LCS·R Net

C.I.R.E.D.

The transition in energy demand sectors to limit global warming to 1.5°C

An overarching modeling approach and its policy implications

Christophe Cassen and the IMACLIM team

cassen@centre-cired.fr

CIRED-CNRS

10th Annual Conference LCS-R net Yokohama 17th July 2018

Context

- Paris Agreement : towards well below 2°C
- Recent scenario litterature (Rogelj et al. 2015, 2018; Van Vuuren et al. 2018) : global optimal 1.5°C scenarios : immediate global emission peak, fast CO2 emission reductions, net zero and large negative emissions beyond 2050
- BUT Resumption of CO2 emissions growth in 2017 after three year ”plateau” (IEA, 2018)

→ Global emission peak / rate of decline and related energy transition until mid-century?

Questions

Implications of delayed peak for energy transition feasibility?

Role of energy-demand patterns/policies in early peaking?

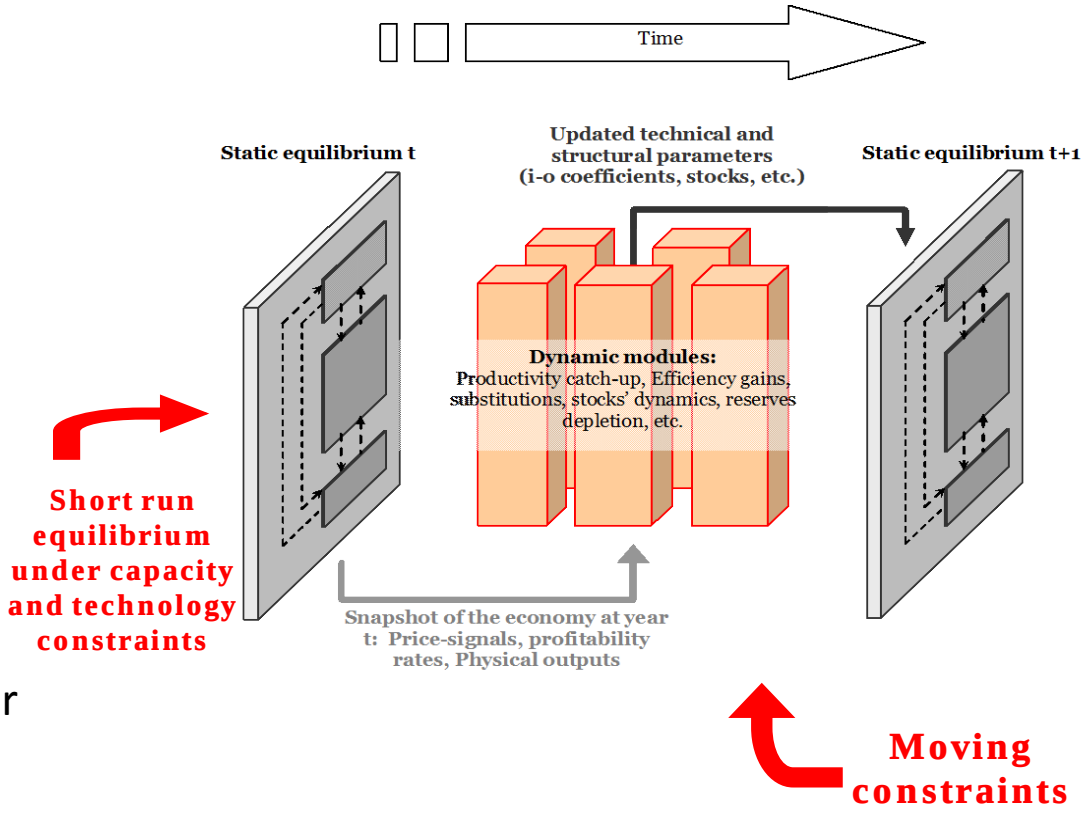
What decarbonization pattern at sector scale with emphasis on energy-demand sectors?

Mejean, A., Guivarch, C., Lefèvre, J., and Hamdi-Cherif, M. (2018). The transition in energy demand sectors to limit global warming to 1.5°C. Energy Efficiency. 1–22.

IMACLIM-R: macro-energy transitions in a “second-best world”

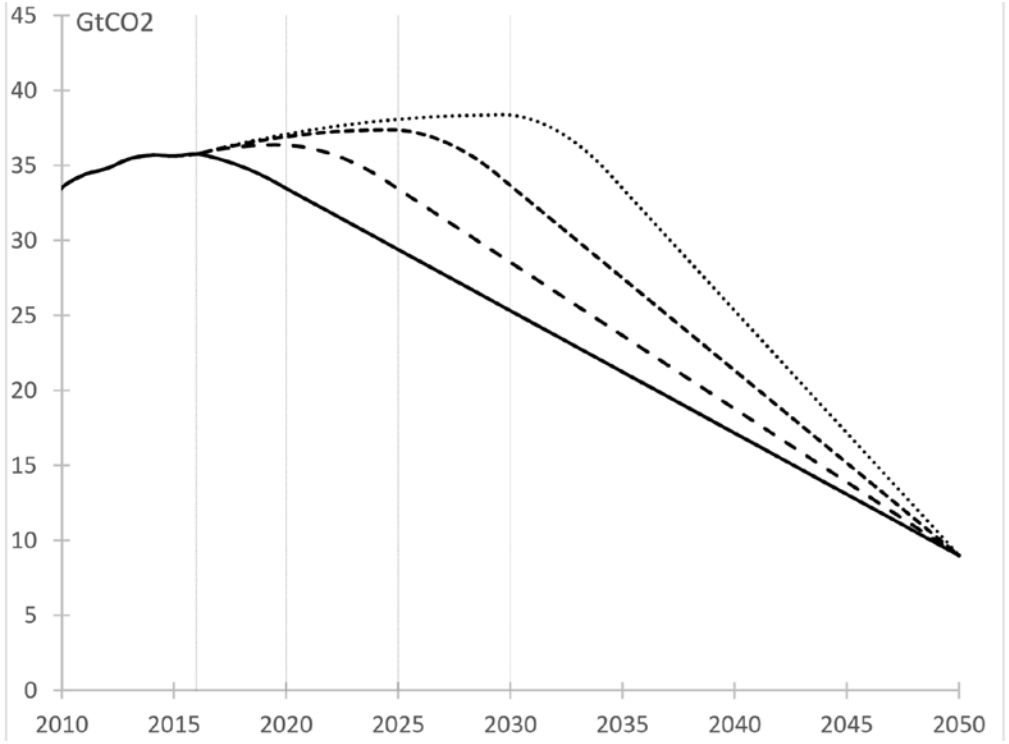
- Multi-region, multi-sector hybrid CGE model : **top-down economic equilibria** / **bottom-up sectoral modules** (power generation, LDVs, buildings)
- **Constrained flexibility** of technical systems (capital inertia, speed of technology diffusion) and interplay with ”**second-best” macroeconomic trajectories** (imperfect markets and expectations)
- Transport and building sectors **inertia**
- Induced technical and structural change, consumption patterns and mobility/housing services
- CO2 only and decarbonization through carbon price

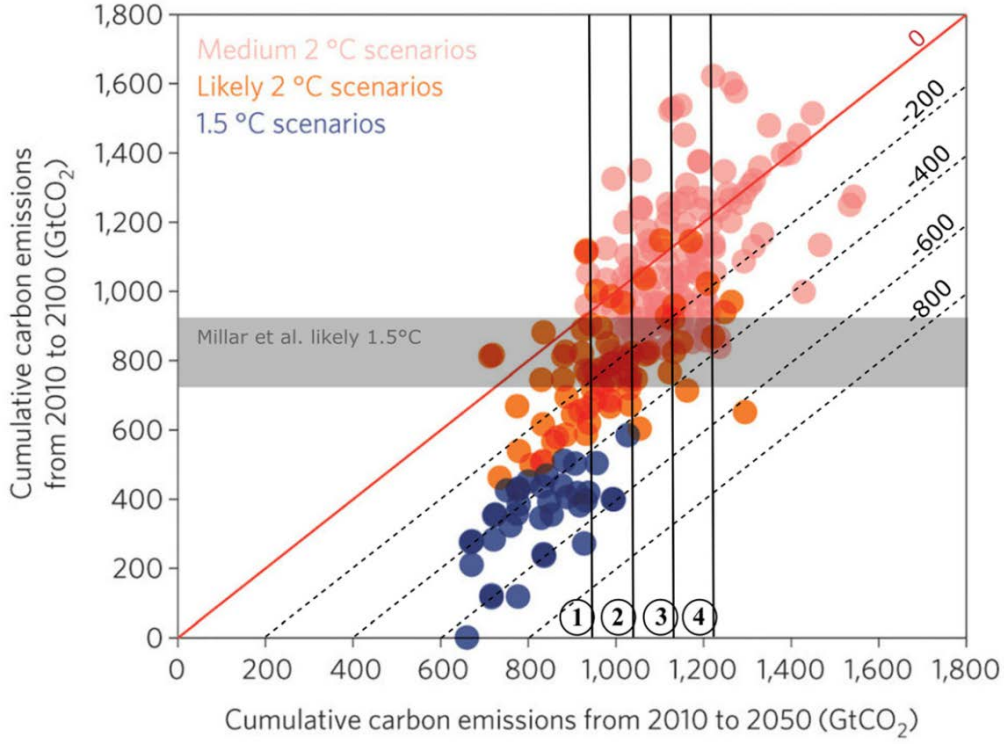
→ A ”low-response” IAM emphasizing mid-term transition issues (Kriegler et al. 2015



Four families of mid-century scenario

- Contrasted date and level of global CO2 emission peak (2016, 2020, 2025 and 2030)/ Same emission level in 2050 (-65% CO2 emissions in 2050 compared to 1990)
- Can be evaluated against 1.5 - 2◦C scenario litterature (Rogelj et al. 2018; Millar et al. 2017)





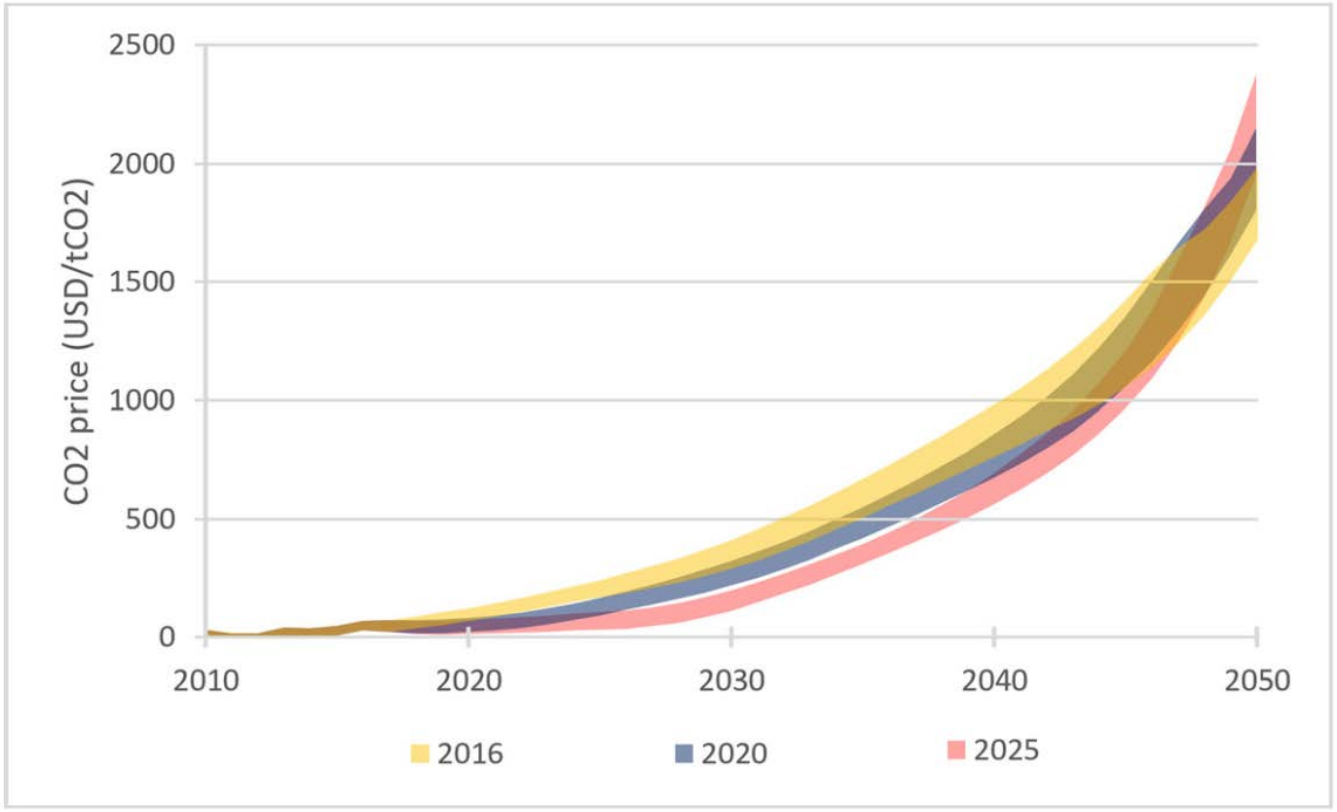
A total set of 32 scenarios

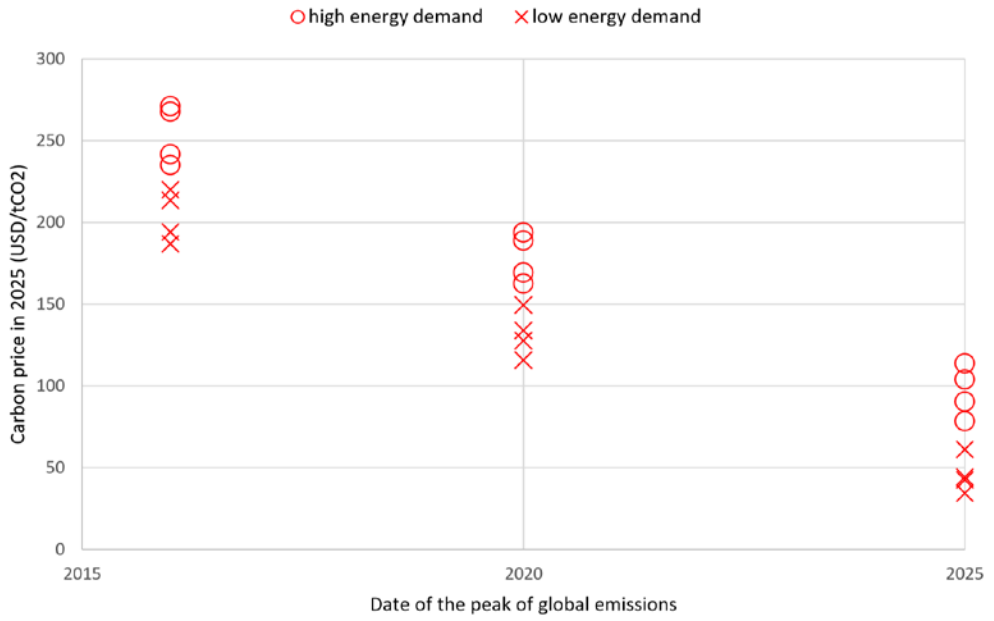
- Alternative assumptions about energy demand, fossil fuel ressources and low carbon technologies
- Low energy demand patterns triggered by sector specific demand-side policies

Parameter family	Sector or technology	High	Low
Energy demand			
Energy efficiency	Agriculture, industry, construction, services	Slow induced energy efficiency improvement	Fast induced energy efficiency improvement
Development patterns	Transport, buildings, consumption of industrial goods	Asymptotic catch-up of developing countries with the US development pattern	A less carbon-intensive development pattern
Fossil fuel resources			
	Coal, gas	Relatively abundant and cheap	Relatively scarce and expensive
	Coal-to-liquids	High penetration	Low penetration
Low carbon technologies			
	Low carbon electricity technologies (renewables, nuclear)	High availability, fast learning	Low availability, slow learning

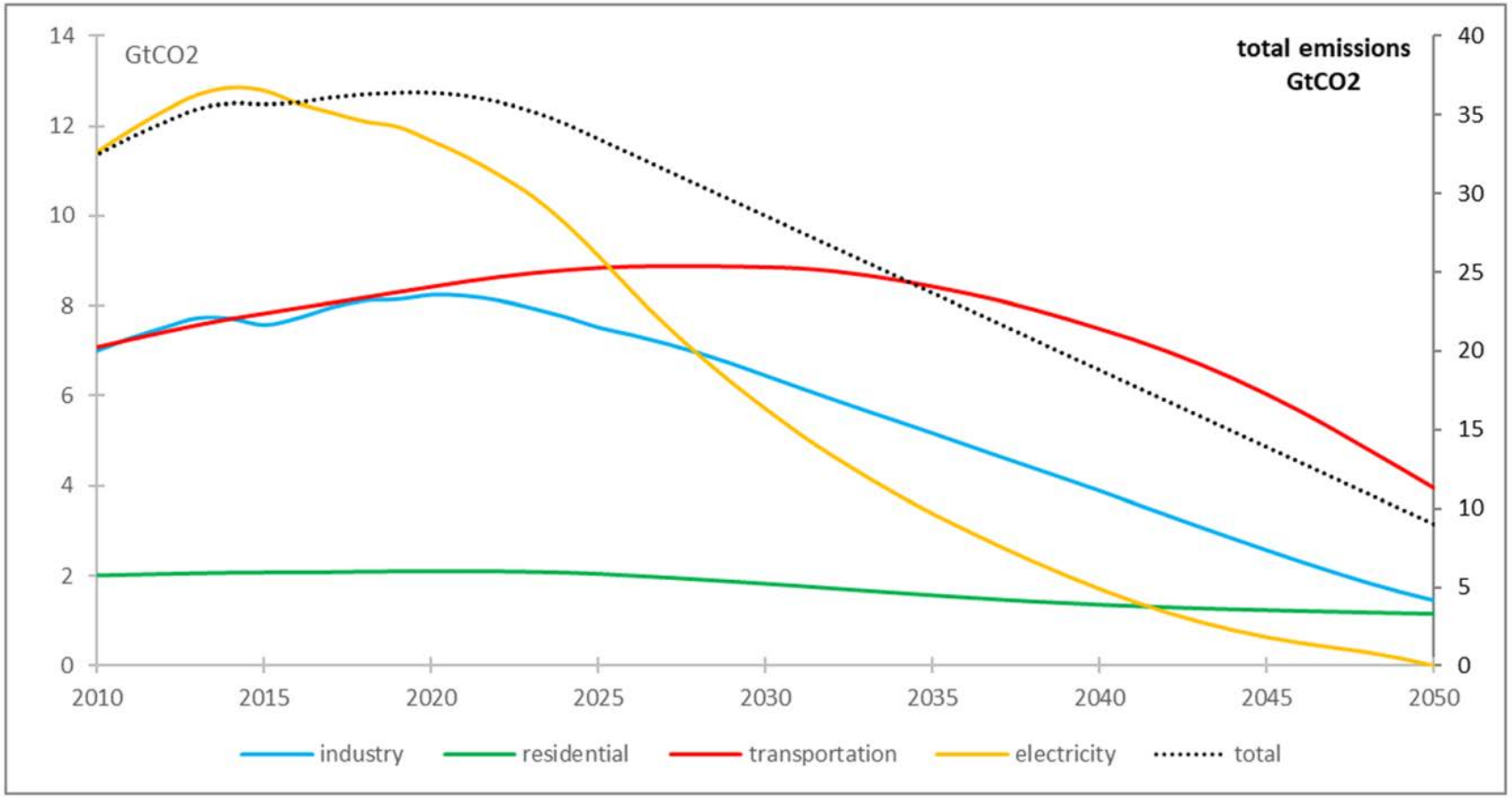
Date of global emission peak and carbon prices

- All 2030-peak scenarios **”infeasible”** whatever the assumptions about energy demand, fossil fuels and low carbon technologies

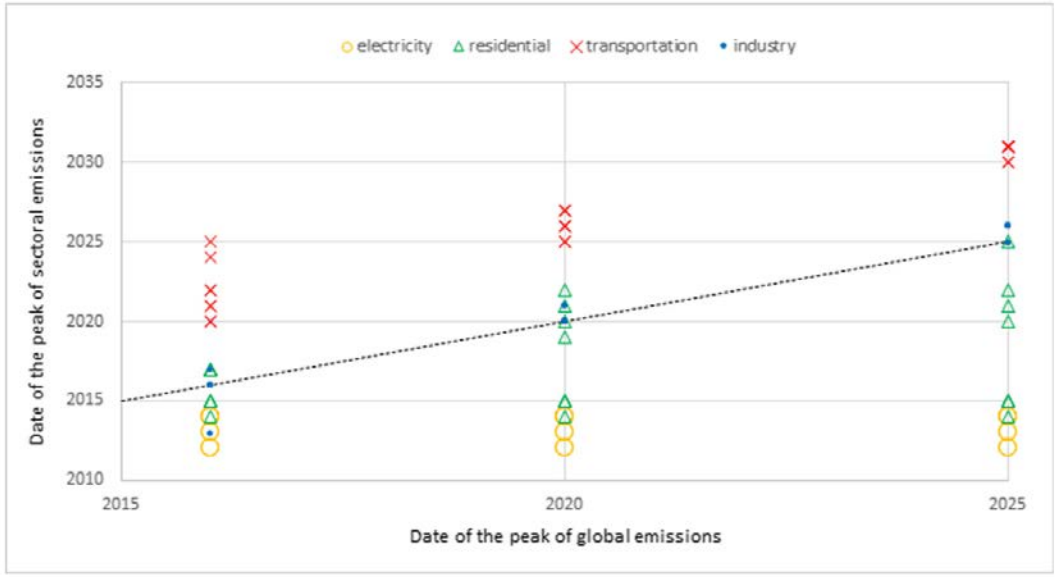


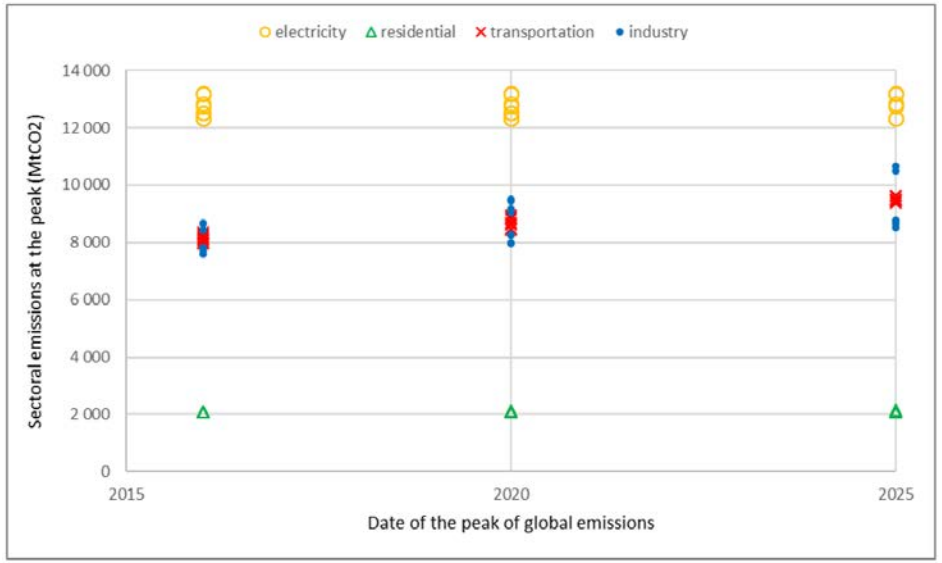


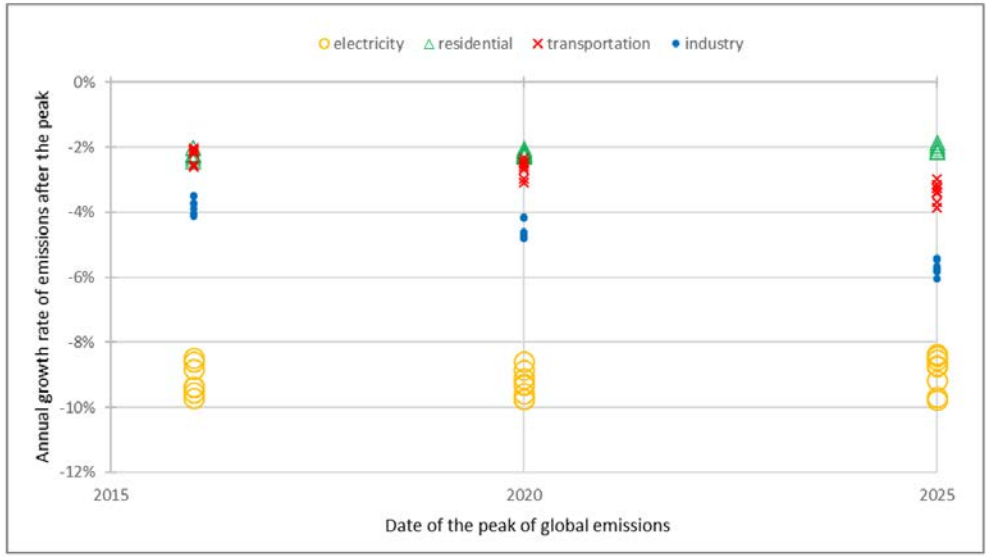
Sectoral decarbonization patterns



Sectoral implications of shifting global emission peak



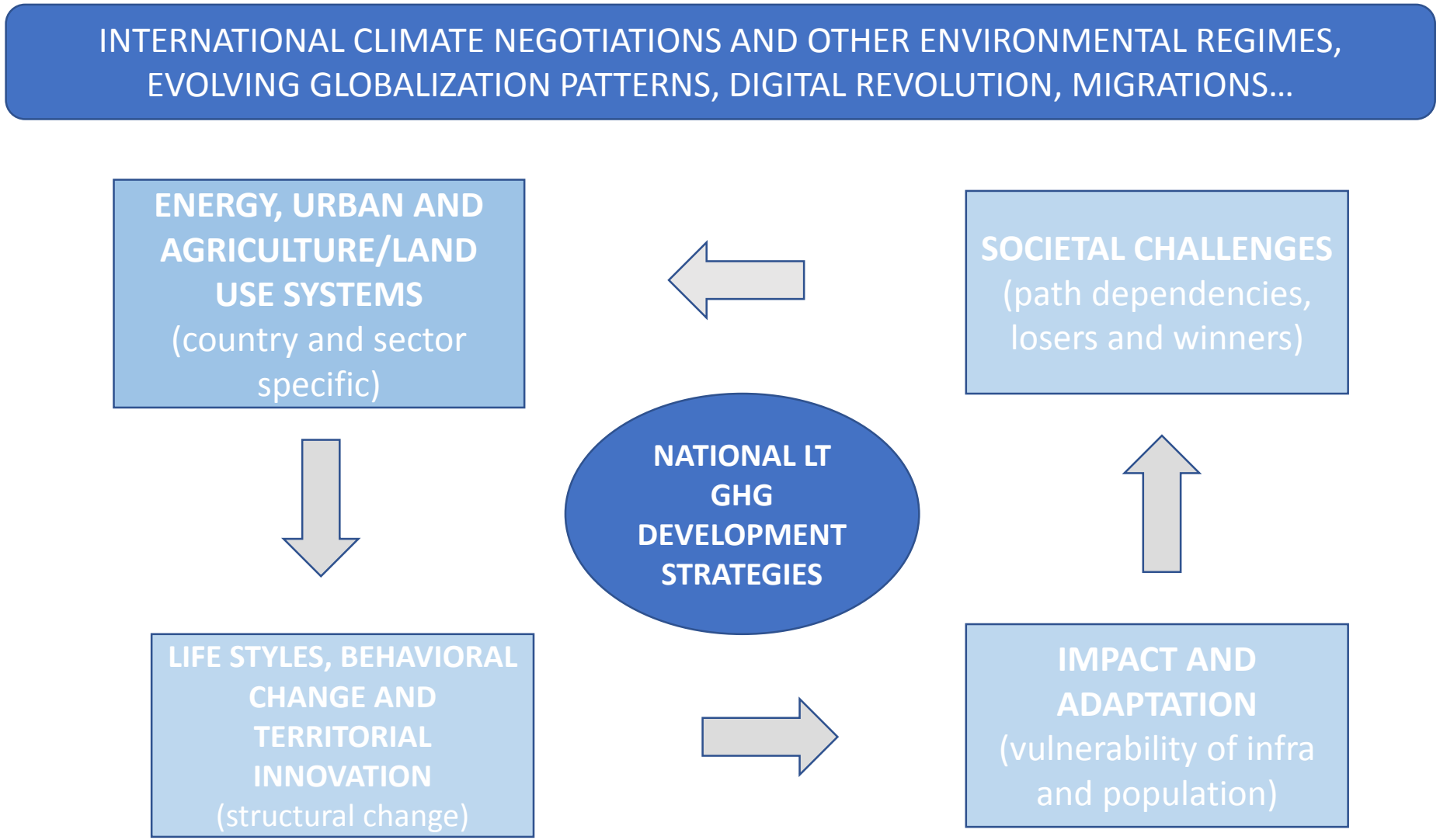




Overall conditions for a feasible transition compatible with 1.5°C

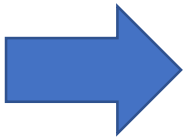
- Delaying emission peak until 2030 may imply **unfeasible** mid-century socio-technical transition needed to be compatible with 1.5°C target
- **Stringent policies in energy-demand sectors** — industry and transportation especially — are needed in the short run to trigger an immediate peak of global emissions and increase the probability to reach the 1.5°C target
- Early global emission peak implies early emission reductions in energy demand sectors —**mainly industry and transportation** - beyond the fast decarbonization of the electricity sector

Elements of long term strategies GHG development strategies of ecodevelopment…



AND ITS POLICY IMPLICATIONS

- Connect demand side policies with SDGs
- Design fair distributive policies (e.g. recycling options of carbon revenues towards households and firms)
- Develop means to accelerate the transition (e.g financing mechanisms to derisk investments…)
- Search for national policy agenda momentum articulated with the stocktake process (pre-2020 actions)
- Improve connections btw IPCC, international research/decision making platforms (TWI2050, 2050 Pathways platform, DDPP, LCS-R net…) and other networks (ICLEI, C40…)



Some ingredients for a fair and inclusive transition in a turmoil geopolitical and fast changing technological context

THANK YOU FOR YOUR ATTENTION!

imaclim@centre-cired.fr

Mejean, A., Guivarch, C., Lefèvre, J., Hamdi-Cherif, M. (2018). ***The transition in energy demand sectors to limit global warming to 1.5°C****. Energy Efficiency. 1–22*

Cassen, C., Cotella, G., Toniolo, J., Lombardi, P., Hourcade, J-C., (2018). ***Low Carbon Scenarios for Europe. An evaluation of upscaling pioneer experiences in a low carbon context,*** *Sustainability 2018, 10(3), 848 ; doi:10.3390/su10030848*

Benveniste, H., O. Boucher, C. Guivarch, H. Le Treut, P. Criqui. (2018). ***Impacts of nationally determined contributions on 2030 global greenhouse gas emissions: uncertainty analysis and distributions of emissions.*** *Environmental Research Letters 13(1)*

Séférian, R., Rocher, M., Guivarch, C., Colin, J. (2018). ***Constraints on biomass energy deployment in mitigation pathways : the case of water scarcity.*** *Environmental Research Letters 13 (5).*