Stakeholder Workshop: Decarbonization in Brazil and Latin America – Opportunities and Challenges

Achieving Net-Zero in Brazil and in Latin America

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Cenergia/PPE/Coppe/UFRJ

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Structure of this presentation

Modelling framework

1.5ºC global pathways

Global, Latin America and Brazil's results

Exploring different burden-sharing schemes

ENGAGE
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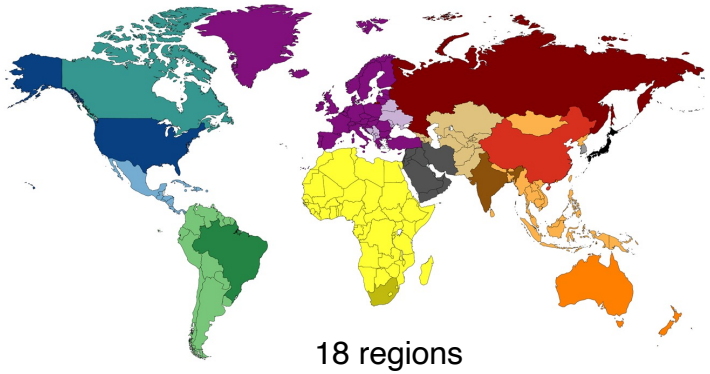
Modelling framework

- COFFEE - TEA suite of IAMs

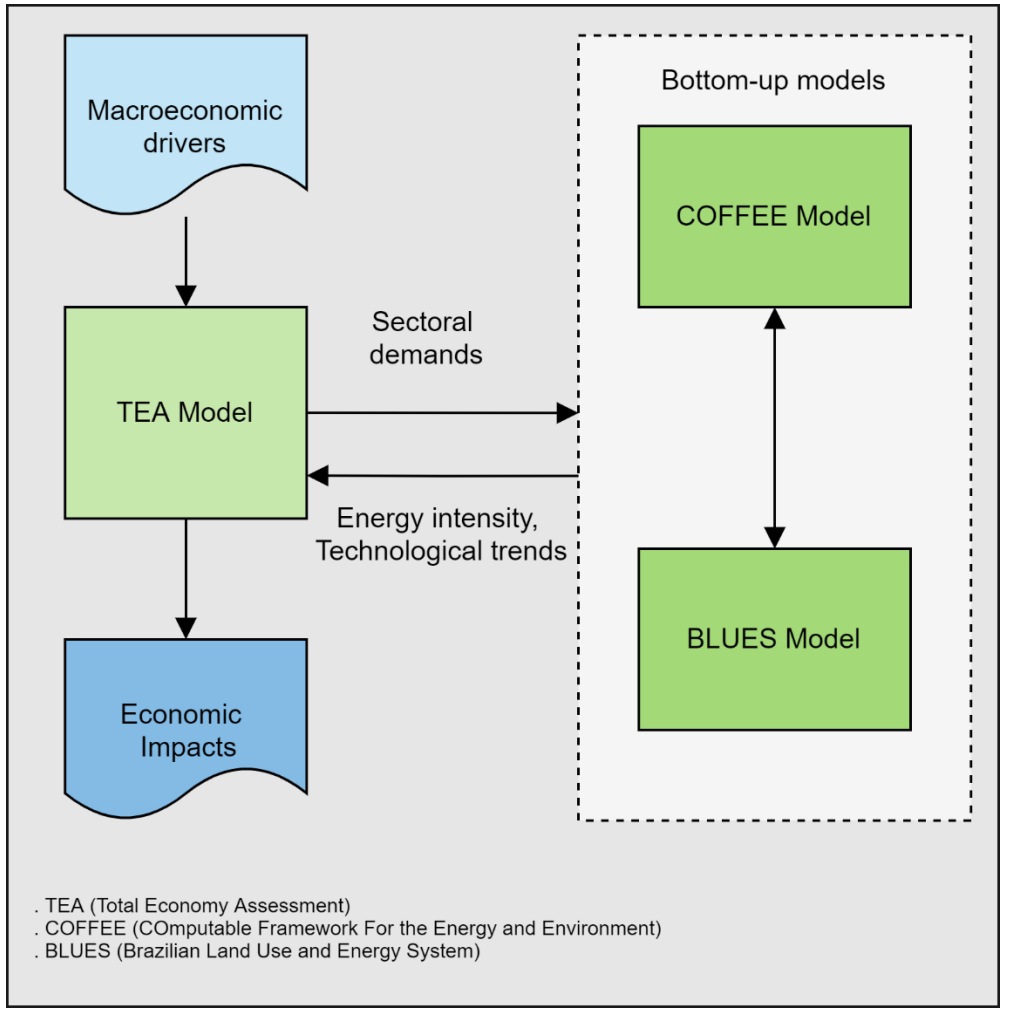
Top-down, recursive dynamic, multi-regional and multi-sectoral general equilibrium model

Bottom-up, perfect foresight, linear optimization, partial equilibrium, global model for the energy and land systems



18 regions

- **Soft-linking procedure:**
  - TEA provides a description of **interactions** between **economic sectors** in a post-COVID world
  - Consistent economic data from TEA are used to guide **exogenous sectoral demands for both the COFFEE and BLUES** models
  - COFFEE and BLUES **allow for long-term global and Brazilian systems analyses** for mitigation scenarios



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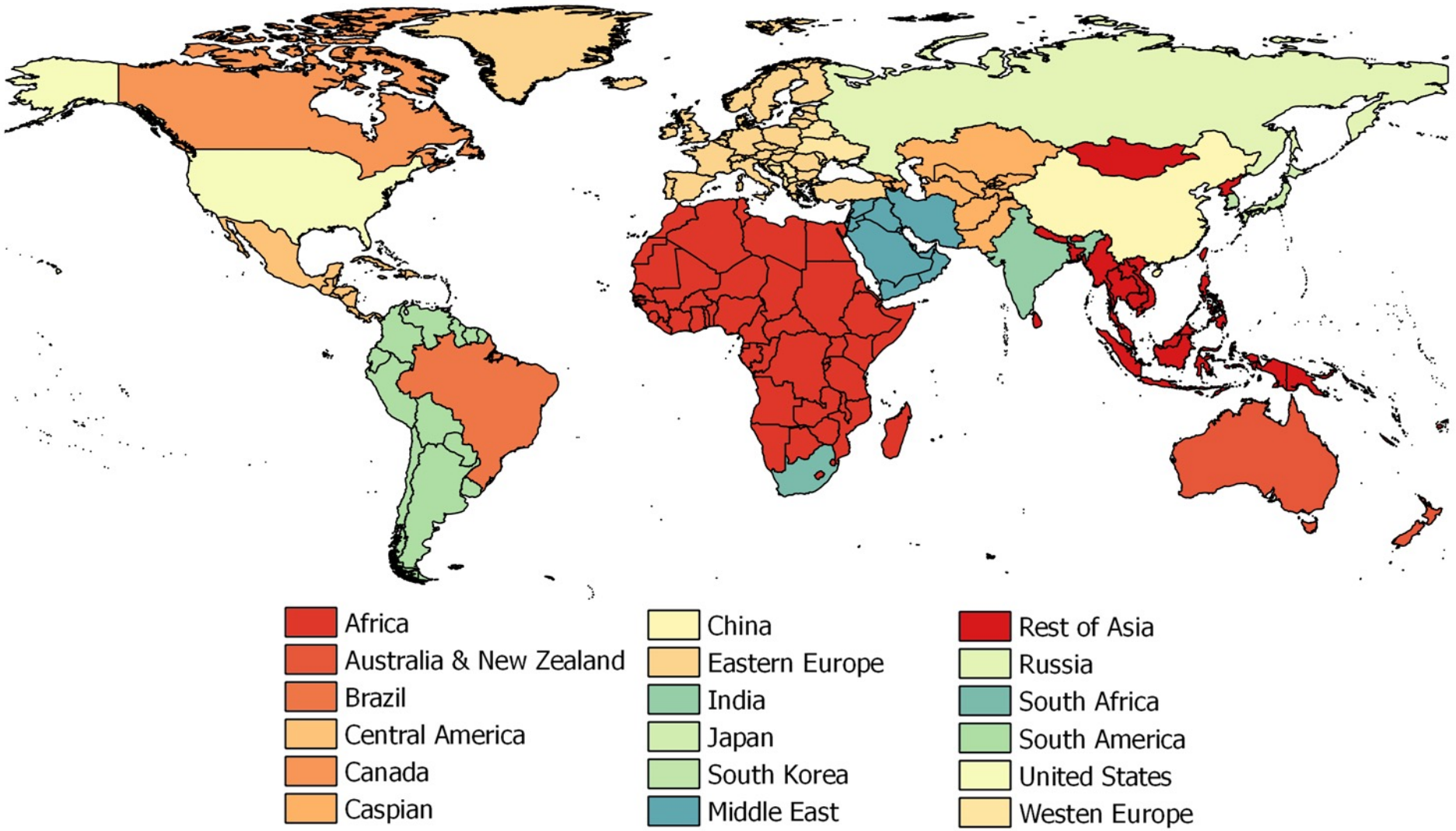
The COFFEE Model and its regional disaggregation



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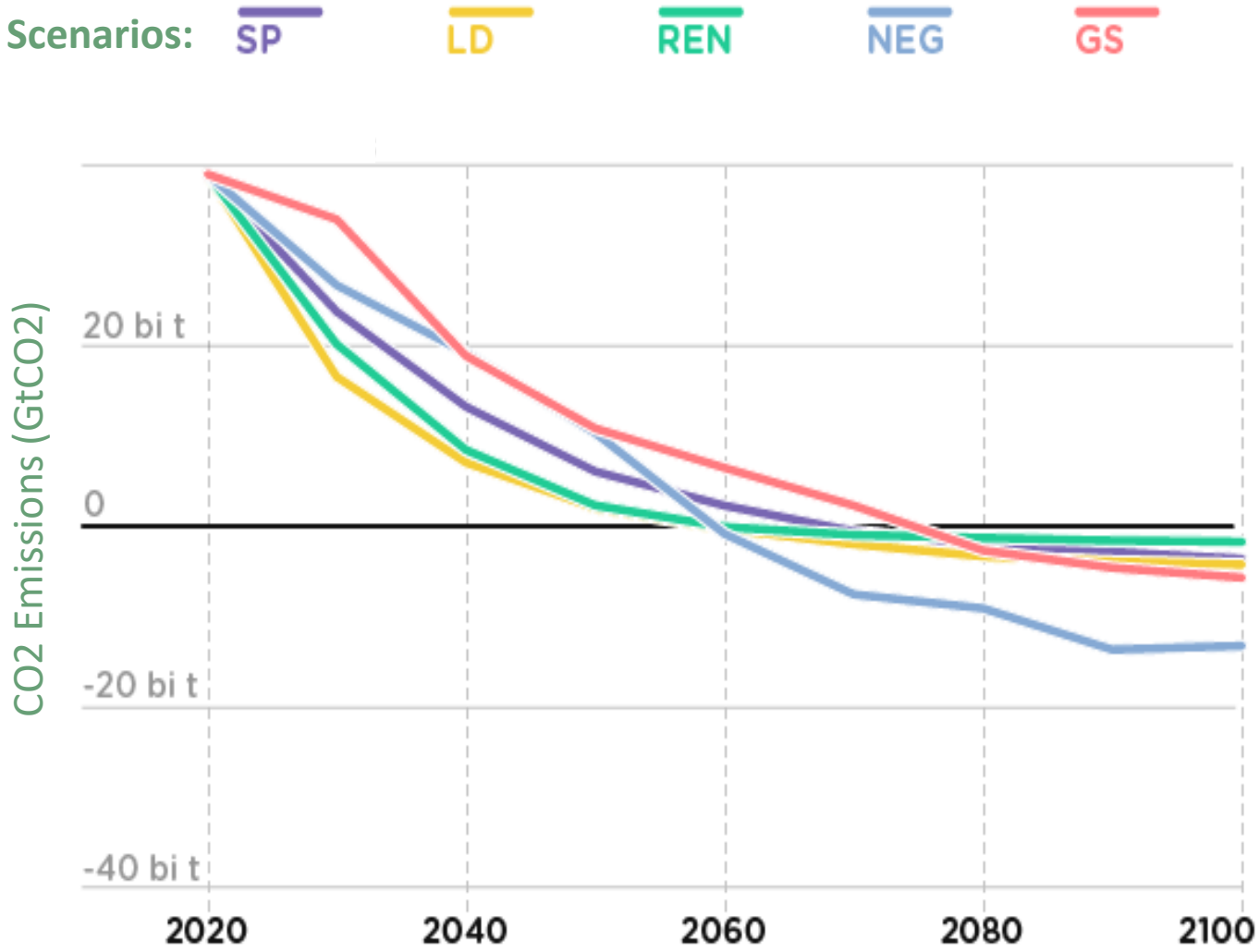
A relevant scenario in the AR6

IMP-Neg scenario

The Illustrative Mitigation Scenario COFFEE 400F



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Just released, the most recent version of the COFFEE model: COFFEE 1.5 (as of March 29th 2023)

O&G sector

- Detailed oil module with light, medium, and heavy oil qualities and typical refining schemes considering their different yields

Industrial sector

- Cement, steel and petrochemicals (HVCs, ammonia and methanol) production and demand representation greatly improved

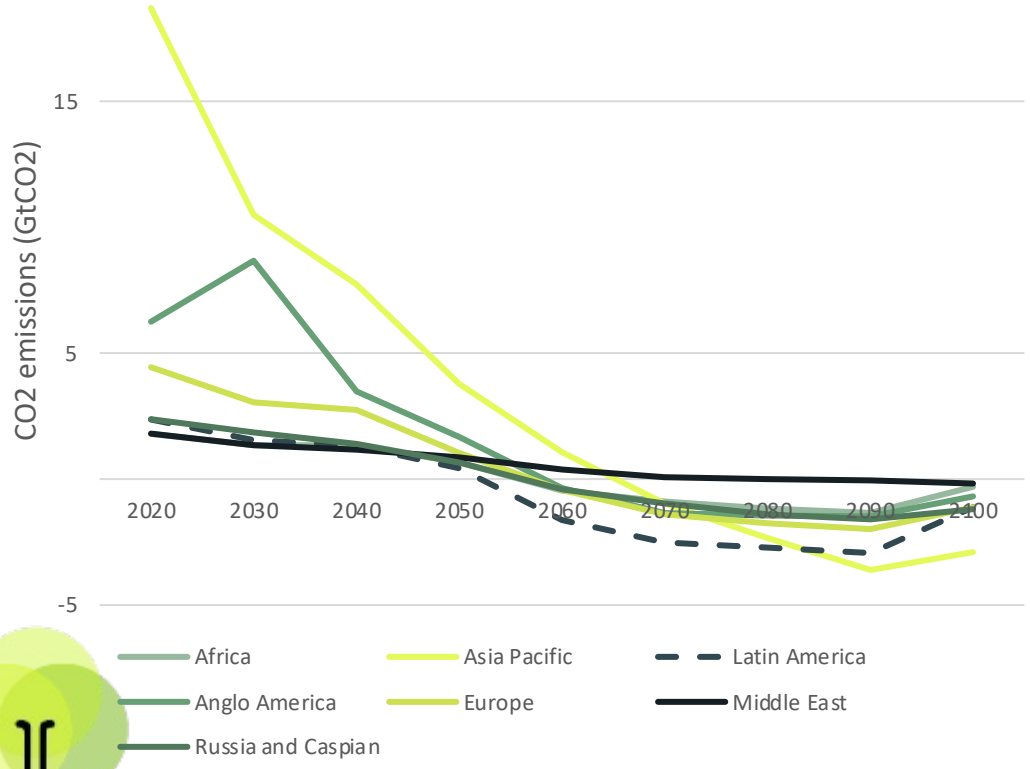
Shipping

- Bottom-up demand modelling (~30 products) and fuel-focused mitigation options

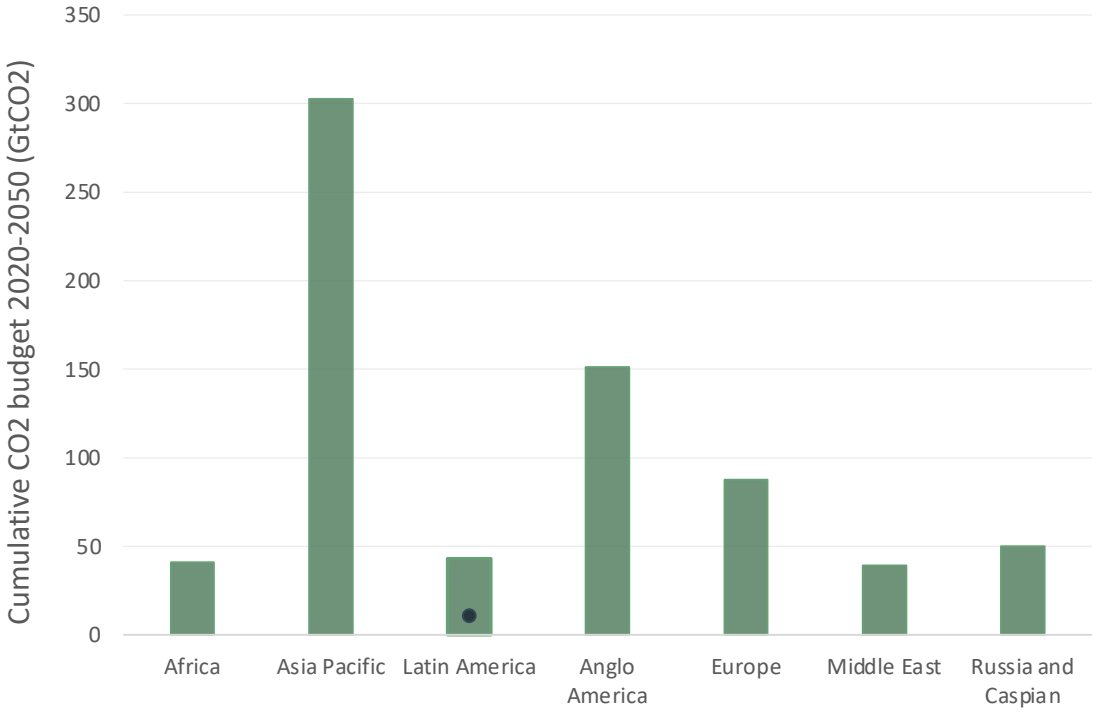
Results for the World, Latin America (LAM) and Brazil

Global and regional CO_2 emissions in a 1.5ºC World

- Global emissions reach **net zero** CO_2 emissions by 2060
  - LAM and Brazil reach net zero CO_2 by 2050



- Remaining carbon budget of approx. 700Gt CO_2 between 2020-2050
  - 43Gt CO_2 for LAM
    - Of which 11Gt CO_2 for Brazil



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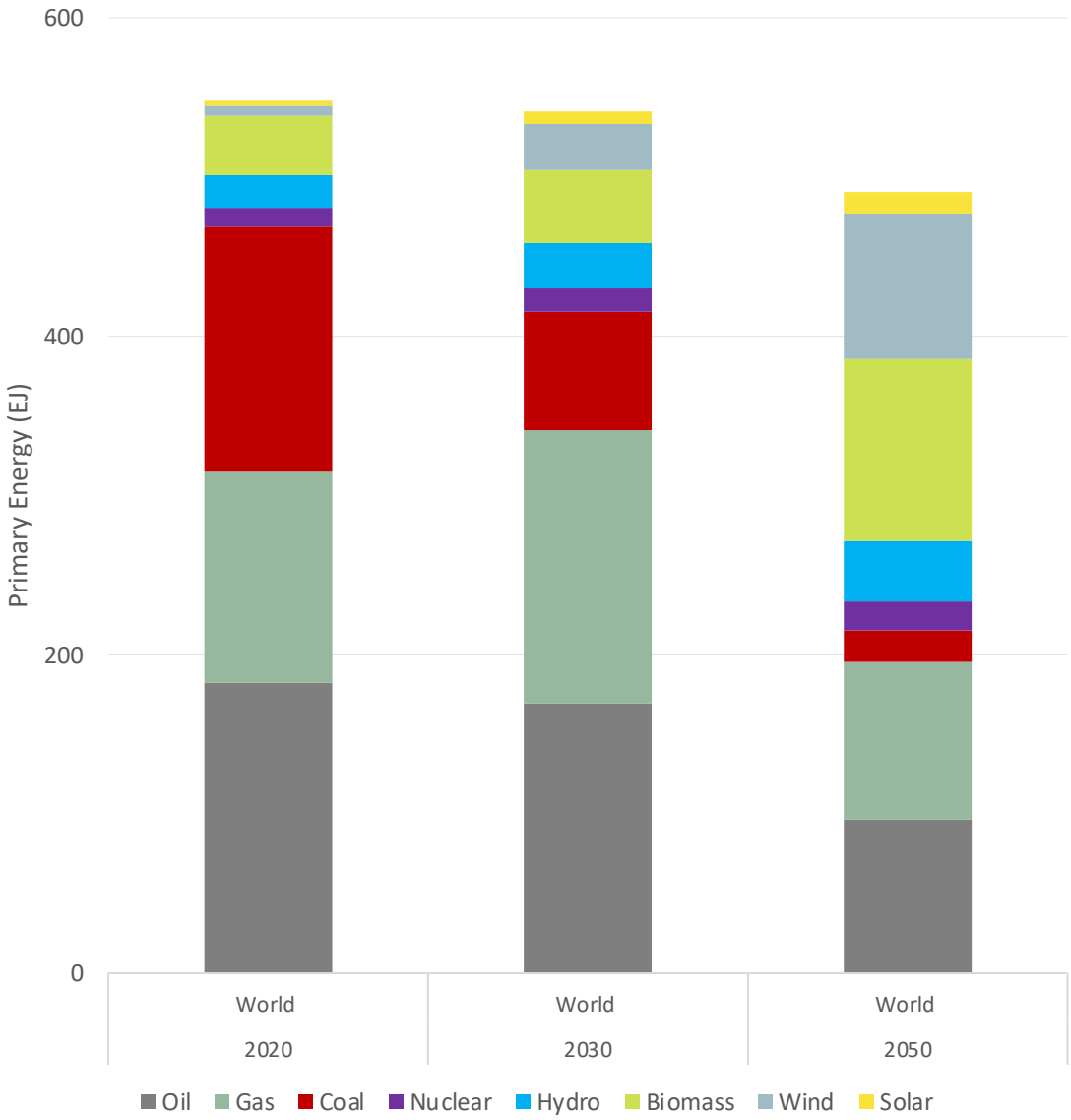
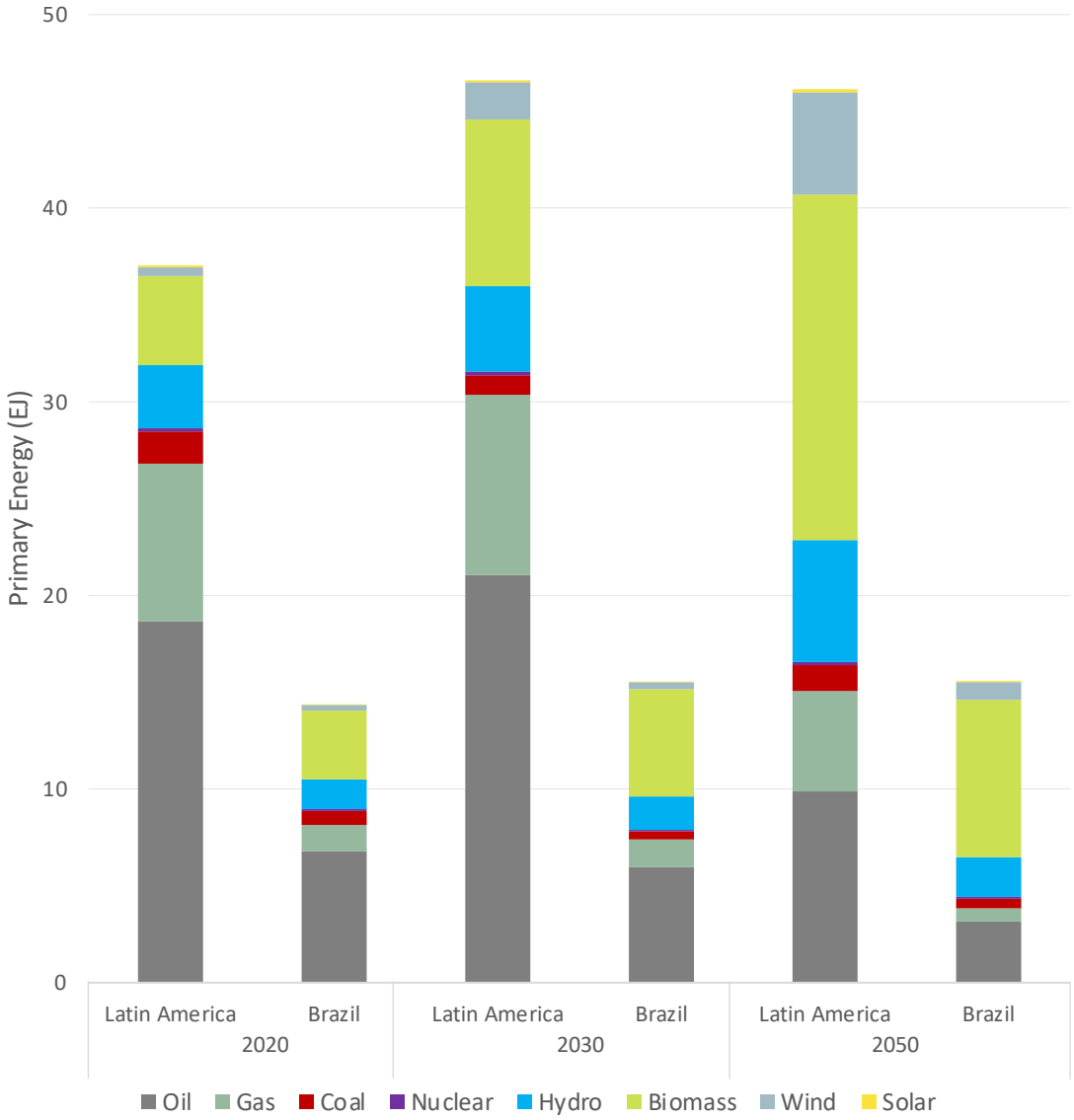
Global: Primary Energy

- Fossil fuels represented ~80% of the total global energy supply in 2020, but this share is **reduced** to ~40% in 2050
- **Renewables** increase from 15% of total global primary energy to ~50% of total primary energy in 2050
- **Renewables** continue to play an extremely important role in the power sector in the future
  - **Wind**, **solar** and **hydro** represent almost 90% of total **electricity supply** globally by 2050



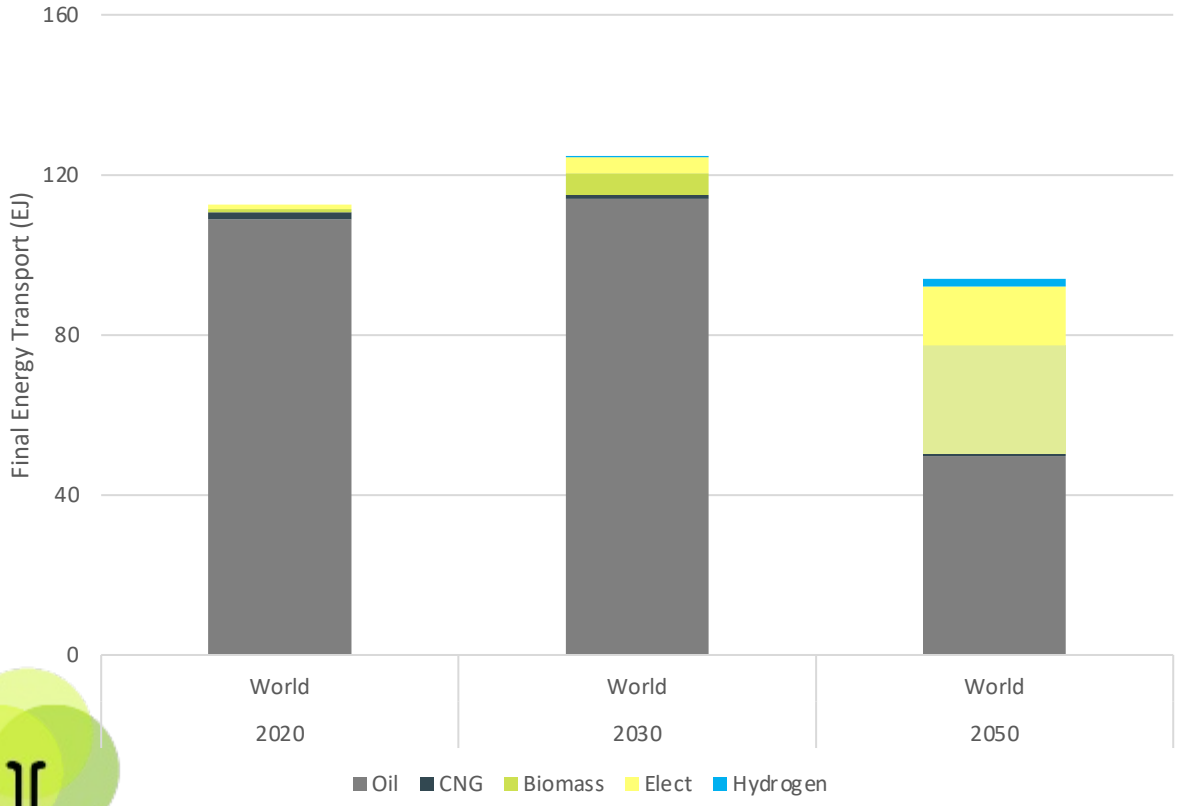
LAM and Brazil: Primary Energy

- Fossil fuels represented ~75% of the LAM energy supply in 2020, but this share is **reduced** to ~35% of LAM and ~30% of Brazil in 2050
- **Renewables** increase from ~25% of total primary energy to ~60% of LAM and ~70% of Brazil in 2050
- **Renewables** continue to play an extremely important role in the power sector of Latin America into the future
  - **Wind**, **solar** and **hydro** represent more than 90% of total **electricity supply** in LAM and Brazil by 2050

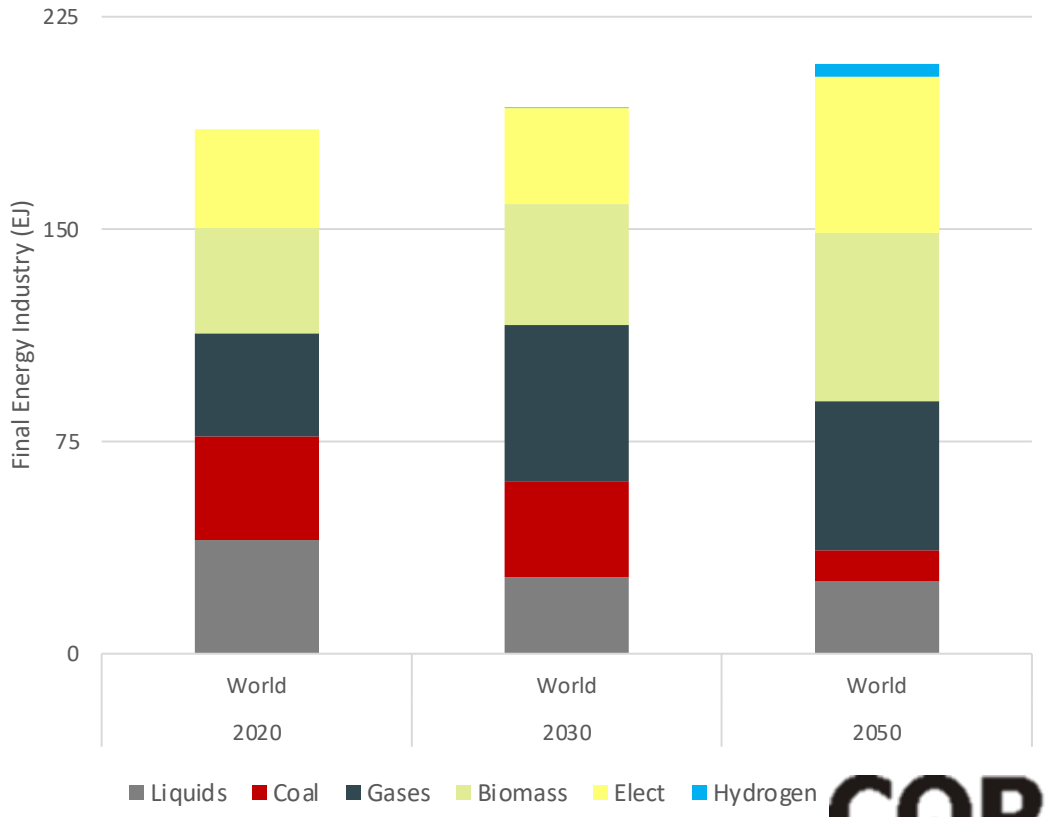


Global: Transport and Industry

- **Biomass-based** fuels increase their share in the long-term, reaching almost 30% of total energy use by the transport sector globally by 2050



- **Electricity and biomass (and some hydrogen)** play a significant role in the global industrial final energy consumption by 2050



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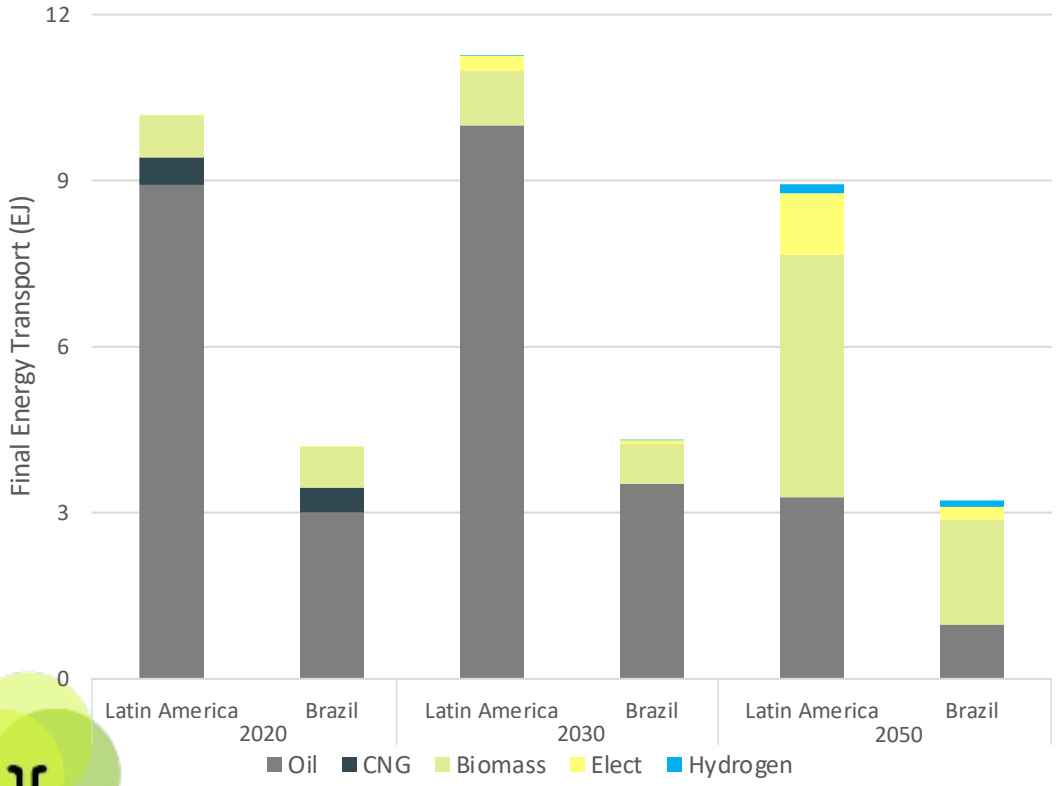
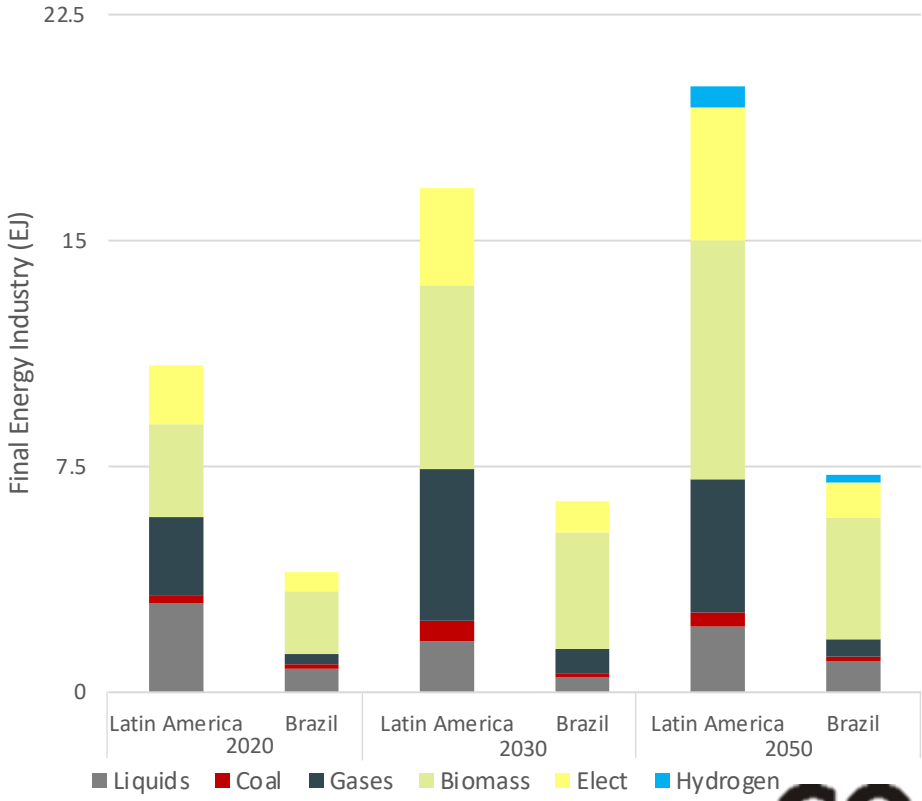
LAM and Brazil: Transport and Industry

- **Biomass-based** fuels increase their share in the long-term, reaching almost 60% of total energy use by the transport sector in LAM by 2050



- Higher participation of electricity, biomass and hydrogen in LAM and in Brazil



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What's next?

- **Results shown here so far derive from a single mitigation scenario produced by the global COFFEE model that corresponds to a 1.5°C-warming-world remaining carbon budget**
- **This scenario was run under a global "least-cost" logic**
- **But other runs can be performed according to different "fairness schemes and allocation rules"**
- **So what?**

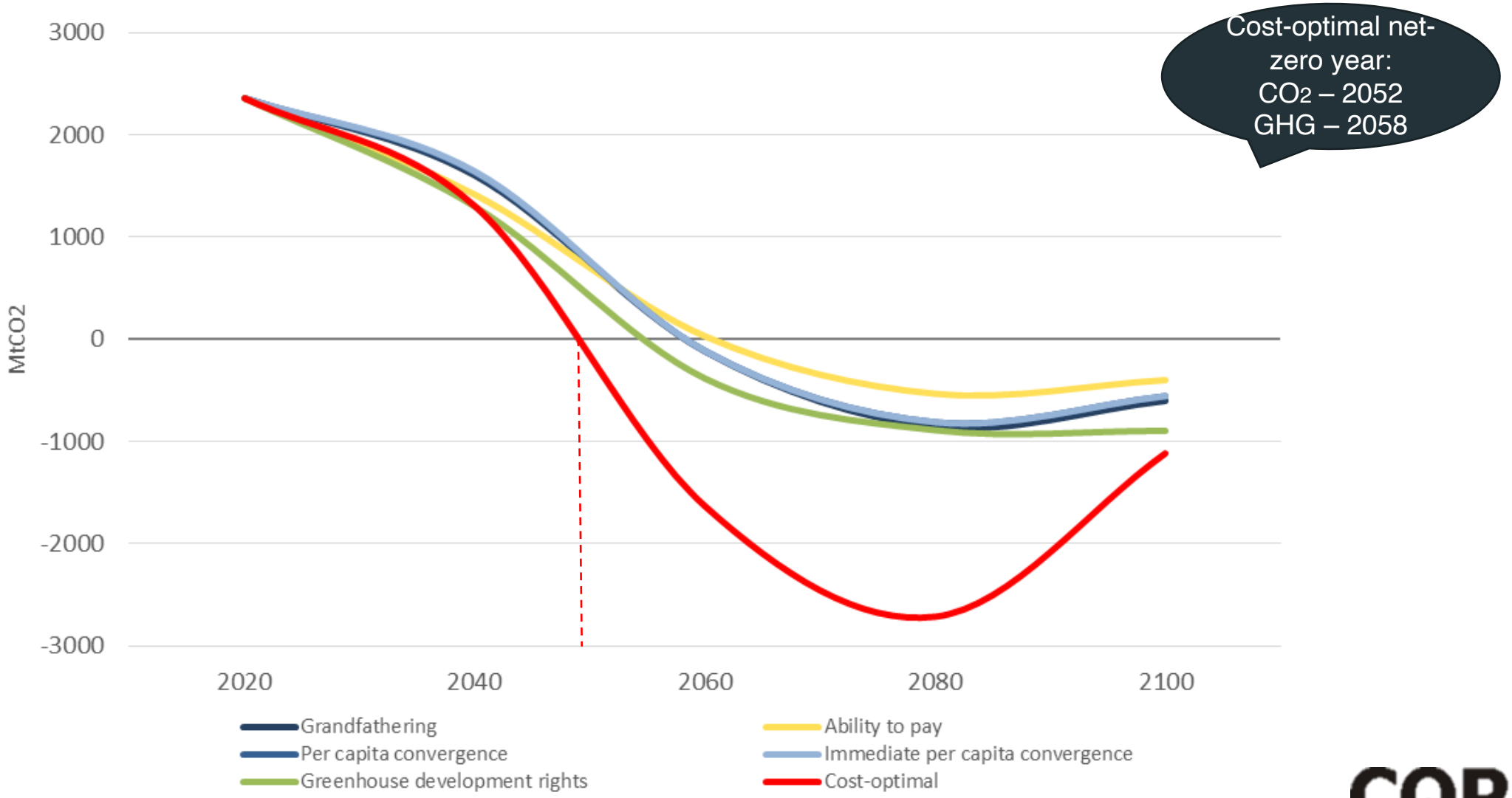
Exploring different burden-sharing schemes for LAM and Brazil

Burden Sharing schemes based on different equity principles

Approach	Equity principle	Criteria to allocate future emissions
Grandfathering (GF)	**Sovereignty** — 'acquired rights' of nations justified by established custom and usage	**Proportional to current emission shares**
Immediate per capita convergence (IEPC)	**Equality** — equal value of all humans, having equal claim to global collective goods	**Immediately** allocated in **proportion to population shares**
Per capita convergence (PCC)	**Sovereignty and equality**	To **converge over time** to being **proportional to population shares**
Ability to pay (AP)	**Capability/need** — ability to bear the burdens	Inversely proportional to annual GDP per capita, with **richer countries undertaking higher emission reductions**
Greenhouse development rights (GDR)	**Responsibility/capability/need** — concept of safeguarding people's right to reach a dignified level of sustainable human development	Based on a **Responsibility-Capacity Index** that considers GDP per capita and income distribution measures

Source: van den Berg, et al. 2020

LAM's CO_2 pathways under different burden-sharing schemes



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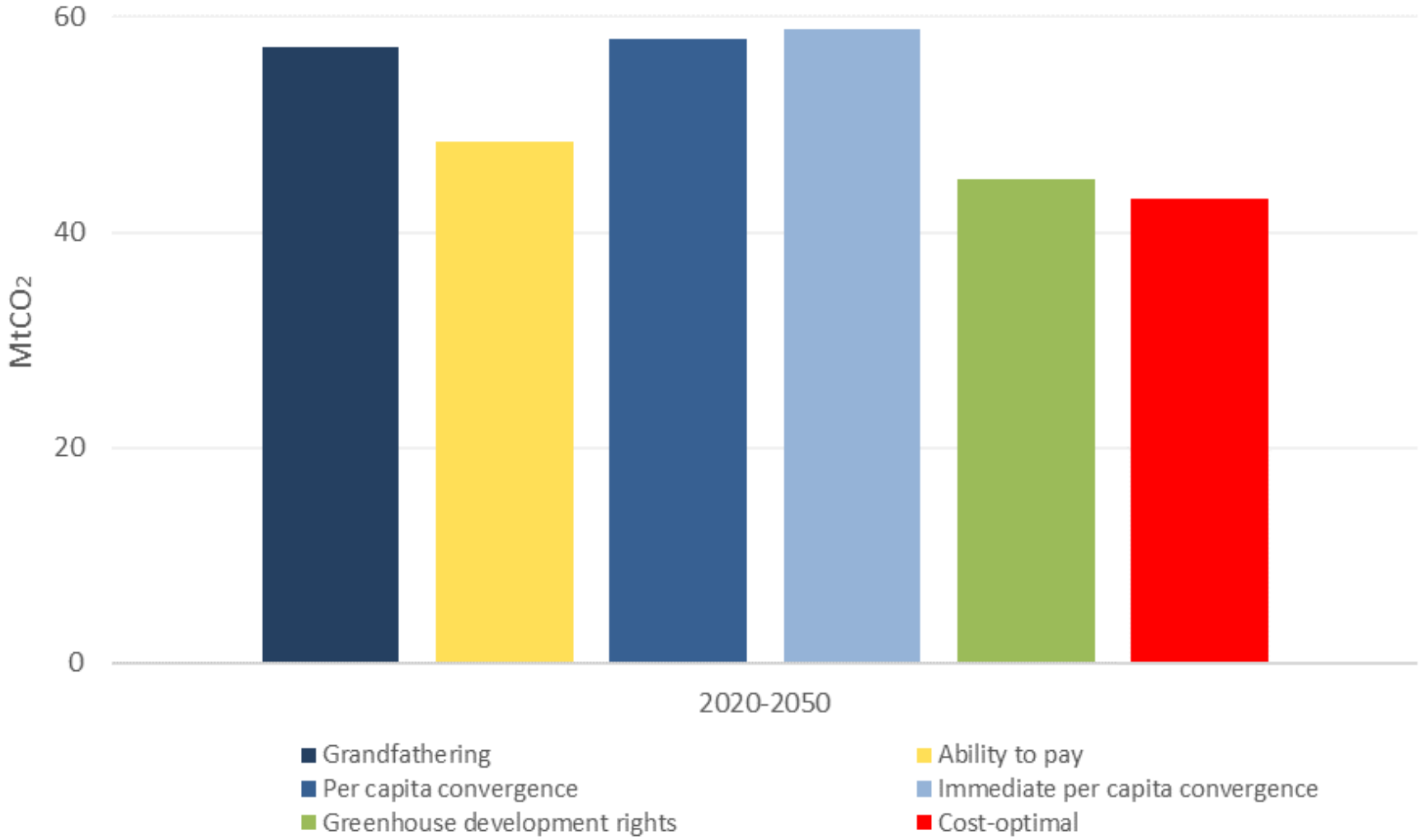
LAM's carbon budgets under different burden-sharing schemes



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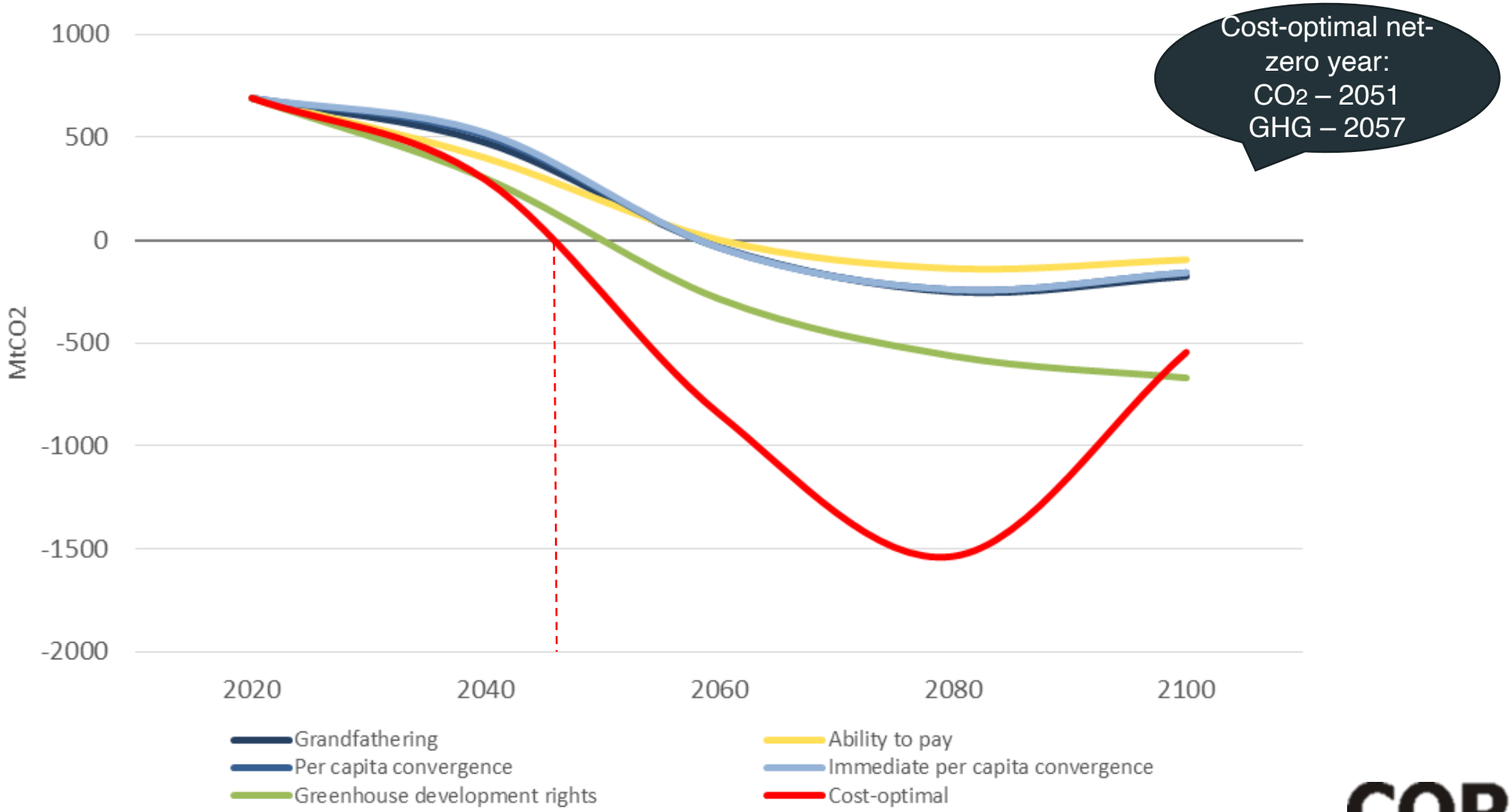
Brazil's CO_2 pathways under different burden-sharing schemes



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What can we conclude from all of this?

We are open for discussions!

Thank you!

Cenergia team

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