Employment effects of Energy transition

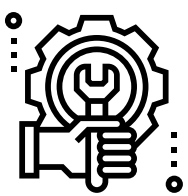
Why study employment in energy transitions?

- Employment important criteria for general well-being.
- Political Economy of energy transition with focus on “just transition”
  - Lobbyism – auto industry
  - Political economy of coal
- Quantify growth and skill of labour required for energy transition
- Examples
  - Employment implications of renewable expansion have been addressed in European Commission clean energy package (legislation of the Paris Agreement), the
  - preservation of coal jobs served in President Trump’s election mandate, and recently,
  - the German coal-exit included economic compensation to losing companies and their employees.

Types of employment

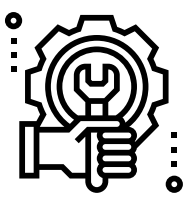
Direct

Jobs related to core activities. E.g., specialty contractors, construction workers, clean-up crews, truck drivers



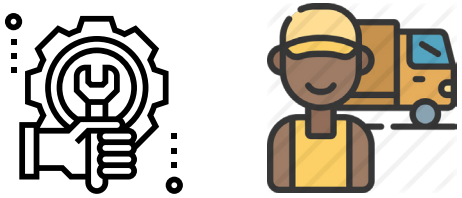
Types of employment

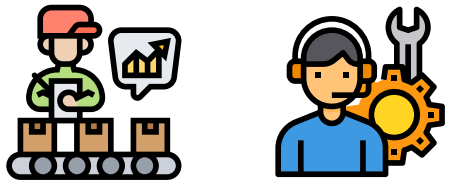
Direct	Indirect
Jobs related to core activities. E.g., specialty contractors, construction workers, clean-up crews, truck drivers	Extraction and processing of raw materials, e.g., copper and steel, marketing and selling, consultancy, R & D.

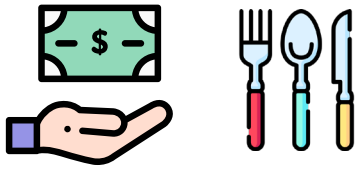


Types of employment

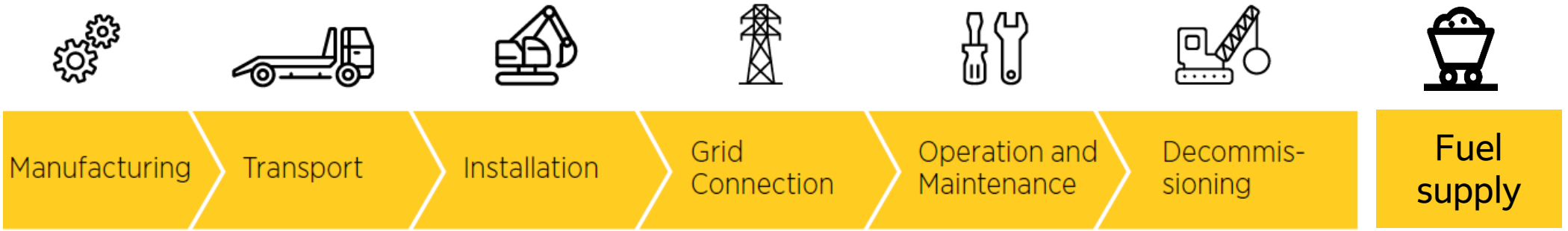
Direct	Indirect	Induced
Jobs related to core activities. E.g., specialty contractors, construction workers, clean-up crews, truck drivers	Extraction and processing of raw materials, e.g., copper and steel, marketing and selling, consultancy, R & D.	Jobs arising from the economic activities of direct and indirect employees.







Technology value chain



Adapted from IRENA (2013)
Icons designed by Freepik

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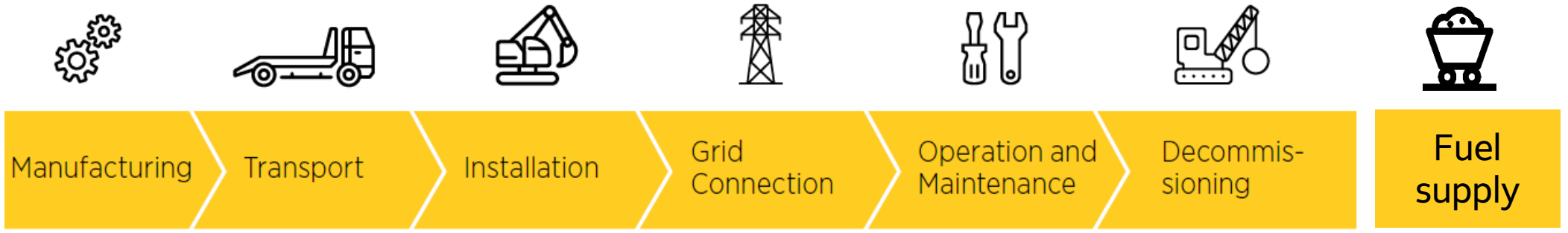


Manufacturing

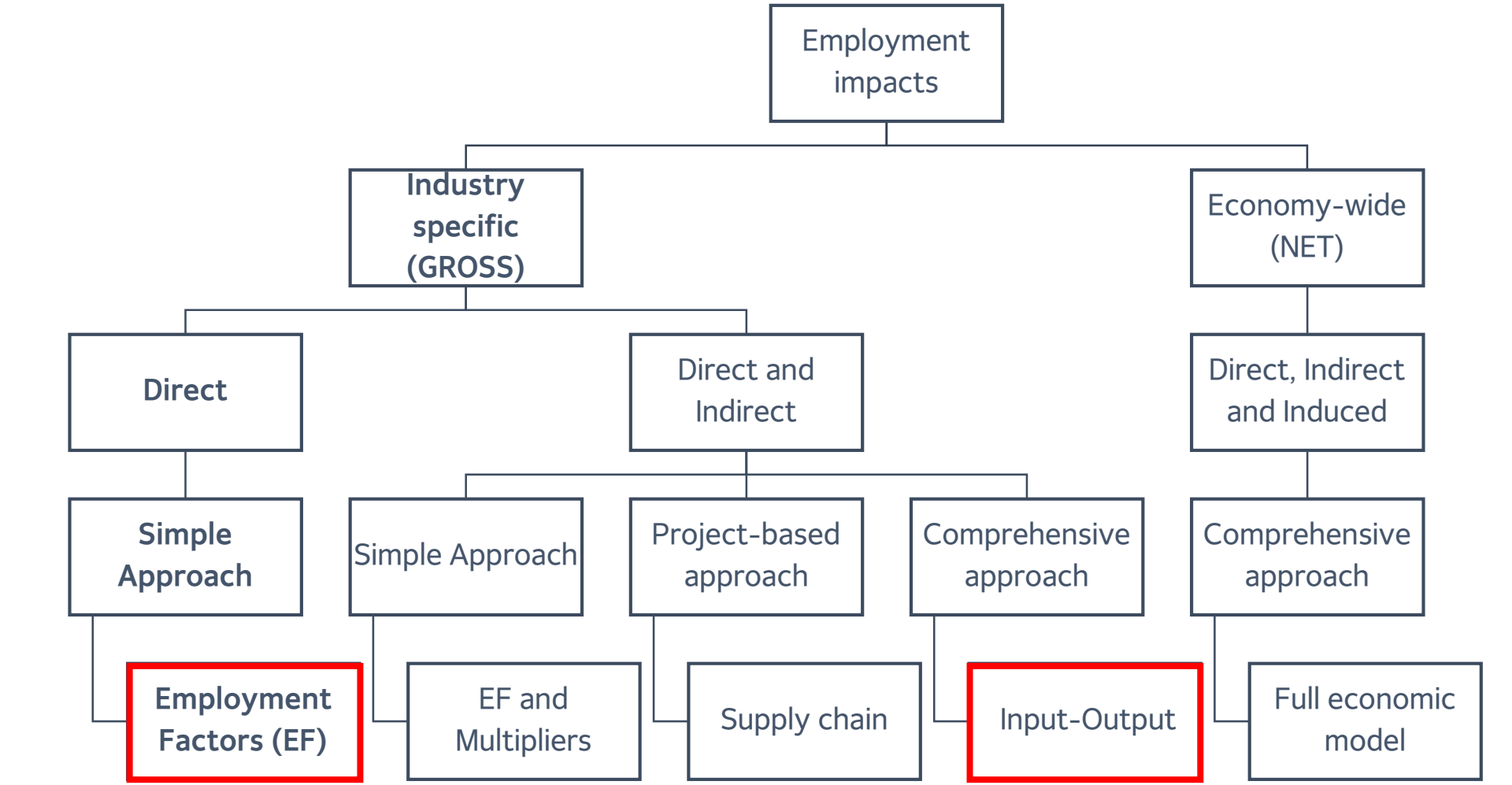
Construction and Installation (CI)

O & M

Decommissioning

Adapted from IRENA (2013)
Icons designed by Freepik

Methodology – employment in energy scenarios



Source: IRENA elaboration, adapted from Breitschopf, Nathani, and Resch (2012)

	Employment factor	Input-Output
Scope	Measures only direct jobs	Can measure both direct and indirect jobs, and with some additional work, also induced employment
Methodology	Relatively simple and transparent method, using data on employment factors, operating and installed capacity etc.	Needs to extend classical economic sectors into new sectors for each RE technology.
Limitations	Few empirical studies on calculating employment factors (e.g. Jobs/MW), most focused in OECD	Tables not available for many developing countries Assume structure of economy will remain constant. Needs additional data on wages .

Employment factor approach

* Only includes solar pv and wind

Based on Rutovitz et al., 2015

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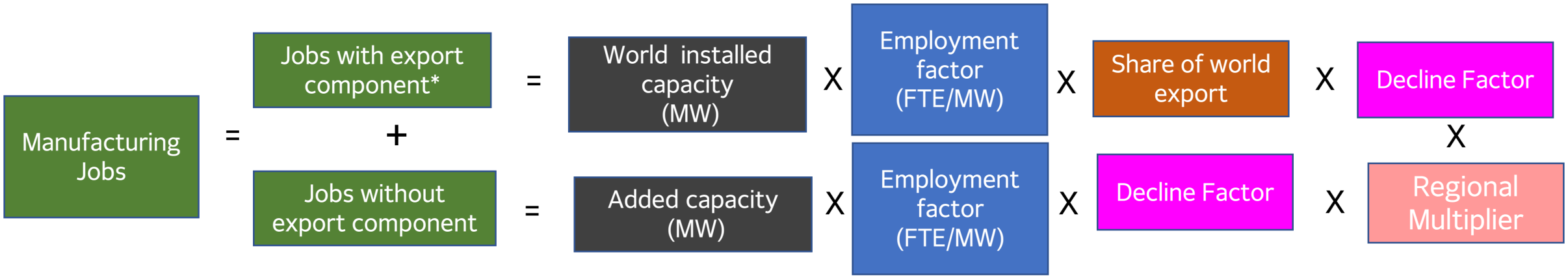

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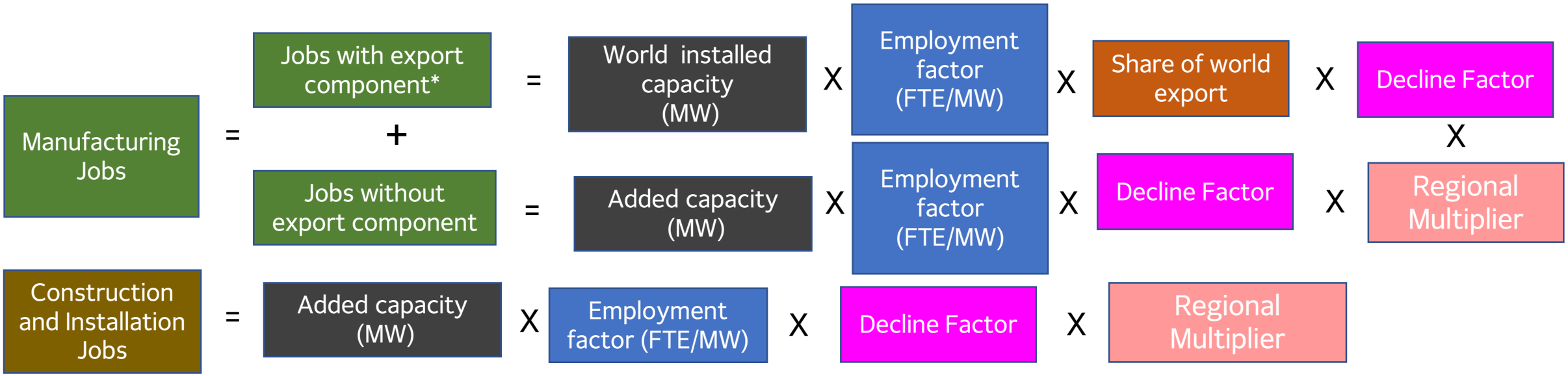

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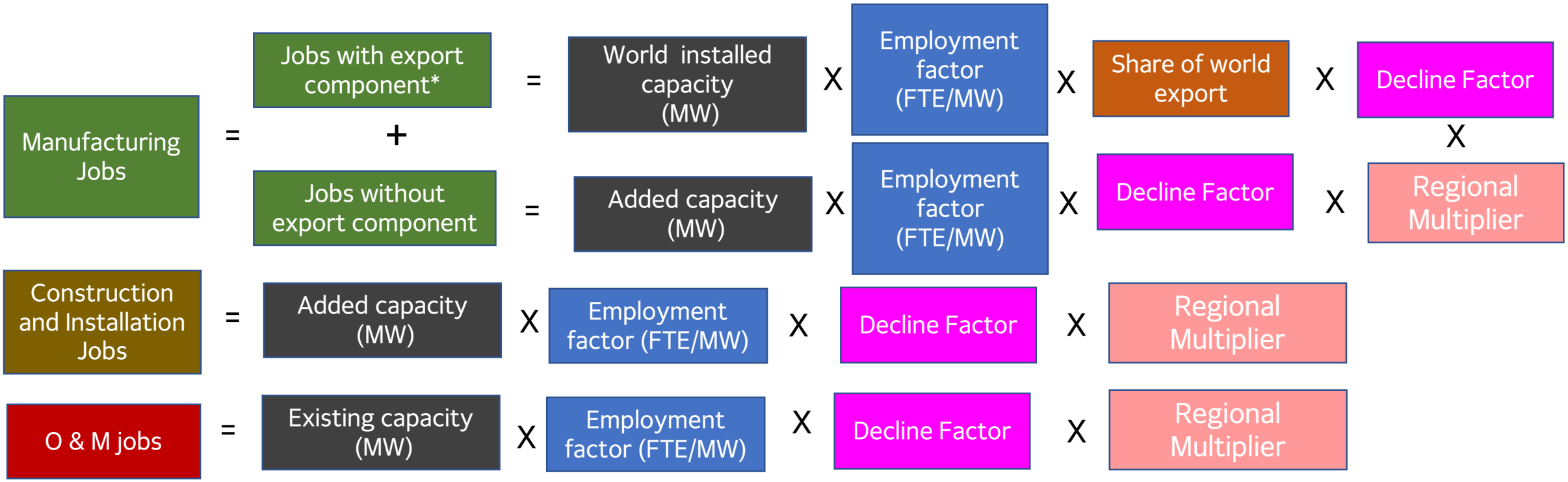
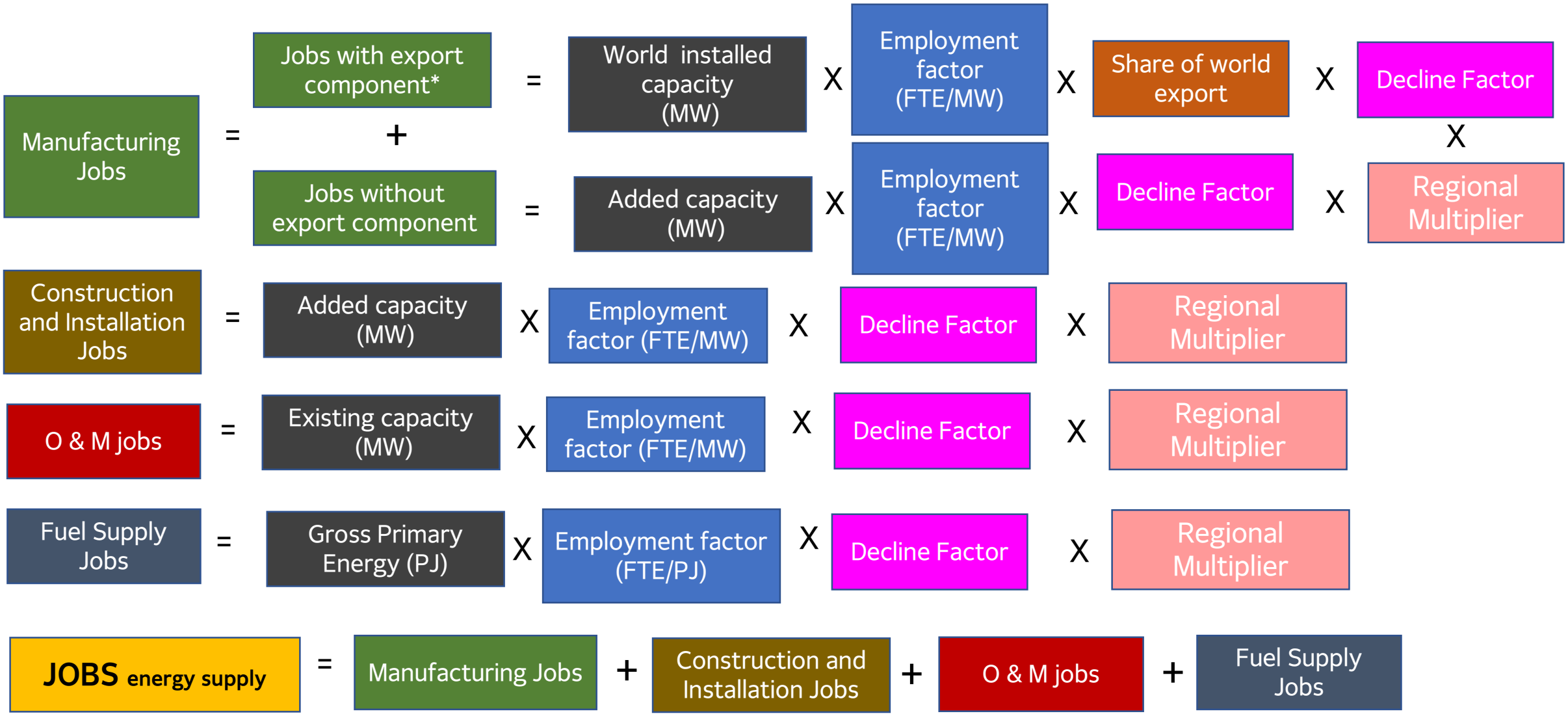


JOBS energy supply = Manufacturing Jobs + Construction and Installation Jobs + O & M jobs + Fuel Supply Jobs

* Only includes solar pv and wind

Based on Rutovitz et al., 2015

Employment factor approach



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Based on Rutovitz et al., 2015

Main model parameters - I

Main model parameters - I

Employment factors

Data from literature and personal communication

Main model parameters - I

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Added Capacity/Installed Capacity/Gross Primary Energy

Result from a REMIND run /any other energy model/IAM.

Main model parameters - II

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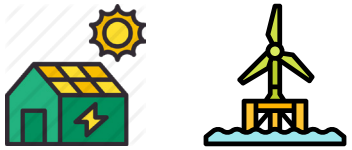
- Share of *subtechs* 
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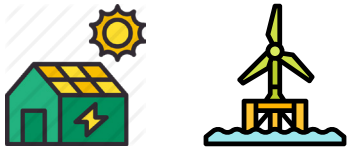
- Share of *subtechs* 
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For all factors, assumptions also on how they evolve with time!

Assumptions of parameters

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Share of subtech

Includes three technologies – Solar rooftop, wind offshore, and small hydro

Expert

Solar rooftop - Share is 30% in 2030 for solar rooftop (40% for India and Japan), which remains same until 2050.

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Small hydro – current shares remain until 2050.

Other options – **current**, **hightolow, lowtohigh, irena**

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Represents maturation of technologies

Capital costs

Employment factors decline with evolution of capital costs and fixed costs – from REMIND

Static

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Current
Current shares remain until 2050

Regional multiplier

Reflects changes in labor productivity. Usually ~ GDP/capita

Rutovitz
Slow improvements for non-OECD countries until 2030, followed by convergence to OECD-level in in 2050.

Ram
Fast improvements until 2030, followed by slow improvements until 2050 (no convergence)

Scope

Scope

What is covered?

Coal
Gas
Oil
Biomass
Nuclear
Solar PV
Wind
Hydro
Solar CSP

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Coal
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Gas
Oil
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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.

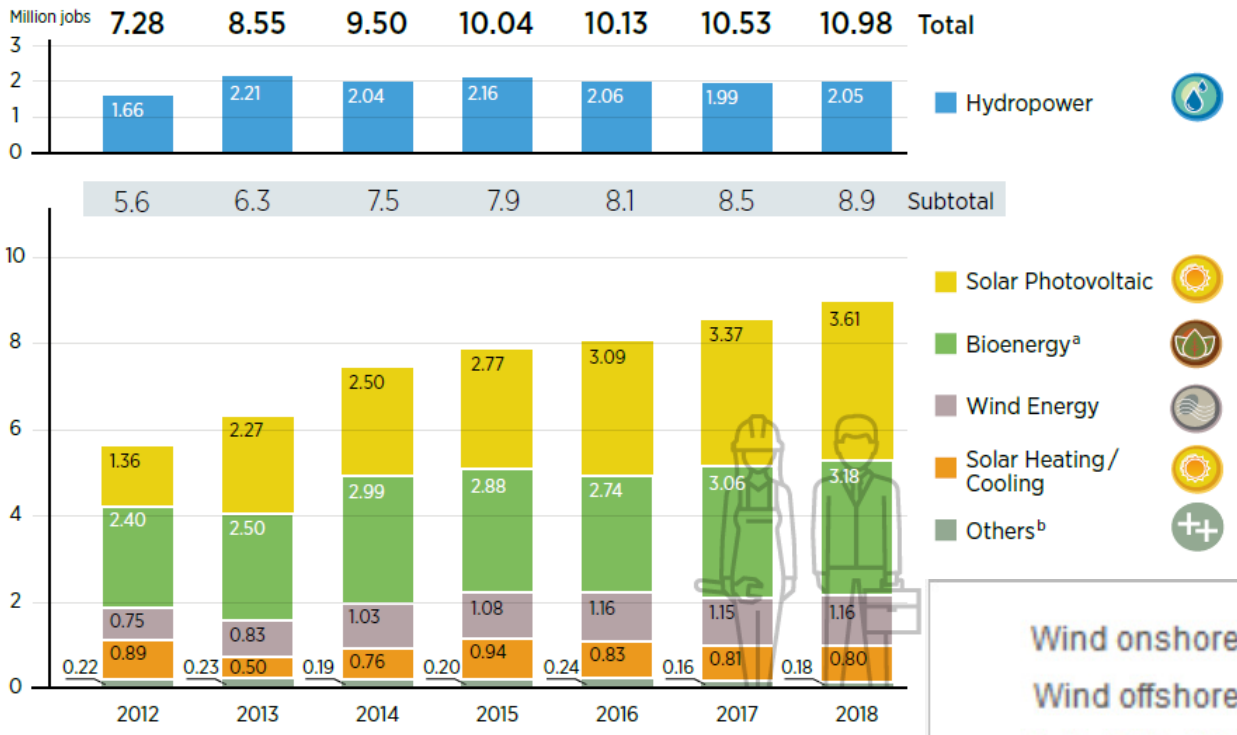
What is not covered?

- Transmission and distribution
- Battery-storage
- Decommissioning
- Oil and gas jobs do not cover distribution e.g., at petrol pumps

Comparison with other studies and 2020 numbers

- Global comparison – IRENA, Pai et al., 2020 ; IEA, 2020
- Regional comparison – IRENA, CEEW, Eurobersver
- Still work in progress

RE Global comparison

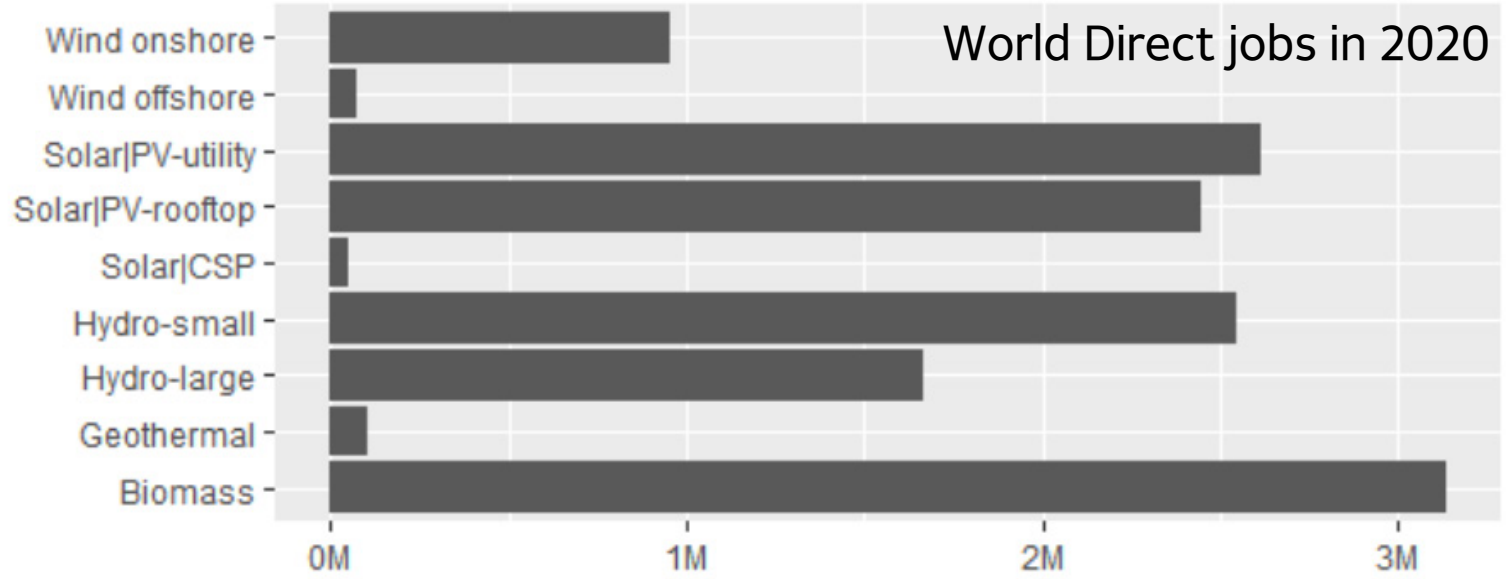


Source: IRENA jobs database.

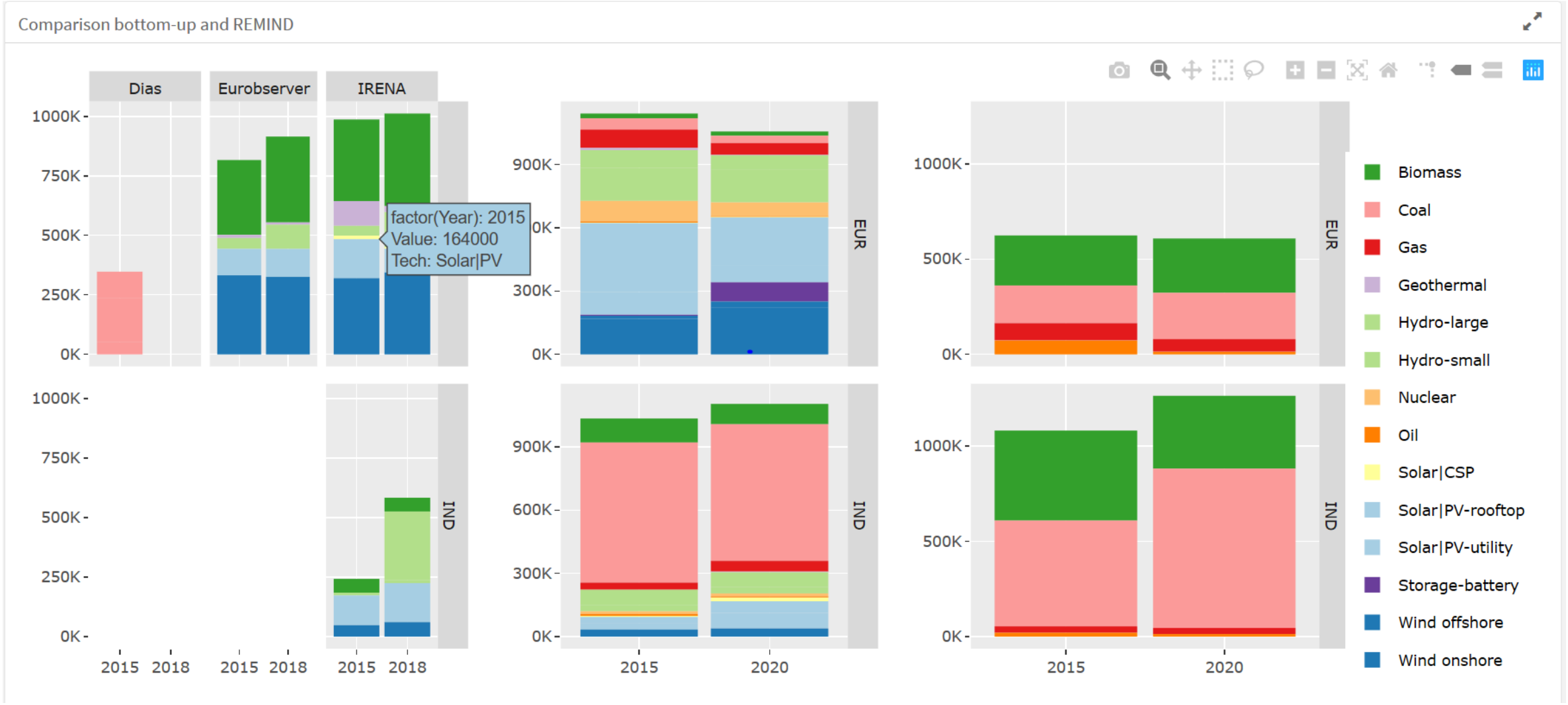
Note: Except for hydropower where a revised methodology led to revisions of job estimates, numbers shown in this figure reflect those reported in past editions of the Annual Review.

Direct and indirect jobs

Probably over-estimating solar PV and Hydro-power jobs



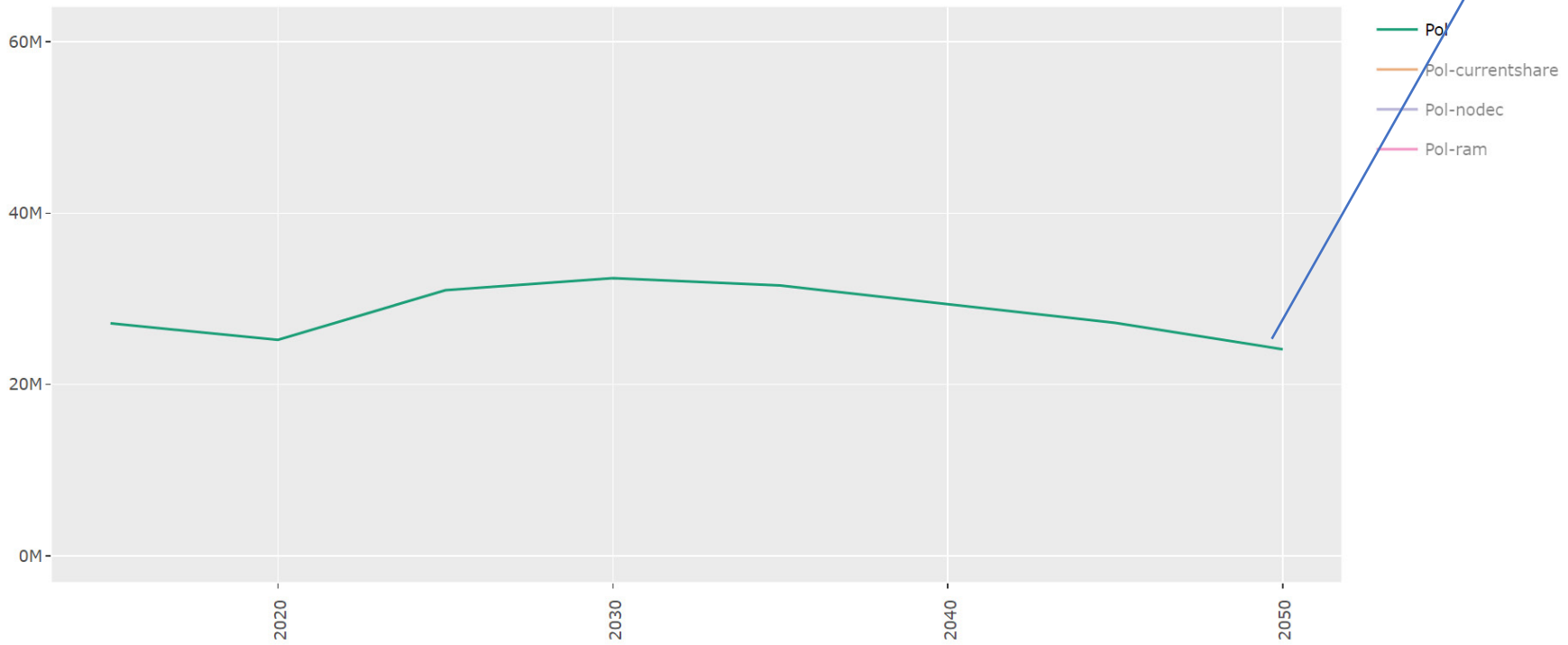
Regional comparison



Central case with “Pol”

Pol represents a policy case with Peak Budget of 1100 GtCO2 ~ 66% probability of 2C in 2100

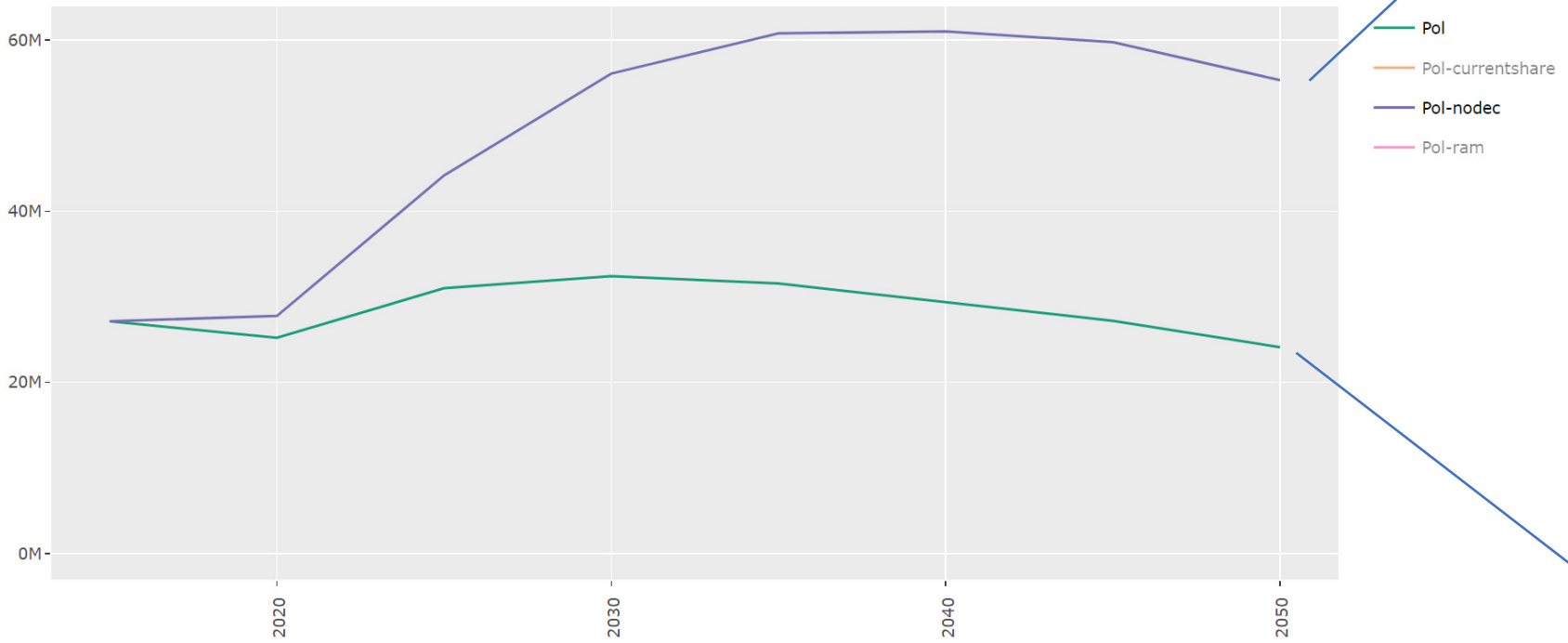
Share subtech = Expert
Multiplier = Rutovitz
Decline factor = Capital costs
Share of world export = Local



Peak in jobs in 2030 due to increasing jobs in manufacturing and construction and installation. Jobs taper off until 2050 as rate of new installations decreases but mostly because of falling employment factors and improving labour productivity.

Extreme case

Share subtech = Expert
Multiplier = Rutovitz
Decline factor = Static
Share of world export = Local



Share subtech = Expert
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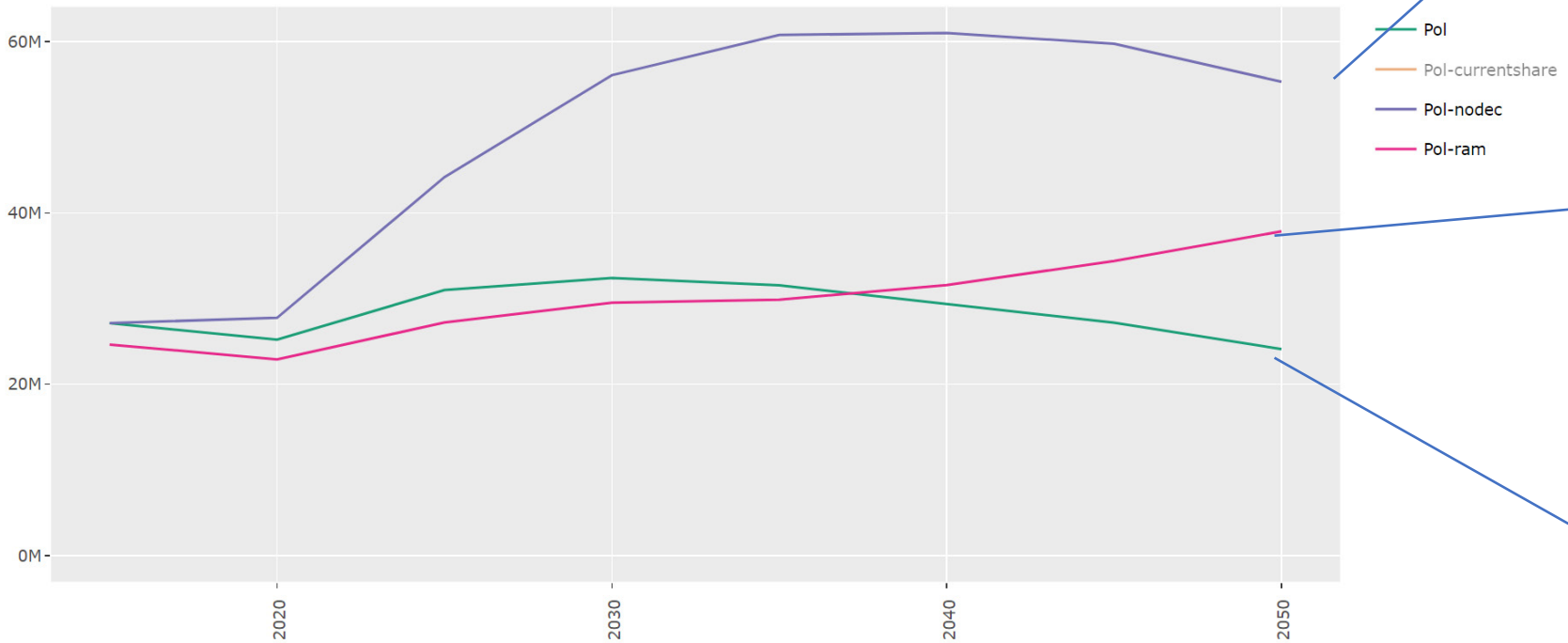
Decline factor = Capital costs
Share of world export = Local

A constant employment multiplier becomes soon meaningless, because it might mean share of labour costs > 100% of total capital costs. However, decline factors significantly effect total jobs. The “right answer” lies somewhere in the middle.

“Shape-shift”



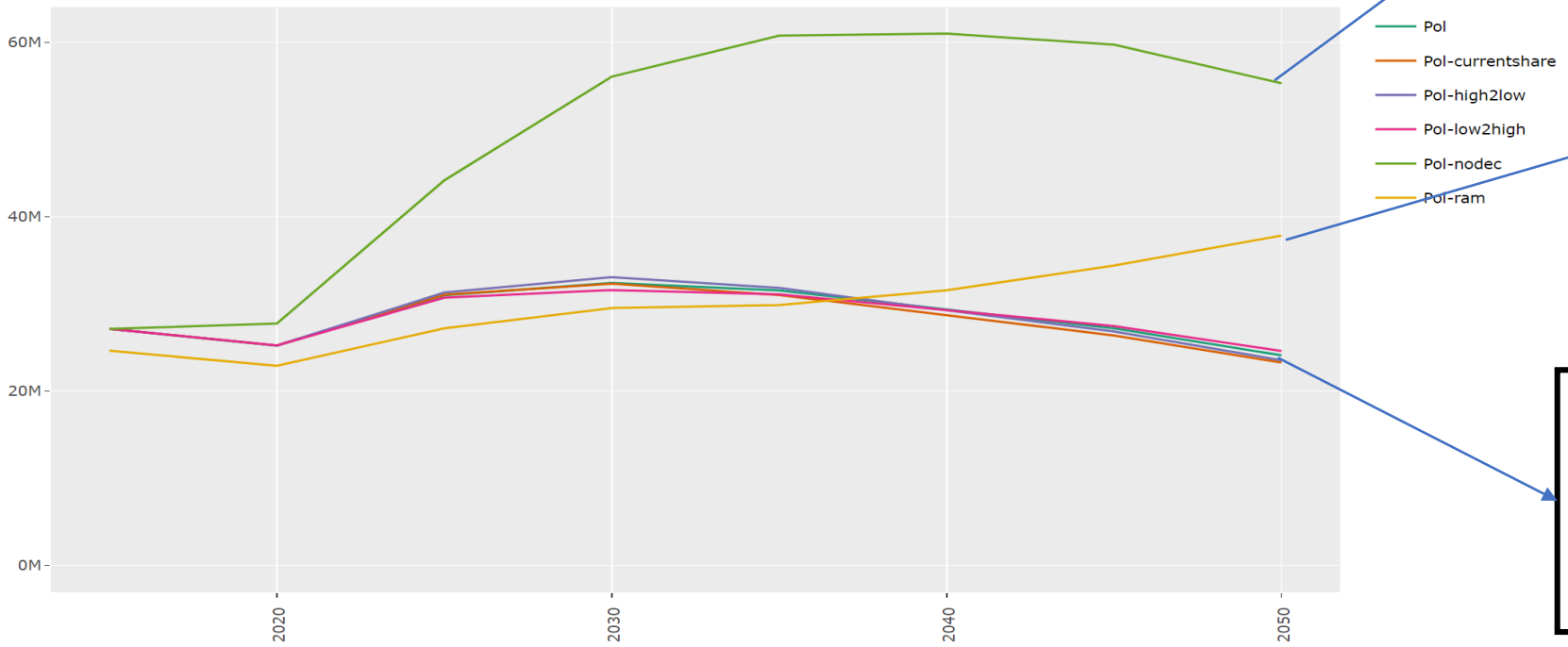
Share subtech = Expert
Multiplier = Rutovitz
Decline factor = Static
Share of world export = Local

Share subtech = Expert
Multiplier = Ram
Decline factor = Capital costs
Share of world export = Local

Share subtech = Expert
Multiplier = Rutovitz
Decline factor = Capital costs
Share of world export = Local

Assuming labour productivity doesn’t converge to OECD in 2050, i.e., regional disparities remain (in accordance with increases in GDP/capita), then the total world jobs actually increase until 2050, changing the shape of the curve.

Sub-tech share



Share subtech = Expert
Multiplier = Rutovitz
Decline factor = Static
Share of world export = Local

Share subtech = Expert
Multiplier = Ram
Decline factor = Capital costs
Share of world export = Local

Share subtech = Expert/low2high/high2low/current
Multiplier = Rutovitz
Decline factor = Capital costs
Share of world export = Local

Changing how the share of sub-technologies like solar rooftop etc. evolve into the future, has little effect on the global job numbers. However, they may be regionally significant.

Conclusions

- How world (direct) energy supply jobs evolve into in any scenario is strongly dependent on the decline factor and the regional multiplier

- Through the one case, we see that the conventional knowledge that a highly renewable world will increase (direct) overall energy supply jobs is challenged.

Limitations

- Transmission and Distribution jobs not included (~13% of total energy jobs, IEA 2020)
- Energy efficiency jobs not included
- Decommissioning jobs not included (~2% of total energy supply jobs in 2050, Ram et al. 2018)
- Battery-storage jobs (limited empirical studies on employment factors) not included (~5% of total energy supply jobs in 2050, Ram et al., 2018)
- Using regional multipliers instead of country-specific employment factors

Way forward

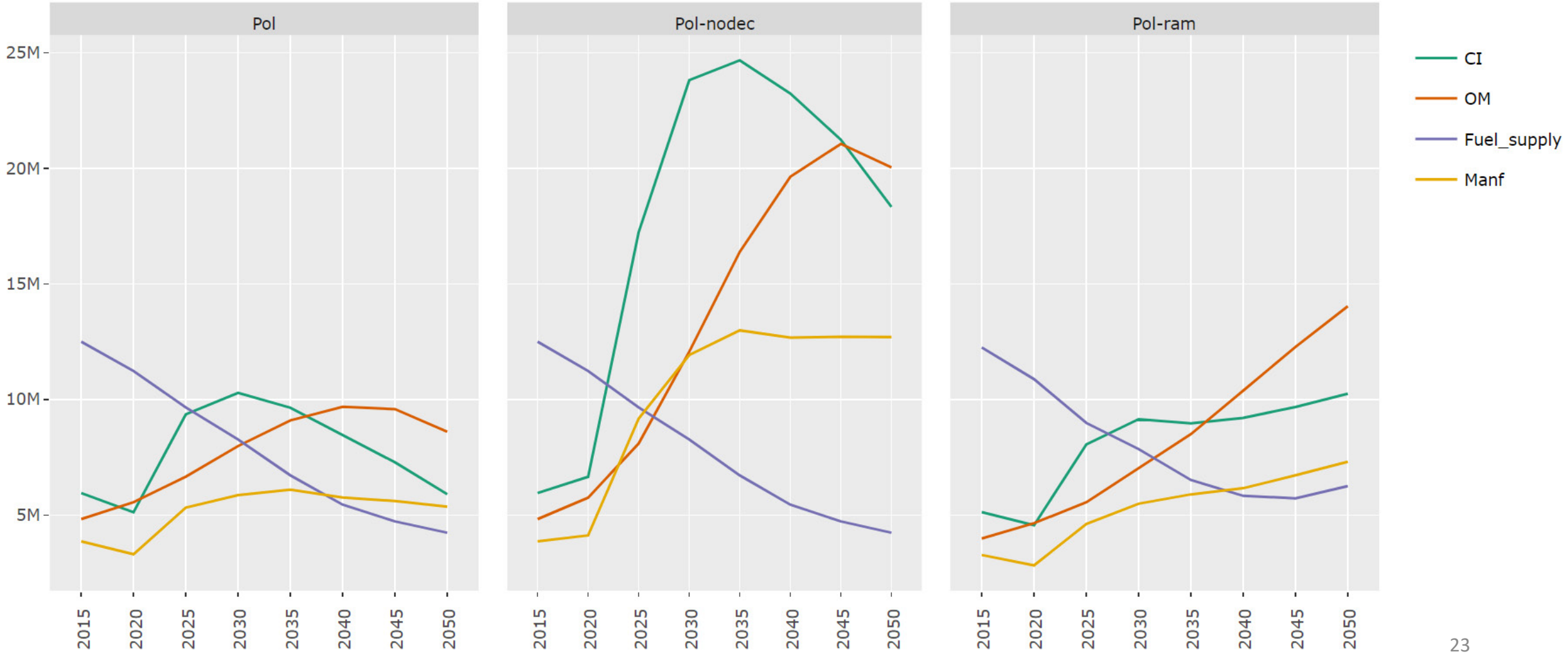
- First PhD Paper – **Malik et al.**(2020). Reducing Stranded Assets through early action in the Indian power sector. *Environmental Research Letters*.

- Second PhD paper - > methodological paper + sensitivity analysis, only for Global Job numbers

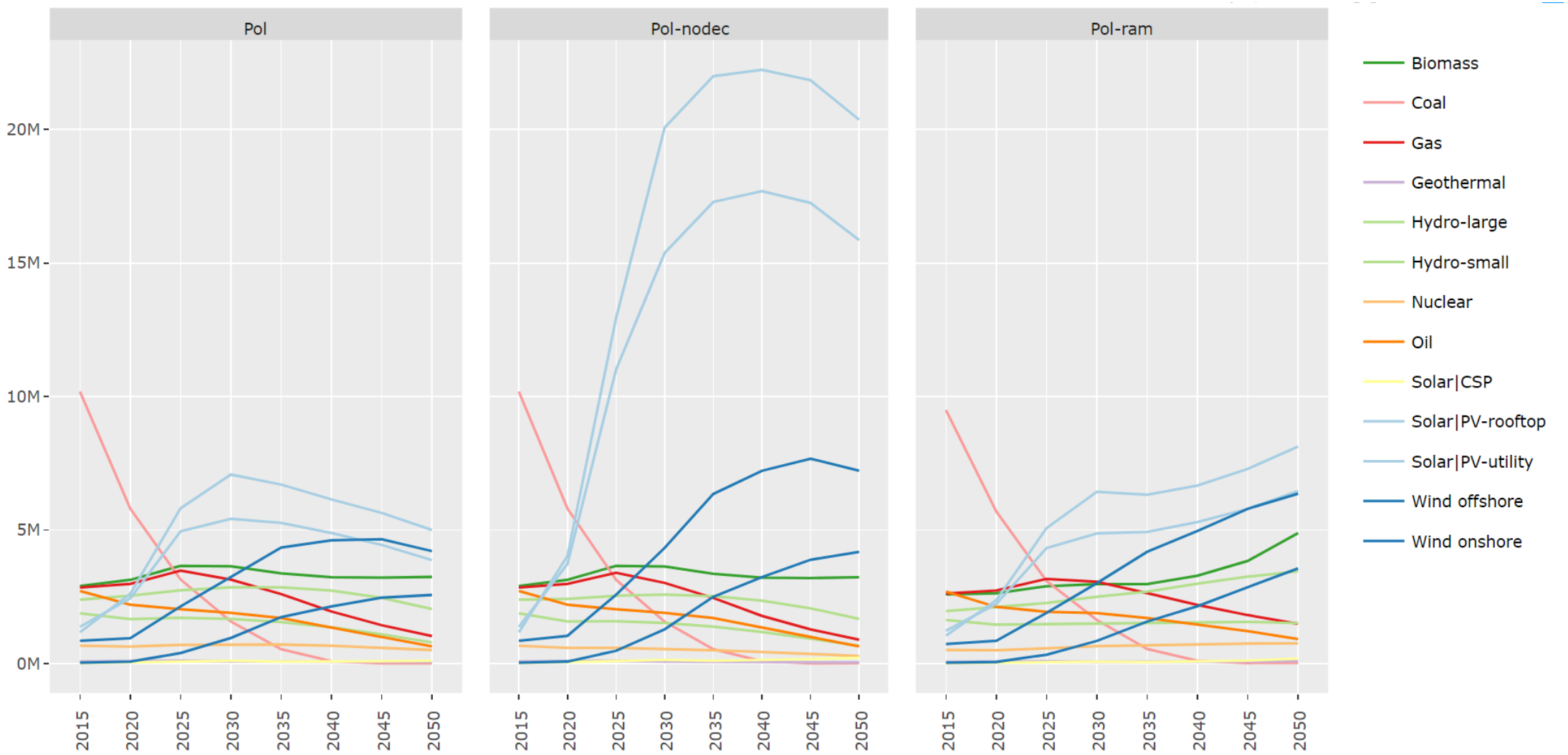
- Third PhD paper - > Regional comparison

Appendix

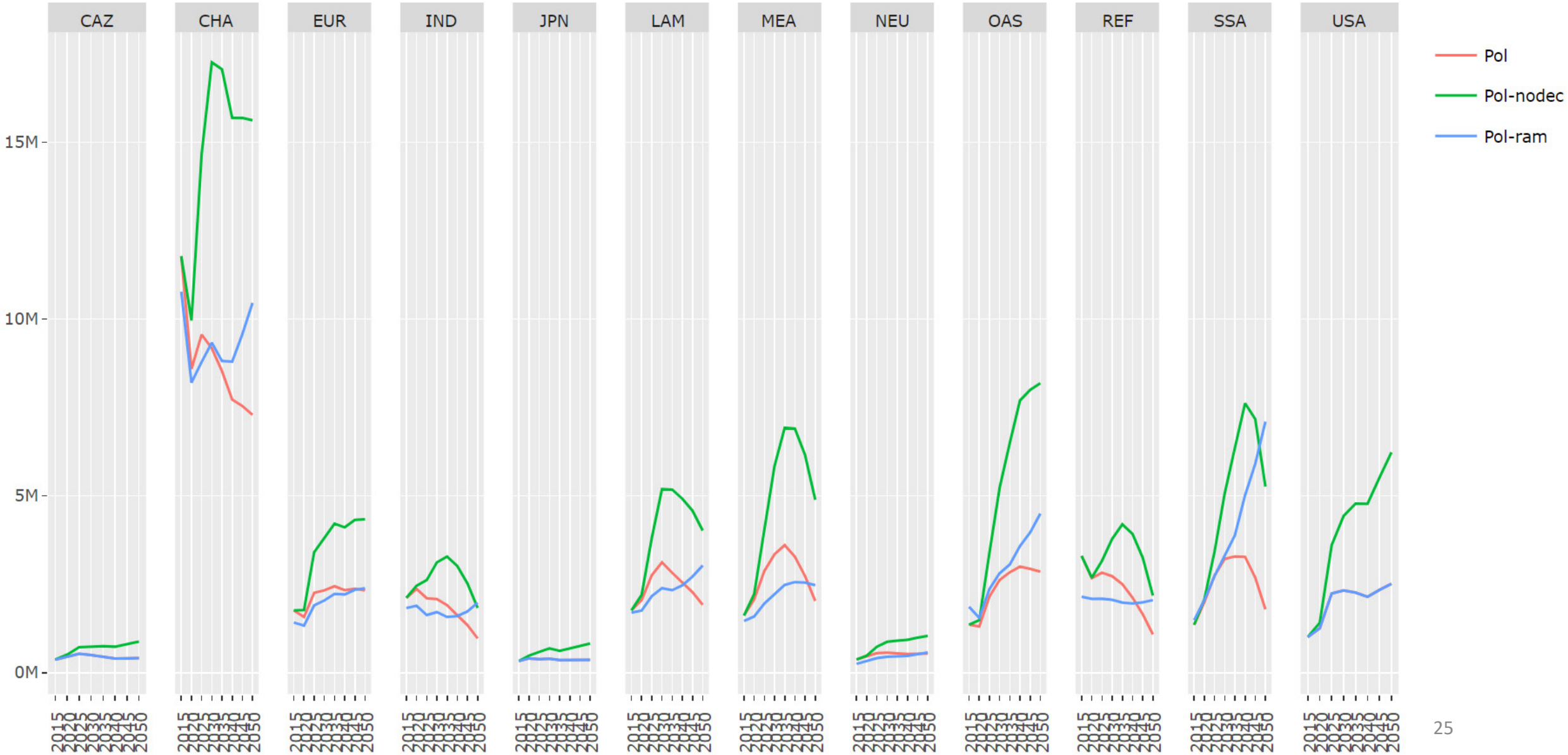
Global jobs by activity



Global jobs by technology



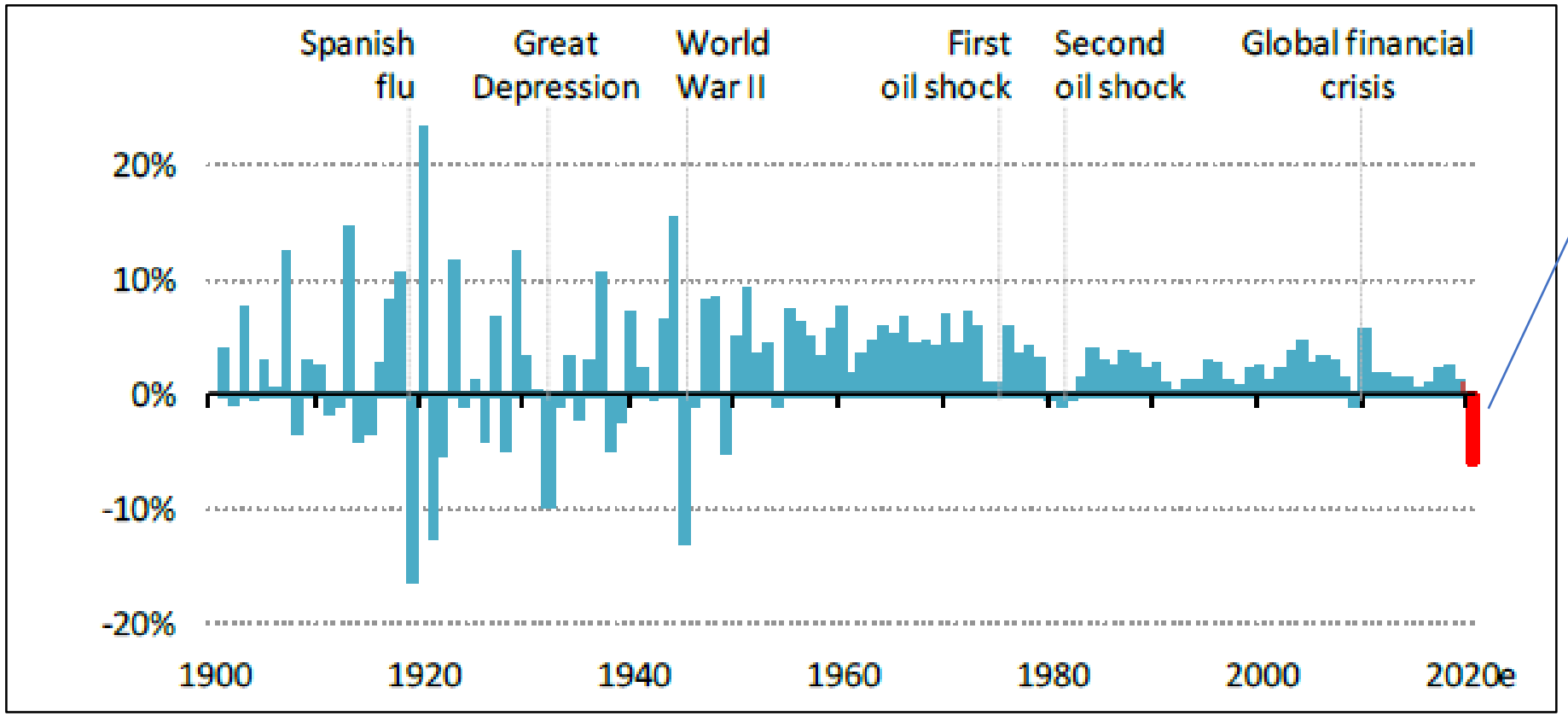
Jobs by Region



Some thoughts on impacts of Covid-19 on employment in the energy sector

- Observations in the months post lockdown and current situation
  - Drastic decrease in demand/activity across all sectors – power, commercial and industrial, aviation, transportation except residential.
  - However, demand picking up again and returning to pre-Covid level. In China, also increased year-on-year (see which sectors).

Change in global primary energy demand, 1900 to 2020e, IEA 2020



Total PE demand to drop by 6%, largest relative decline in 70 years and biggest ever decline in absolute terms.

Oil	8
Natural gas	4
Coal	8
Nuclear	2.5
Electricity	20
Electricity from RE	5

Energy sector employment

- Overall 2020 decrease in jobs, driven by job reductions in upstream operations for oil and gas.
- Coal demand already reducing, decreased further due to reduced electricity demand and coal to gas switching.
- Power demand to return back quickly (e.g., India) – O & M jobs secure, new projects on hold until demand picks up again.
- Recovery packages