

**Coupled bottom-up and top-down modelling to investigate cooperative climate policies** (*Annals of Operations Research*, Submitted).

Authors: M. Labriet et al.

**Abstract.** In order to assess the cooperation between industrialized and developing countries in the design of a comprehensive worldwide climate policy to limit the global long-term temperature increase to 2°C, we developed an iterative procedure to link the global technology-rich optimization energy model TIAM and the global general equilibrium model GEMINI-E3. Such a novel coupling methodology combines the precise representation of technology choices and their impact on climate change, and a coherent representation of the welfare gains or losses associated with the techno-economic choices. The assessment of globally and partially cooperative agreements (equivalent to a global Emissions Trading System or to project-based technology cooperation) shows that drastic technology breakthroughs and implementations are required as soon as possible, especially in the larger emitting countries, and in all sectors of the economy; focussing only on the power sector is not sufficient. Moreover, some risk of delocalization of both gas extraction and energy-intensive industries exist in the case of partial agreements, but they result in a limited carbon leakage thanks to the reduction of oil extraction in all cases.

**Keywords.** Energy modelling; Coupling Methodology; Bottom-up model; Top-down model; Climate cooperative policy.