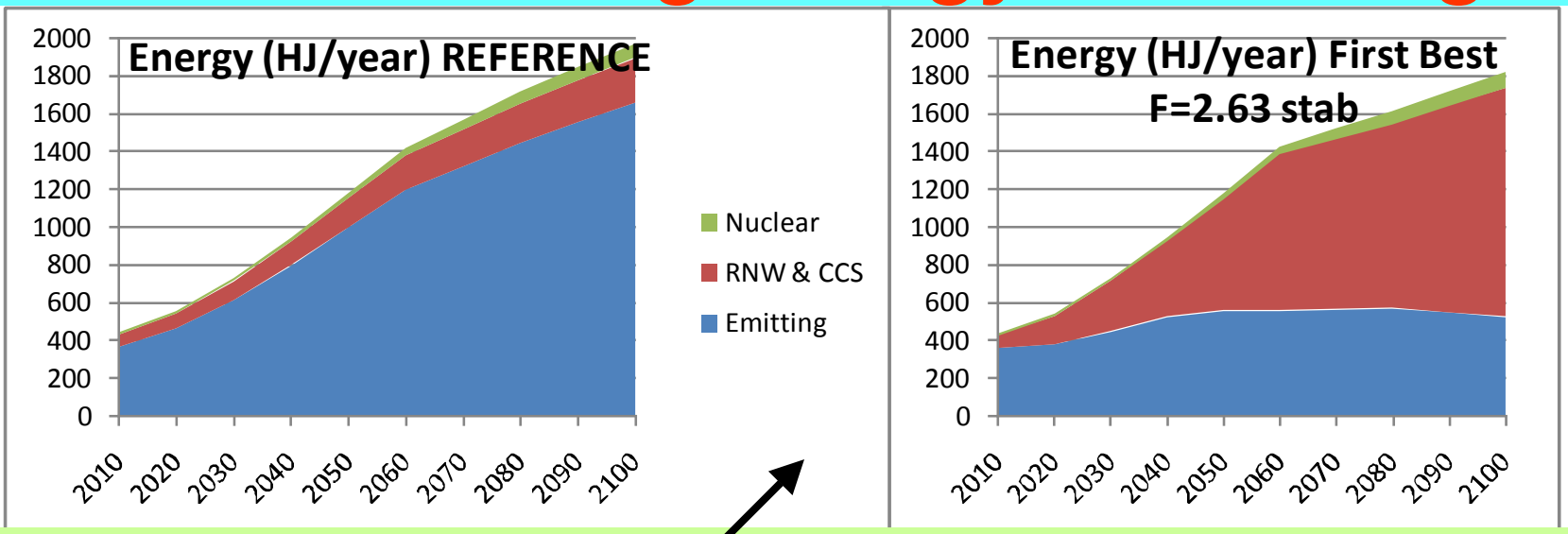
- We assume conservatively that emissions decline linear to 0 from 2100 to 2400

Forcing peaks before 2100 in all cases except FB3-4

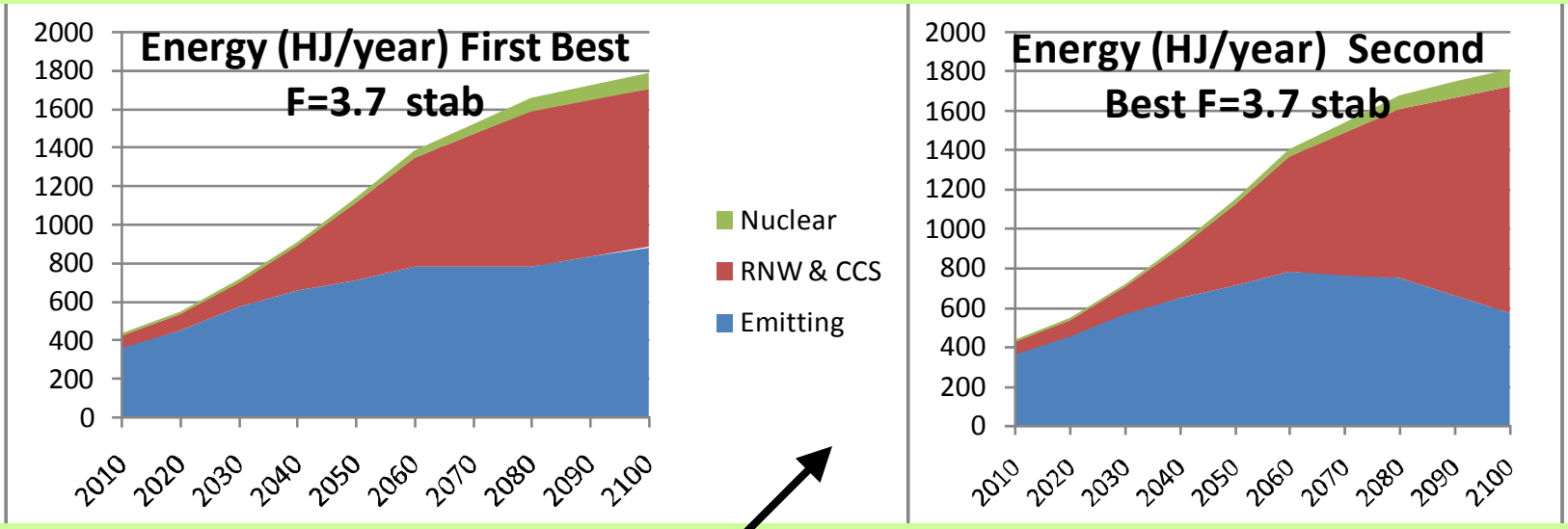




III. Non emitting energy technologies



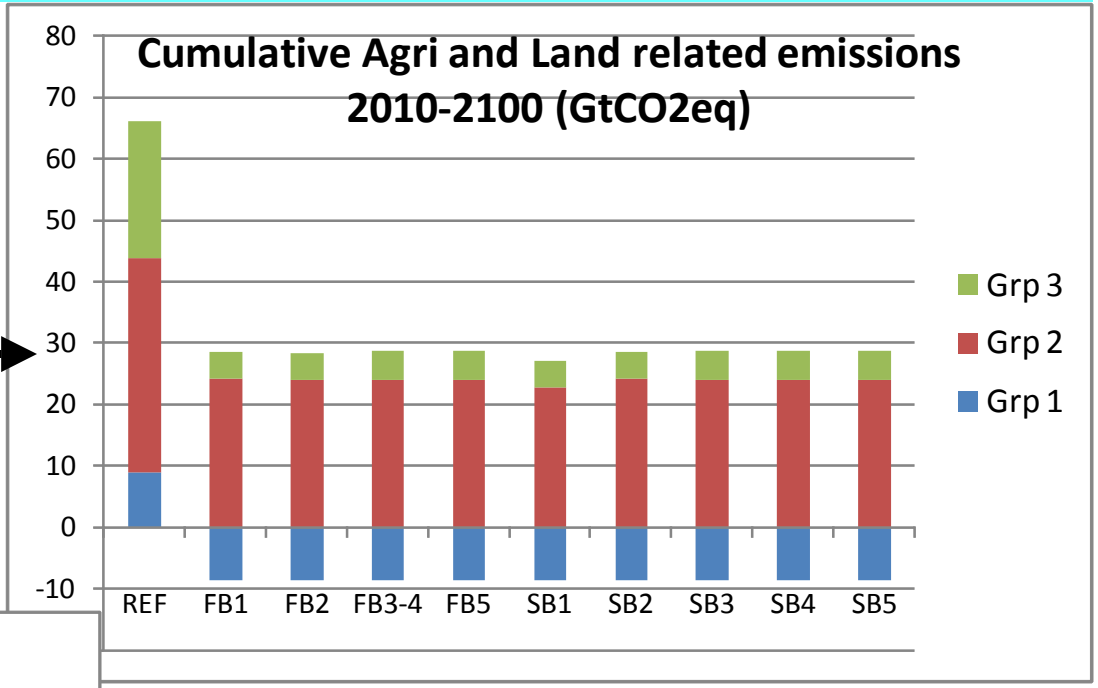
2.63 W/m² target : 10% more energy savings, and 70% non-emitting energy in 2100

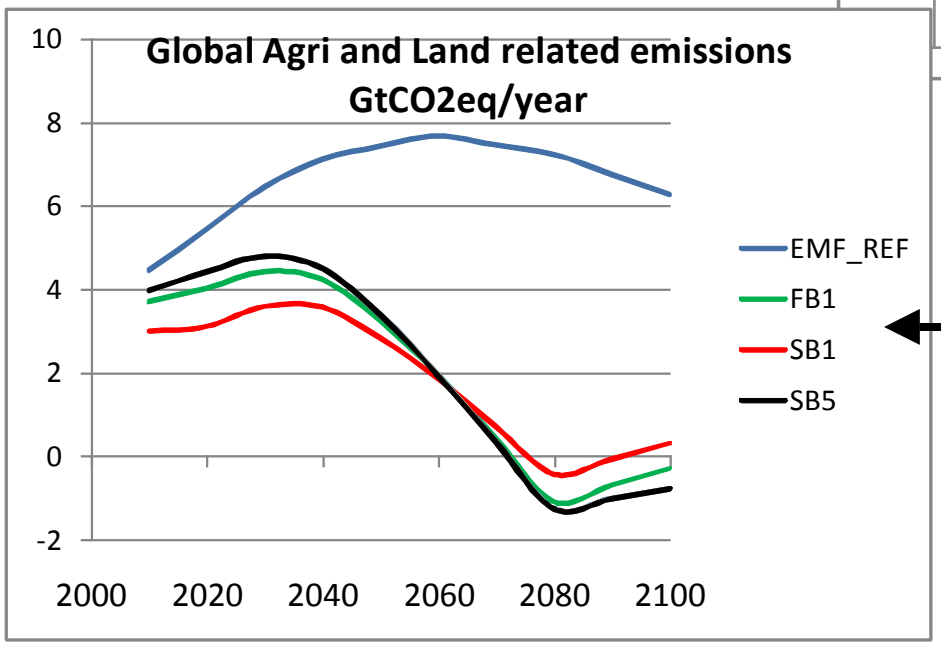


3.7 W/m² target: Late entry induces additional non emitting energy in late century

IV. AGRI and LAND related Emissions

1. Carbon pricing has a strong and uniform impact on *cumulative* land emissions in all 3 Groups





2. Carbon pricing has a differentiated impact on land emission *profiles* (mostly due to forestation options)