

Employment effects in Energy transitions

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IAMC

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Why study employment in energy transitions?

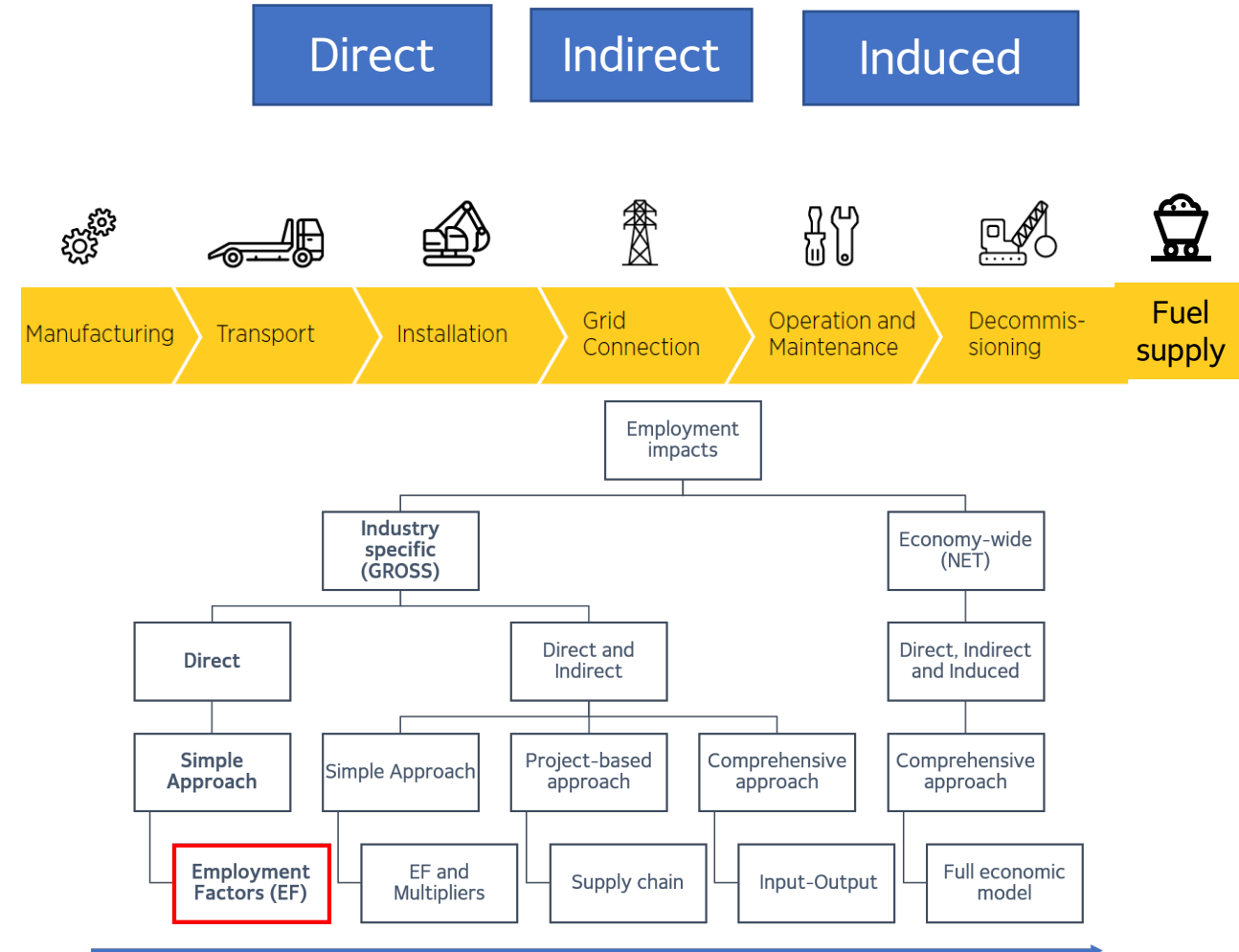
8 DECENT WORK AND
ECONOMIC GROWTH



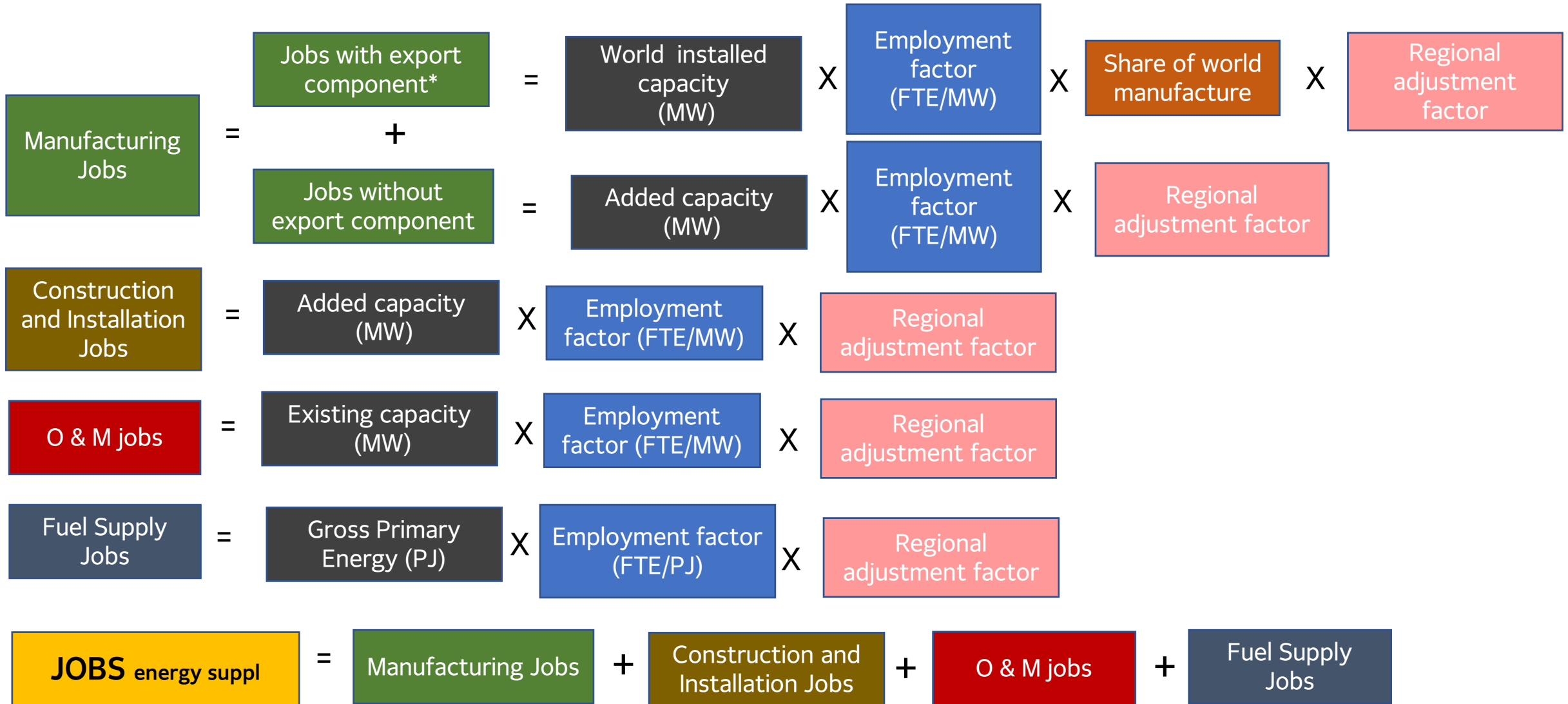
- Employment important criteria for general well-being and part of SDG 8.
- As part of political economy of energy transition
 - Lobbyism – auto industry
 - Political economy of coal with focus on “just transition”
- Quantify growth and skill of labour required for energy transition
- Examples
 - Employment implications addressed in European Commission clean energy package.
 - the German coal-exit included economic compensation to losing companies and their employees.

This work focuses on -

- Only direct jobs – *related to core industry* in the energy supply sector.
- Across the value chain, divided into Manufacturing, Construction and Installation (CI), Operation and Maintenance (O & M), and Fuel supply/Extraction.
- Uses an updated employment factor approach, ex –post on REMIND scenarios



Employment factor approach



* Only includes solar pv and wind

Based on Rutovitz et al., 2015⁴

Scope

What is covered?

Coal

Gas

Oil

Biomass


Nuclear

Solar PV

Wind

Hydro

Solar CSP



Divided into *solar pv rooftop and utility, wind onshore and offshore* and *small and large hydro* through an **external share parameter**.

What is not covered?

- Transmission and distribution
- Battery-storage
- Decommissioning
- Coal, oil, gas jobs do not include refining, transportation, and distribution.
- Jobs in heat industry
- Energy-efficiency jobs

Scenario setup

Policy scenarios

Scenario name	Scenario description
NDC	Reaching NDC targets in 2030 via iteratively adjusted carbon prices, assuming gradual convergence at average prices thereafter.
Pol	Constraint in carbon budget (900 GtCO ₂) from 2011-peak of CO ₂ emissions. ~ 66% chance below 1.5°C end of century

Employment Factor scenarios– post processing assumptions

Labour productivity	Capital costs	Name	Description
Inverse of GDP/capita	Static	Only LP	EF evolution depends upon Improvements in labour productivity only
static	Capcosts	Only capcosts	EF evolution depends upon decline factors based on capital costs
Inverse of GDP/capita	Capcosts	Both LP and capcosts	Both improvements in LP and decrease in capital costs

Employment factors evolvement

Labour productivity (LP) – shifts in methods of production
Capital costs – maturity of technology, economies of scale

~ GDP per capita

Only capcosts

$$\text{Employment factor}_{T, \text{Region}, \text{tech}} = \text{Employment factor}_{2020, \text{Region}, \text{tech}} \times \text{Relative capital costs}_{T, \text{Region}, \text{tech}}$$

Regionally differentiated capital costs.
Employment factors for extraction sector
(except coal remain static)

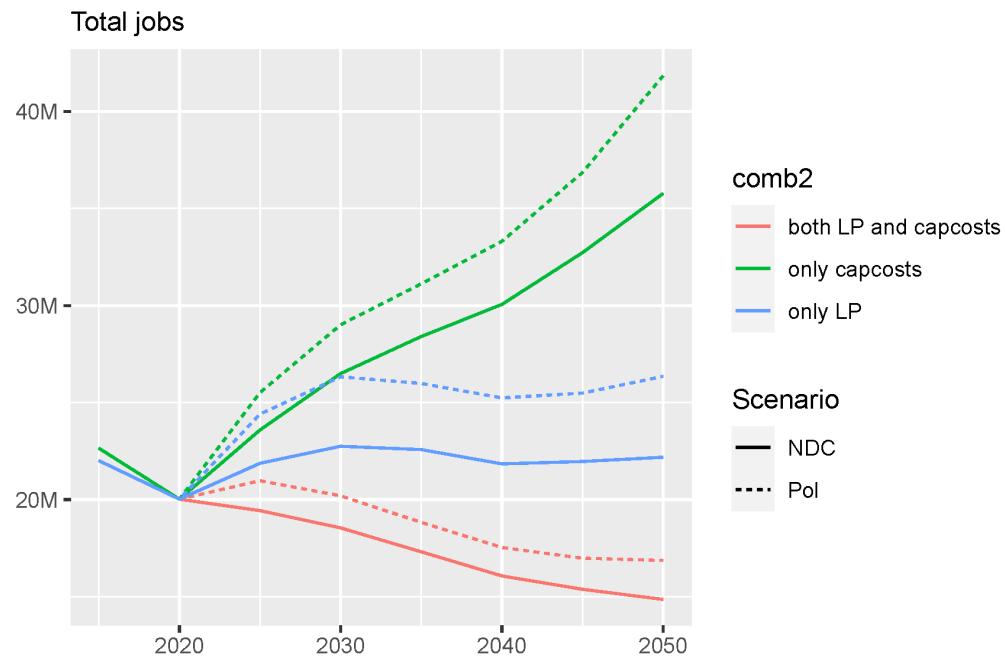
Only LP

$$\text{Employment factor}_{T, \text{Region}} = \text{Employment factor}_{2020, \text{tech}} \times \text{Relative (inverse of) GDP per capita}_{T, \text{region}}$$

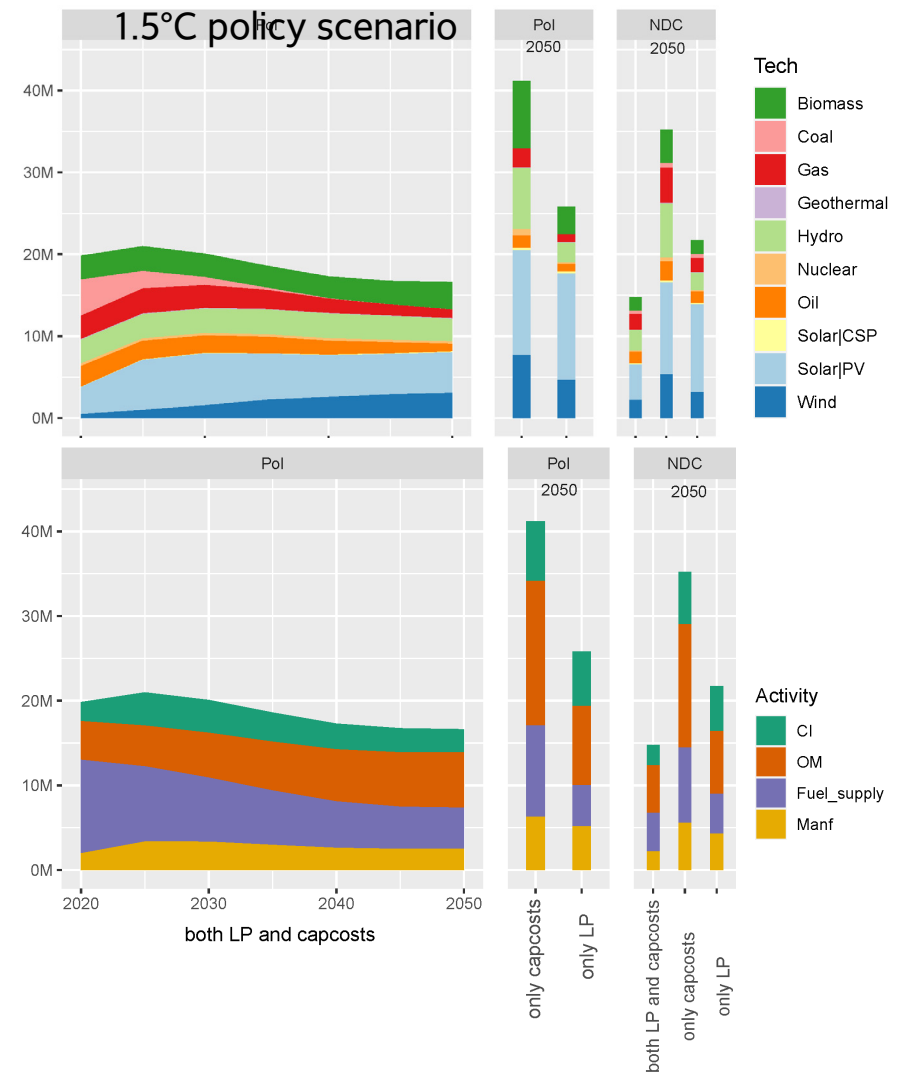
Both LP and capcosts

$$\text{Employment factor}_{T, \text{Region}, \text{tech}} = \text{Employment factor}_{2020, \text{Region}, \text{tech}} \times \text{Relative capital costs}_{T, \text{Region}, \text{tech}} \times \text{Relative (inverse of) GDP per capita}_{T, \text{region}}$$

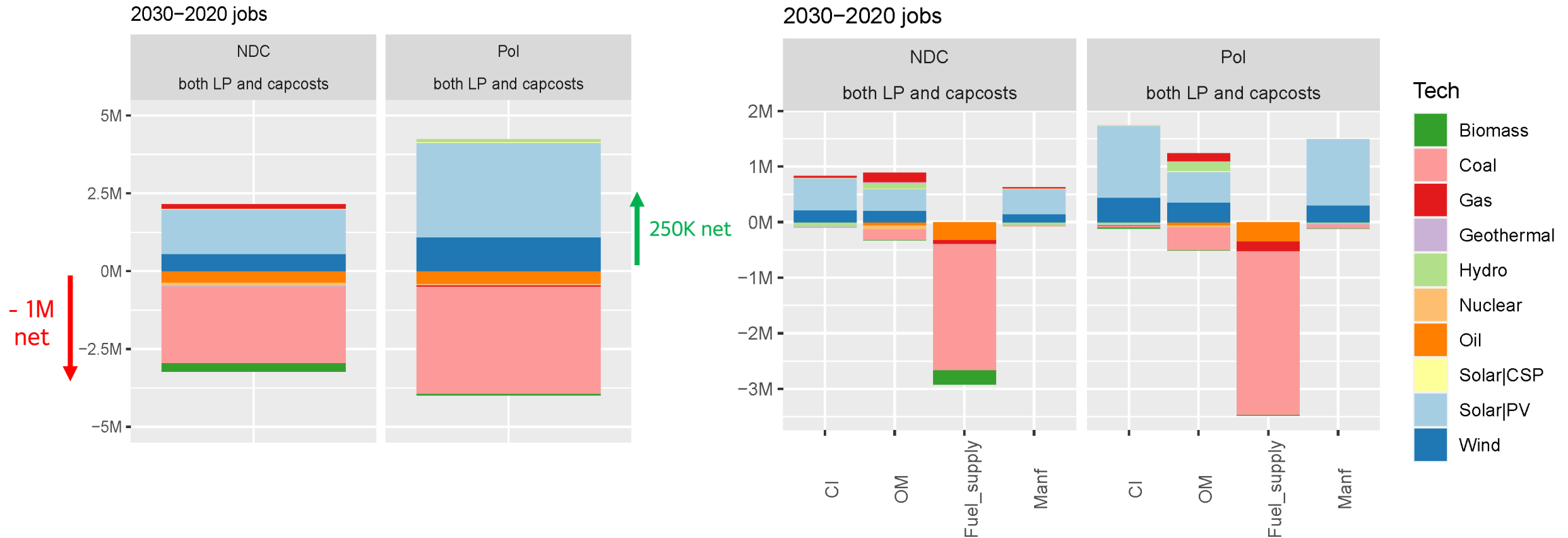
1. Improvements in labour productivity and shifting means of production lead to decrease in energy jobs in 2050. Renewables dominate total jobs (75-90%) led by solar and wind; O & M becomes major employing activity (40%), replacing extraction.



Higher total job number in 1.5°C Policy scenario compared to NDC



2. In near-term, only under a 1.5°C scenario do job increases in RE compensate job losses in the fossil fuel sector. Losses in the fossil sector are mainly from coal extraction (80-85%), while gains are mainly from CI and Manufacturing activities in solar and wind (~90%).

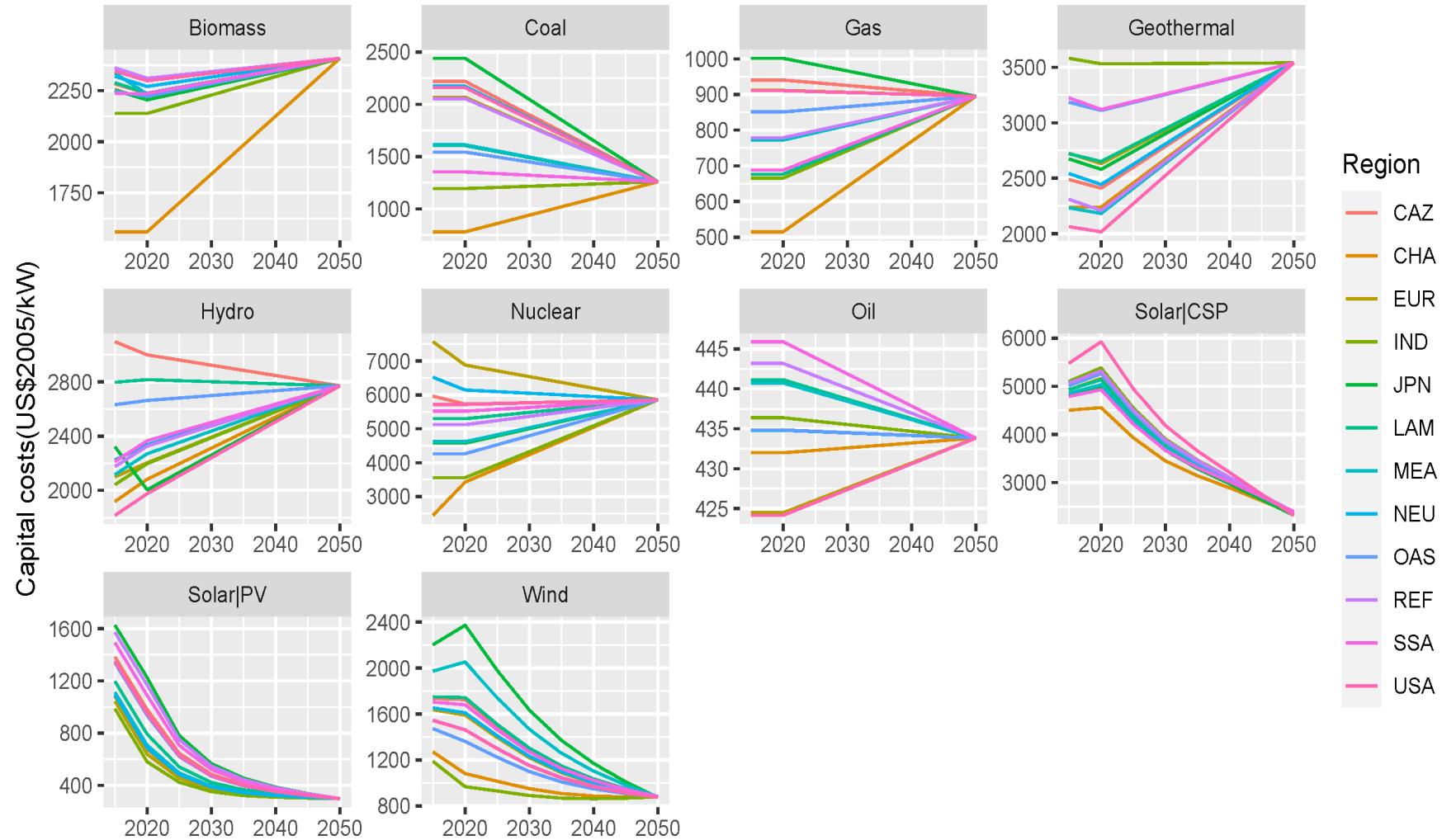


Conclusions

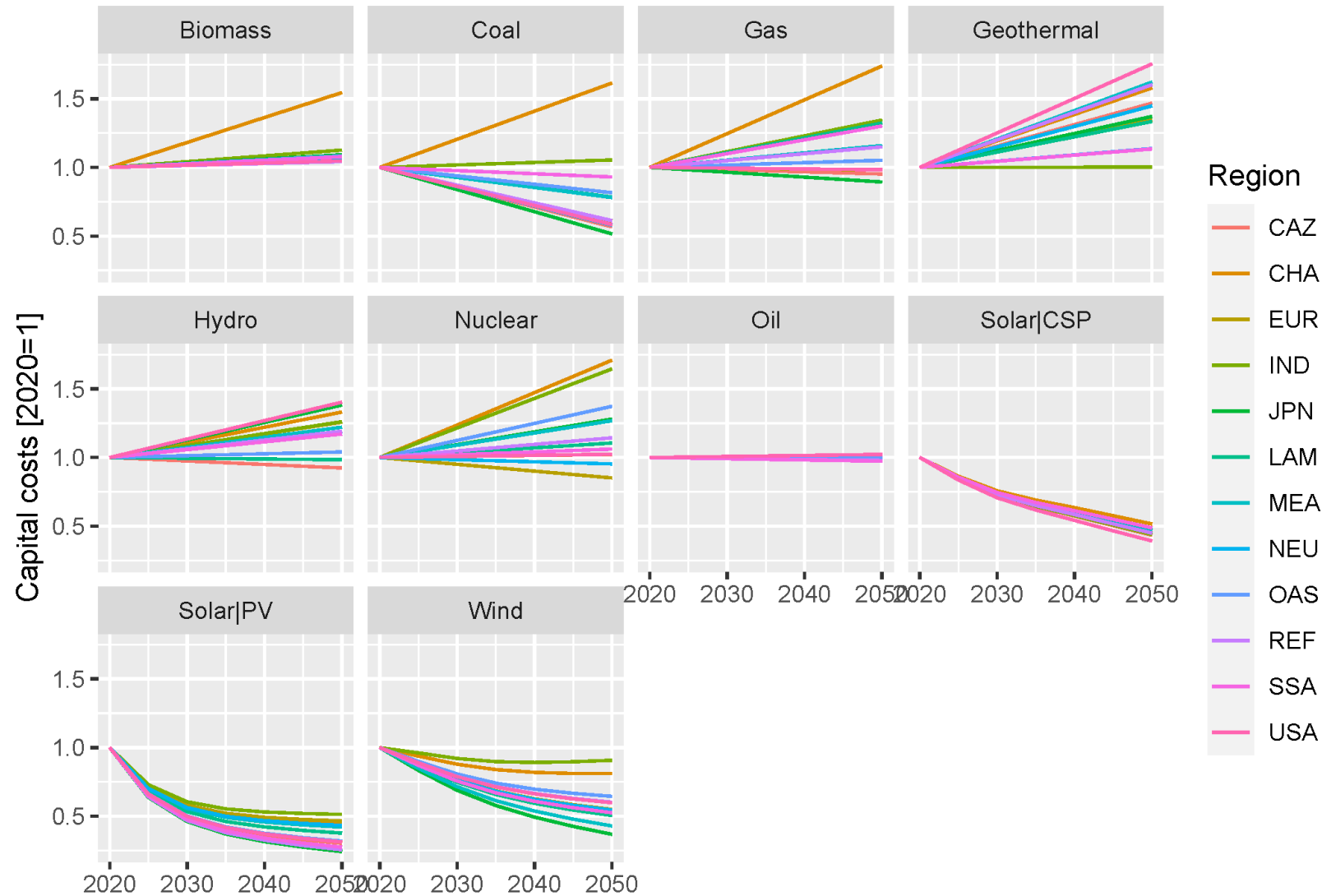
- Analysis shows that assumption on how employment factors evolve are critical to future job-estimates, and this might have important implications for policy making.
- Under very plausible assumptions that employment factors decrease with both labour productivity improvements and capital costs reductions, total energy supply jobs decrease for both NDC and 1.5°C cases (caveat – some technology types not included).
- Stable O & M jobs in solar and wind become increasingly important over time, reaching ~40% in 2050.
- In the near-term, although job losses in the 1.5C scenario are higher in policy compared to NDC, the gains in CI and Manufacturing jobs in solar and wind compensate these losses.

Questions?
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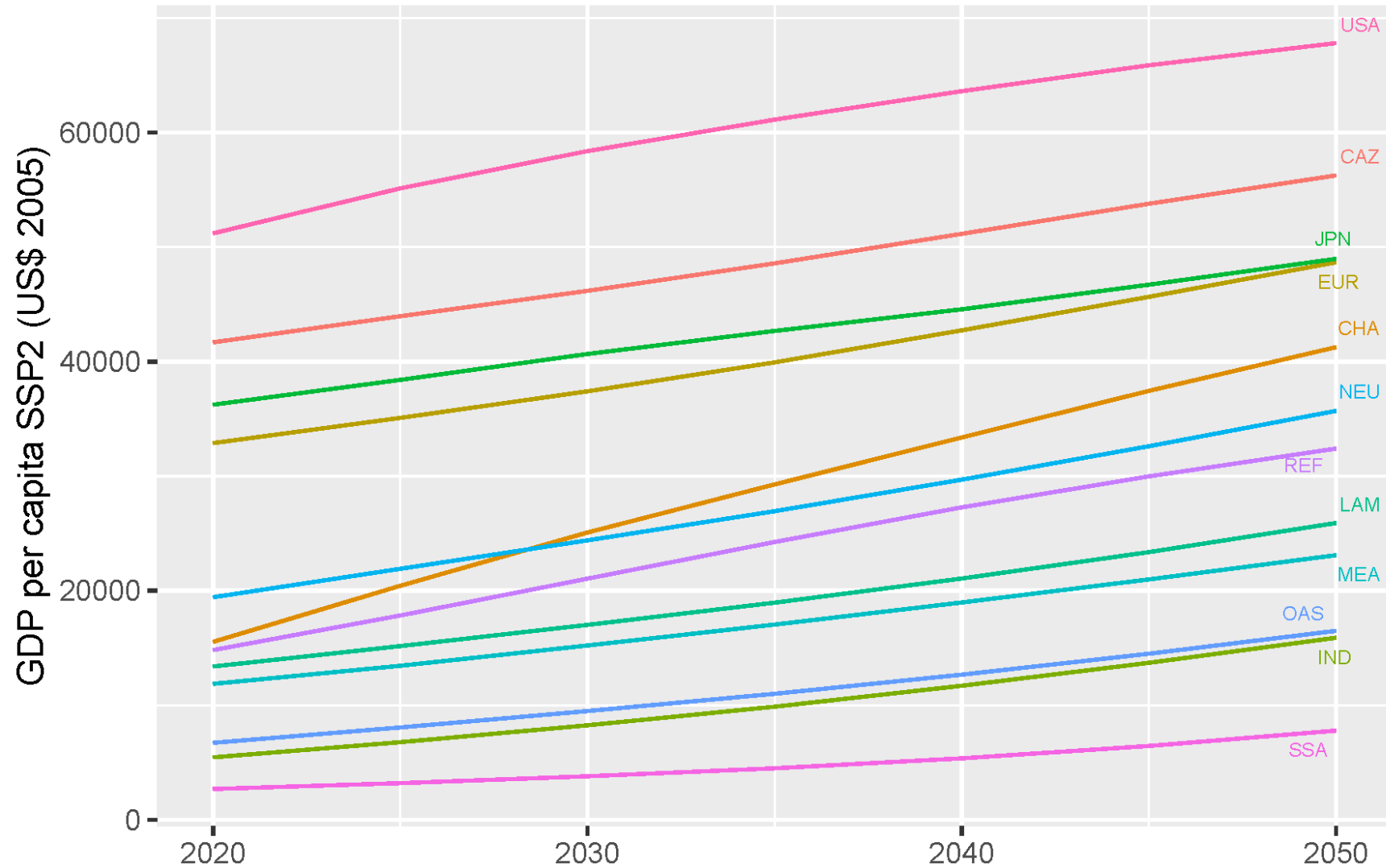
Capital costs - absolute



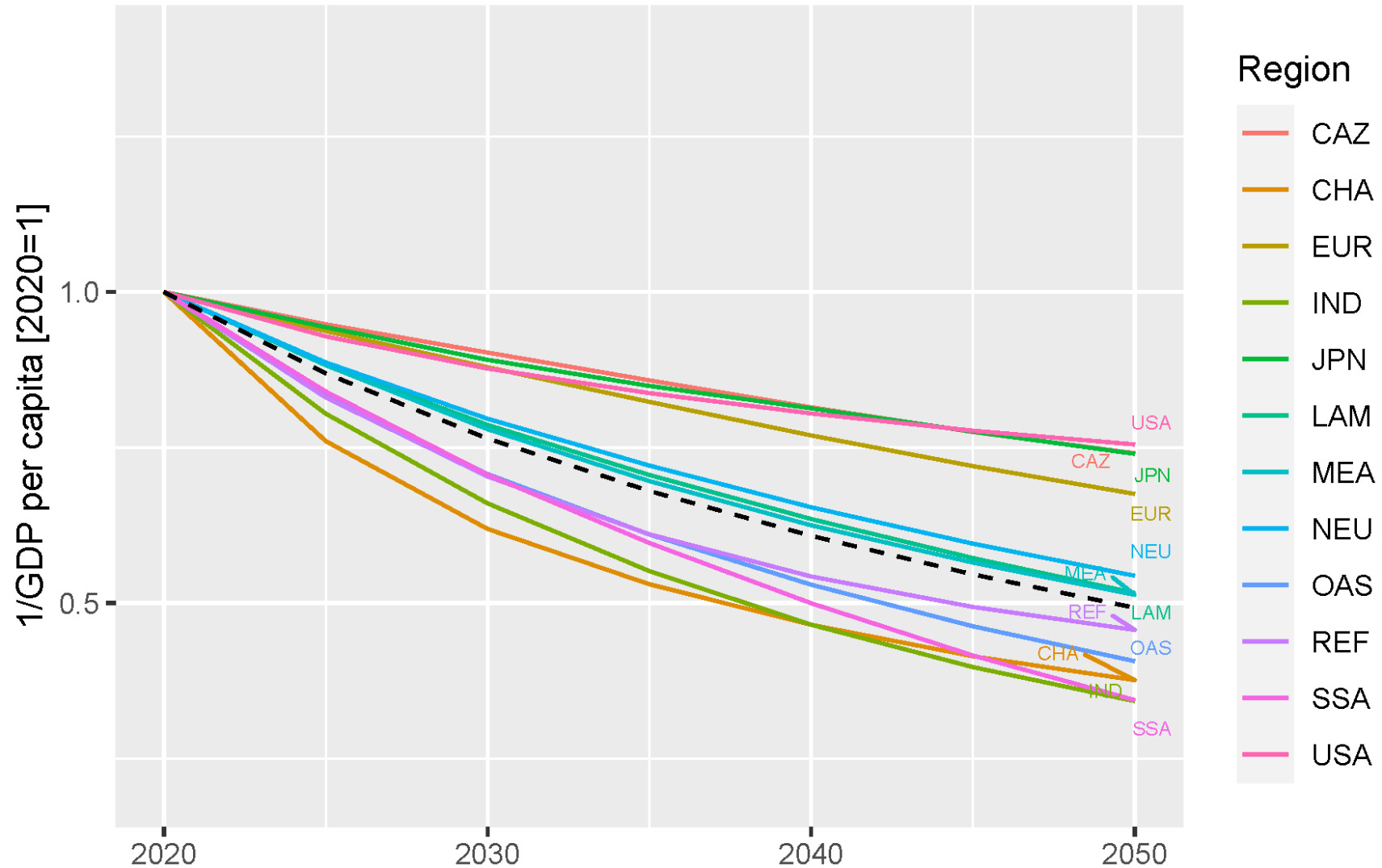
Capital costs - relative

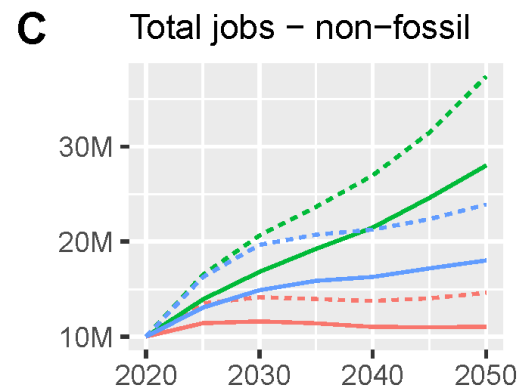
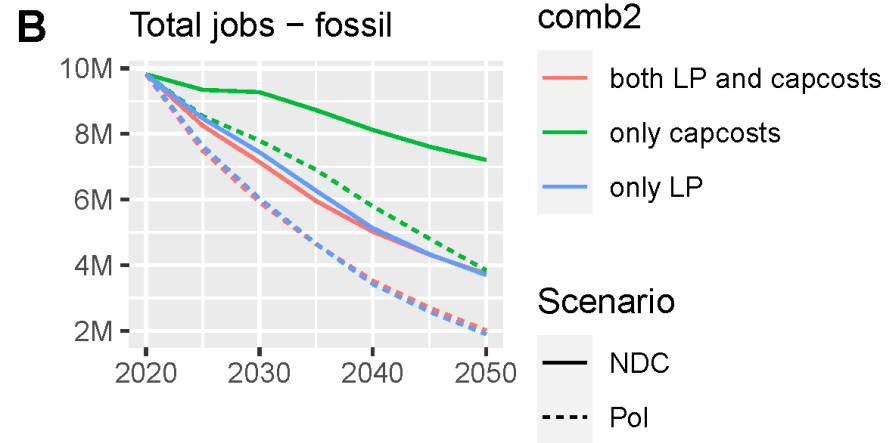
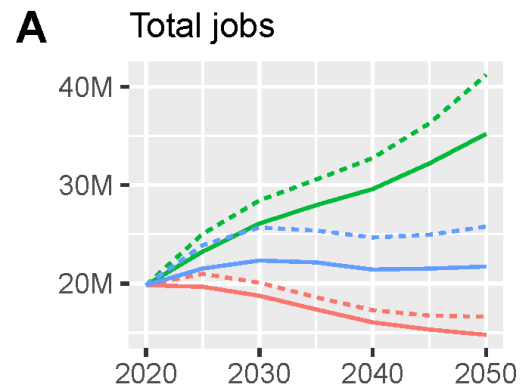


GDP per capita - absolute



Inverse of GDP per capita - relative

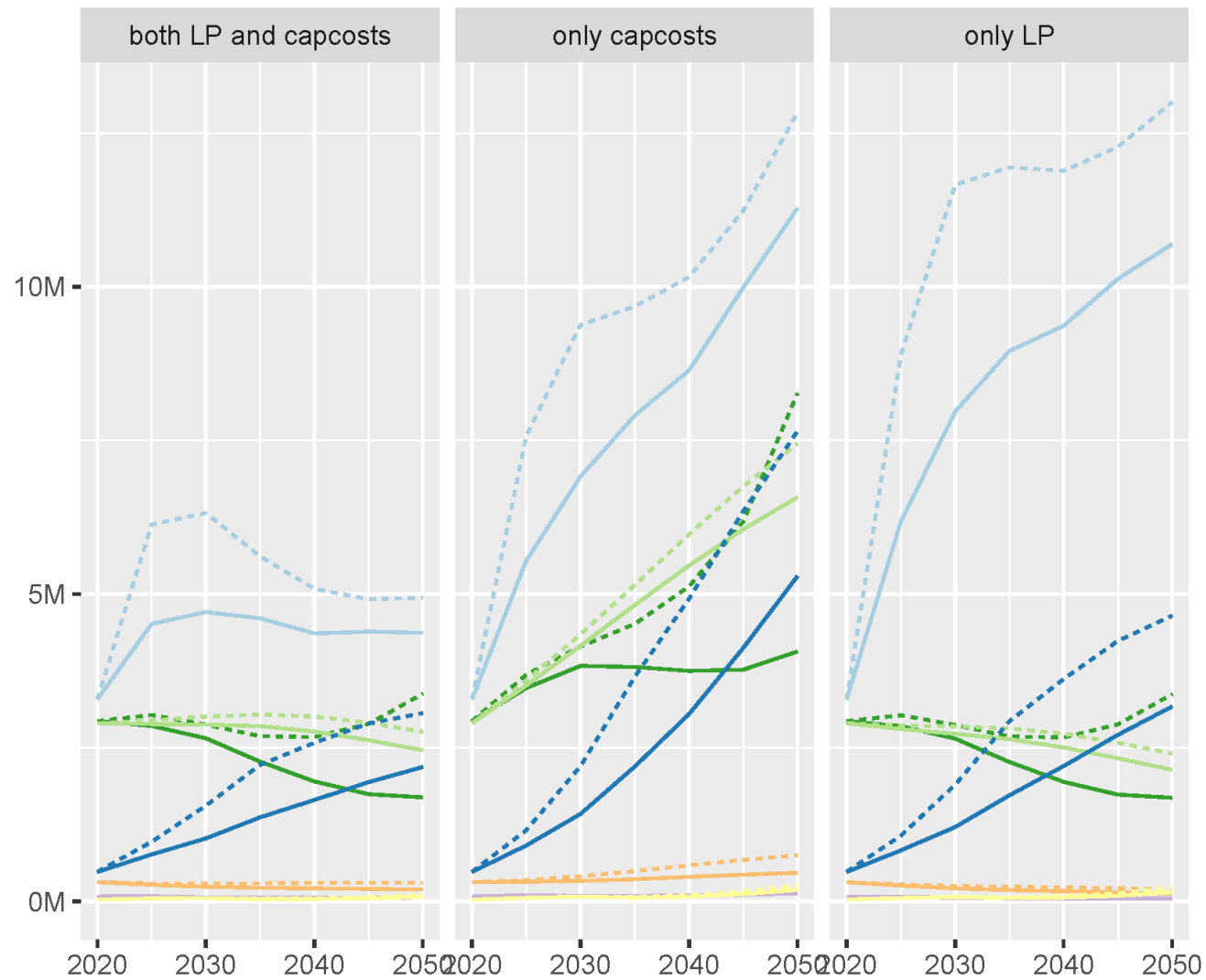




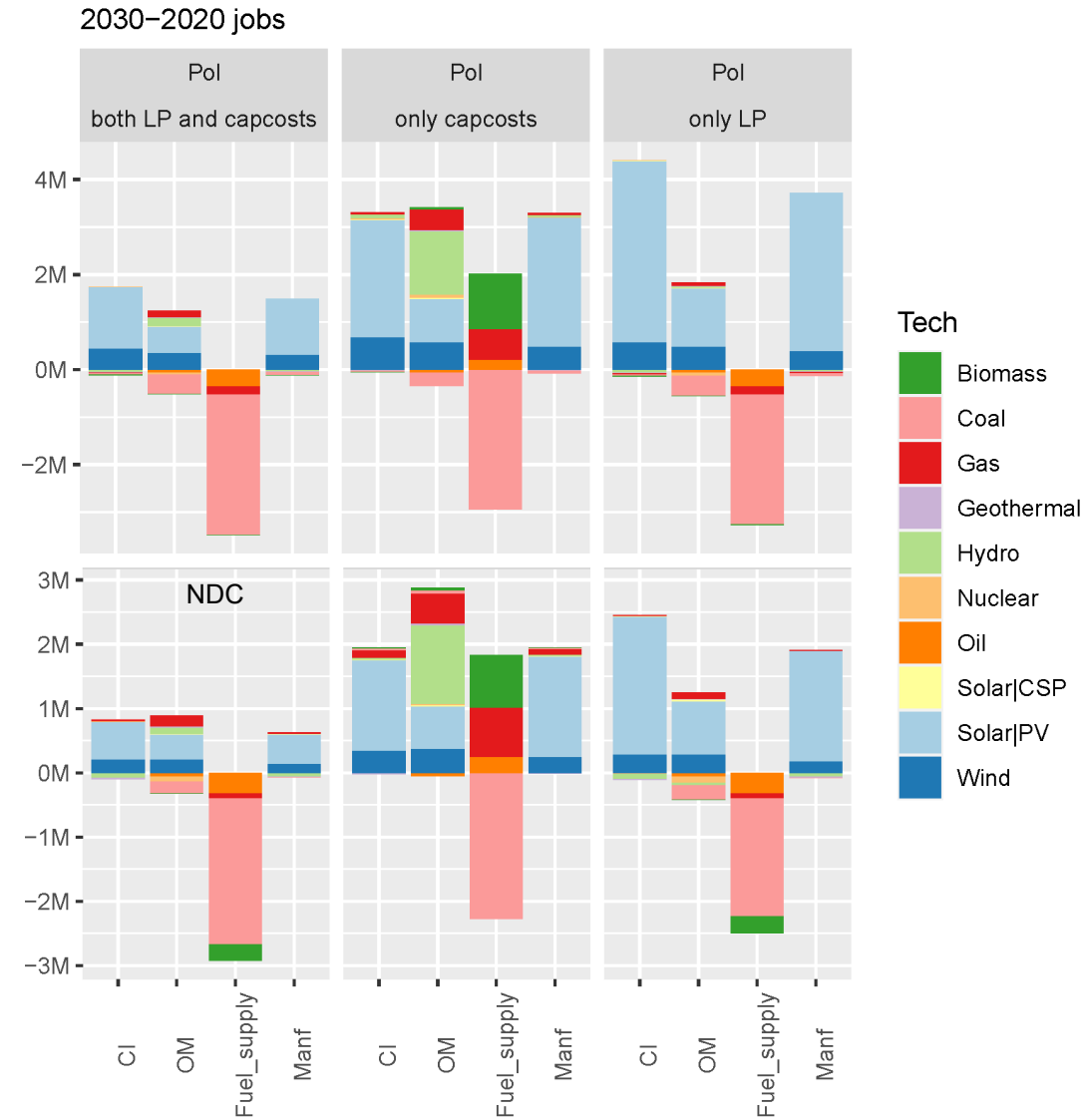
Total jobs – fossil



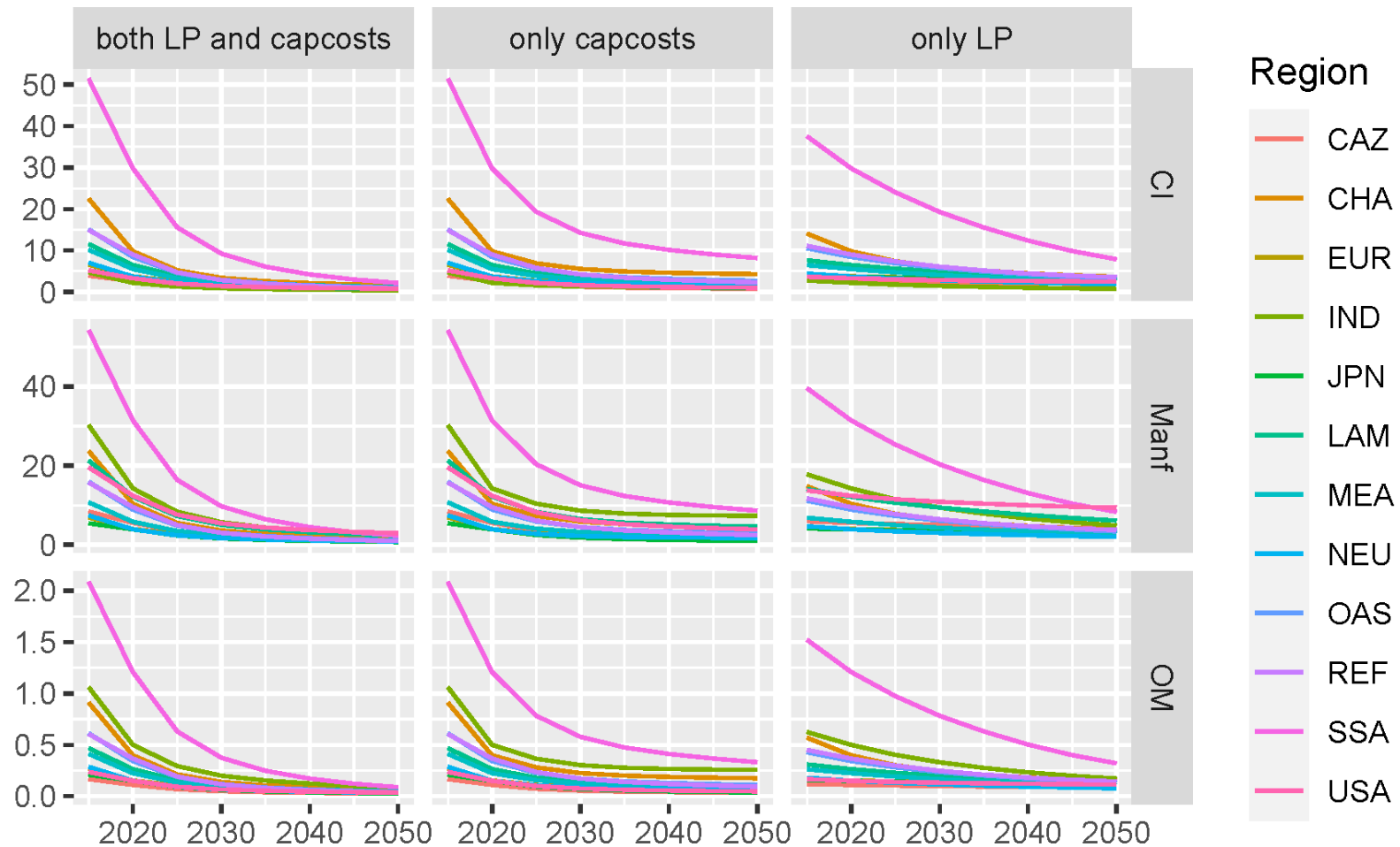
Total jobs – non fossil



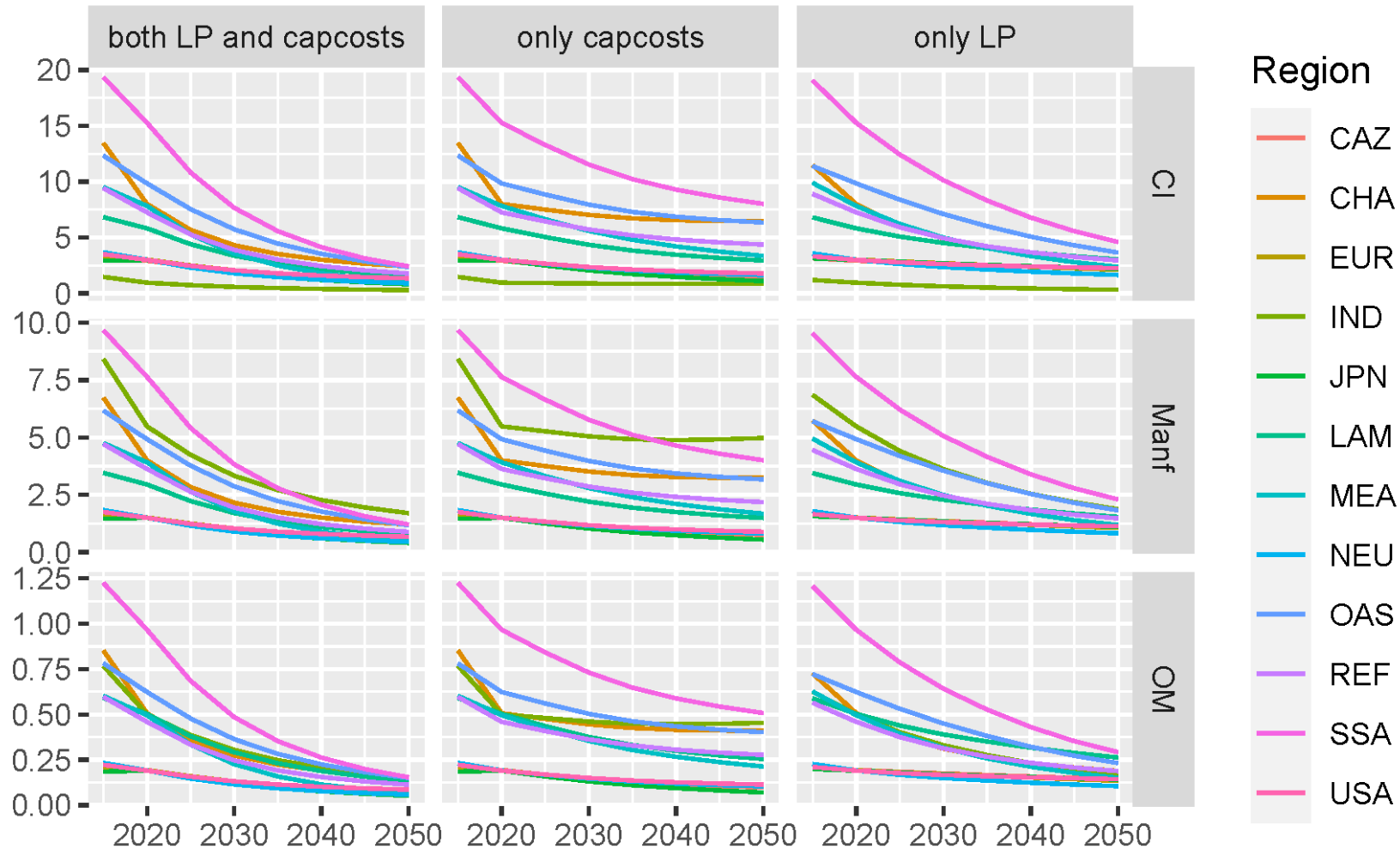
2030-2020 jobs



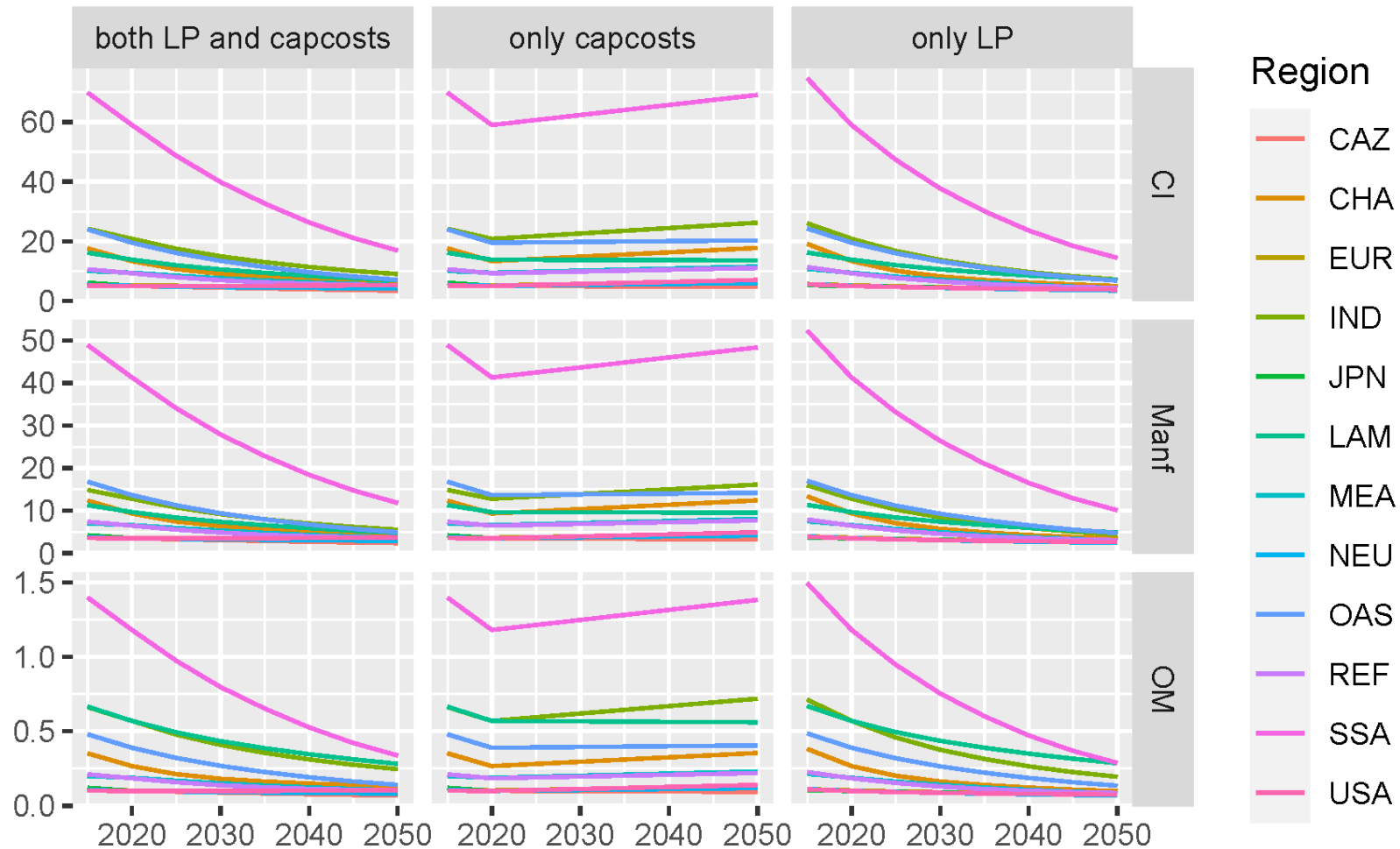
Employment factors – solar pv (FTE/MW)



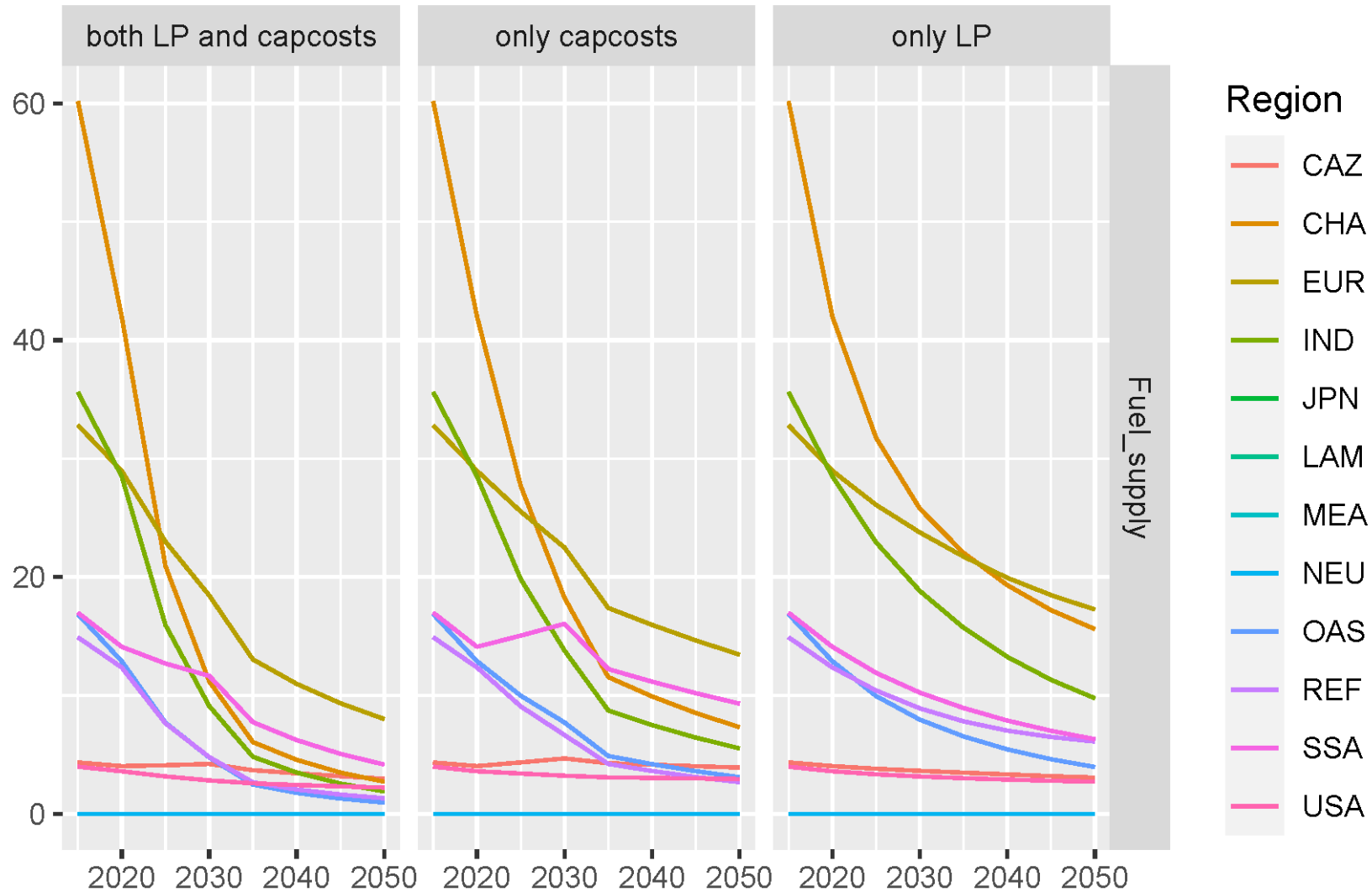
Employment factors – wind (FTE/MW)



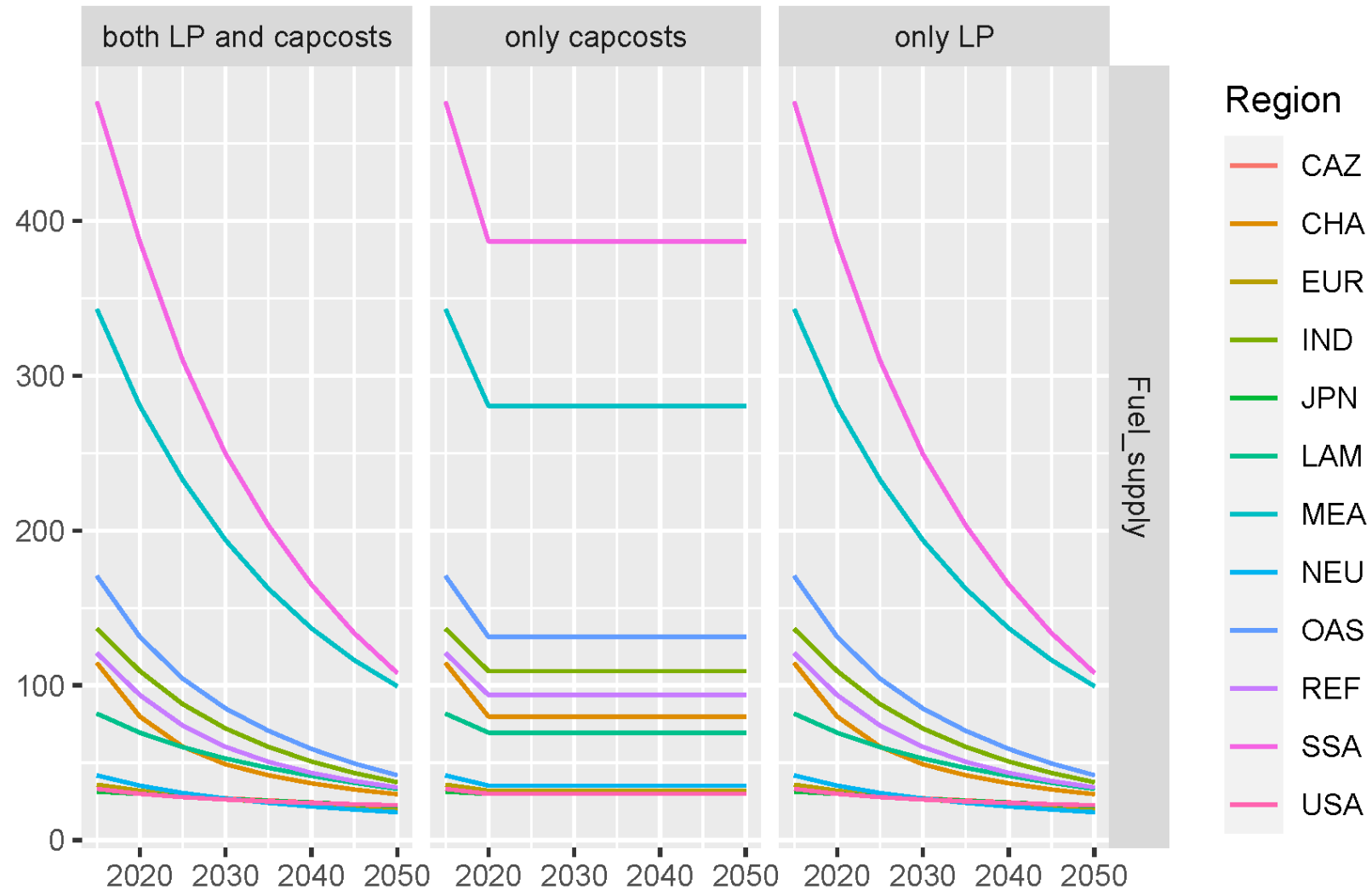
Employment factors – hydro (FTE/MW)



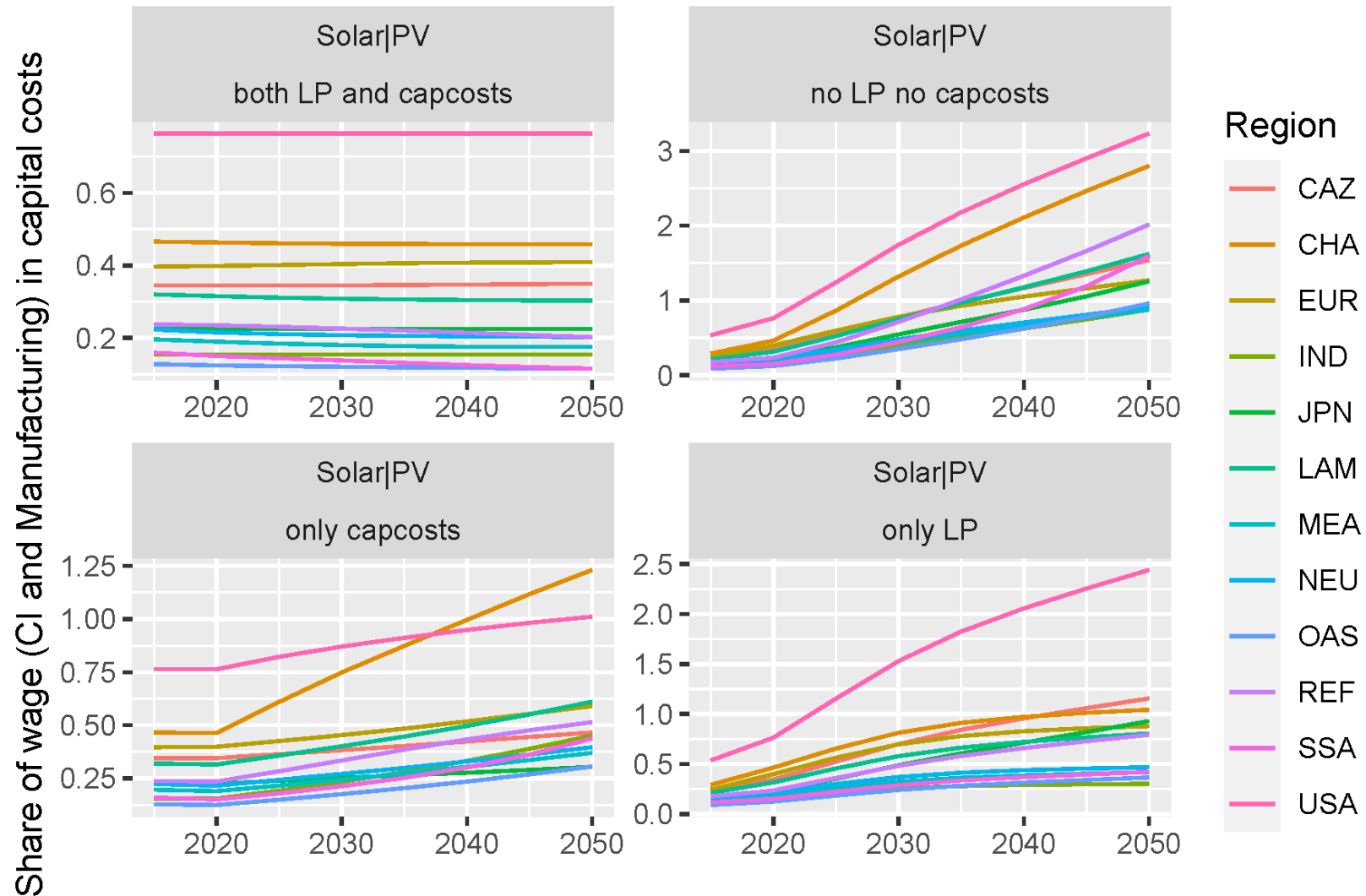
Employment factors – coal (FTE/PJ)



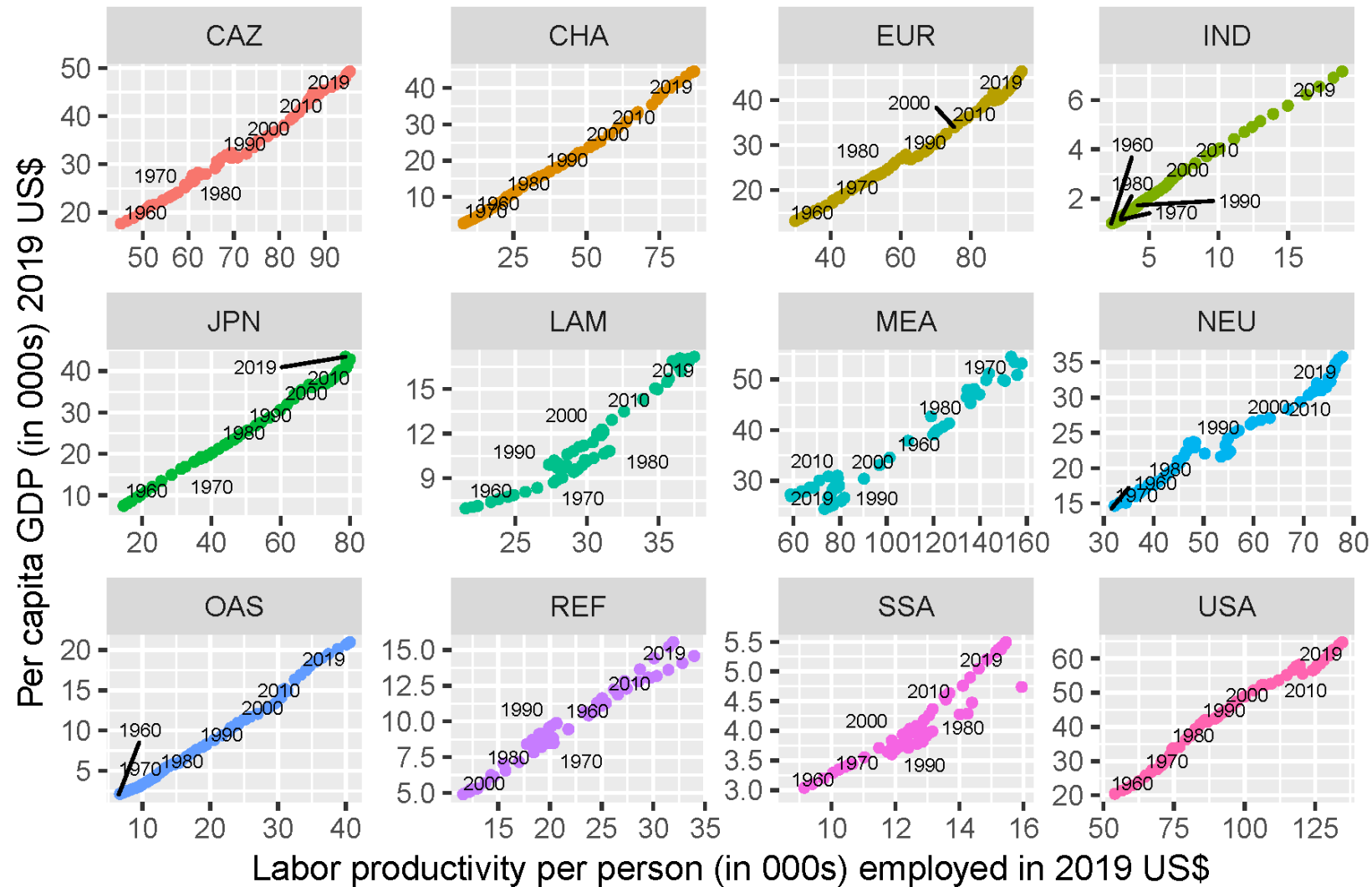
Employment factors – Biomass (FTE/PJ)



Wage share – solar PV



GDP per capita and LP



Main model parameters - I








Employment factors

- Expressed as Jobs/MW, Jobs/PJ
- Per region and activity
- Data from literature (grey and peer-reviewed) and personal communication

Added Capacity/Installed Capacity/Gross Primary Energy

- Result from a REMIND run /any other energy model/IAM.
- Per region and technology/fuel

Main model parameters - II

- **Share of *subtechs***  
 - represents share of sub-technologies (not included in REMIND). E.g., solar rooftop, wind offshore
- **Capital costs** 
 - Represents the maturation of technologies – learning rate
- **Share of world export**  
 - represents share of world production (only for pv and wind)
- **Labour productivity**  
 - Represents differing labour productivity in the world

For all factors, assumptions also on how they evolve with time!