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Optimizing Germany's energy transformation: Connecting labor markets, training strategies, and migration policies with energy system modelling

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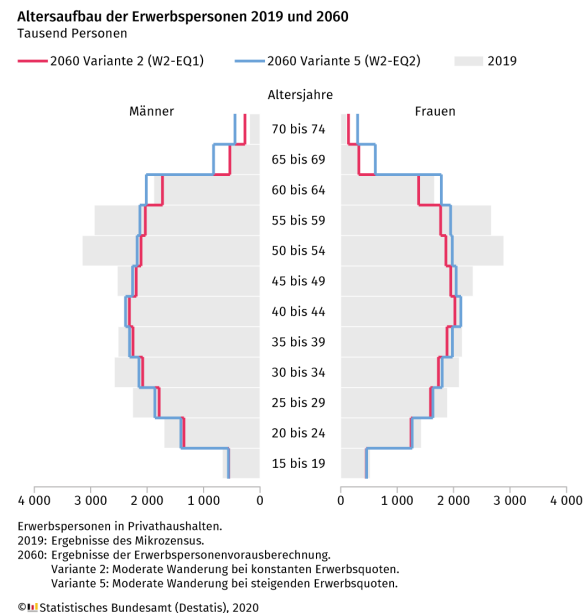
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Aging Population reduces employment

Labor market developments affect energy transformation

- Availability of labor force determines the energy transformation – already shortages in sectors (e.g. heat pump installation)
- Only few ESM consider labor markets and usually ex-post and not as limiting element during optimization
- Energy System Models (ESM) need to consider labor markets as constraining factors



Source: Destatis (2020).

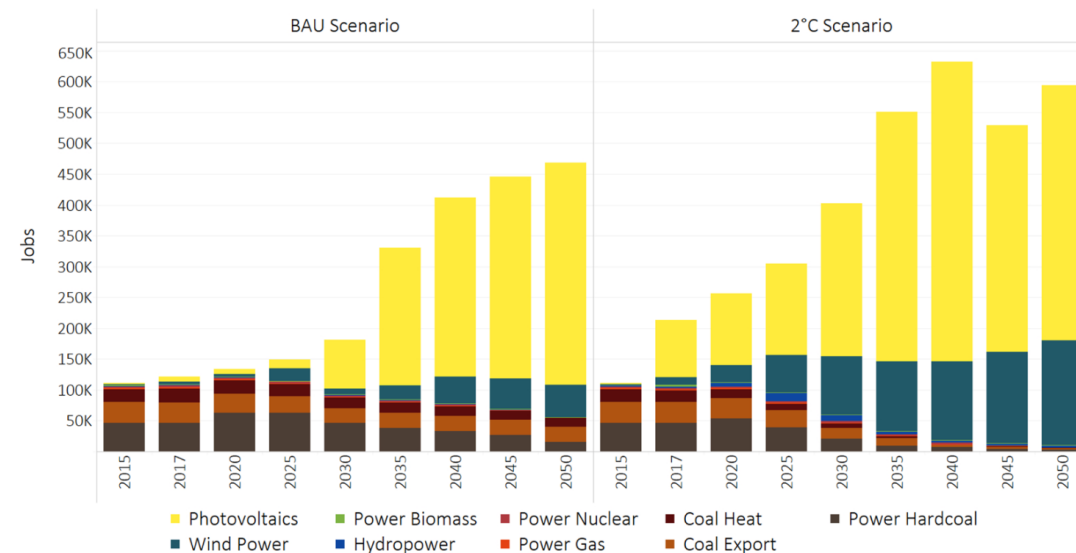


Fig. 4. Employment effect in South Africa. Source: Own illustration.

Sorce: Hanto el al. (2021).

1 Motivation

2 Energy System Model GENeSYS-MOD

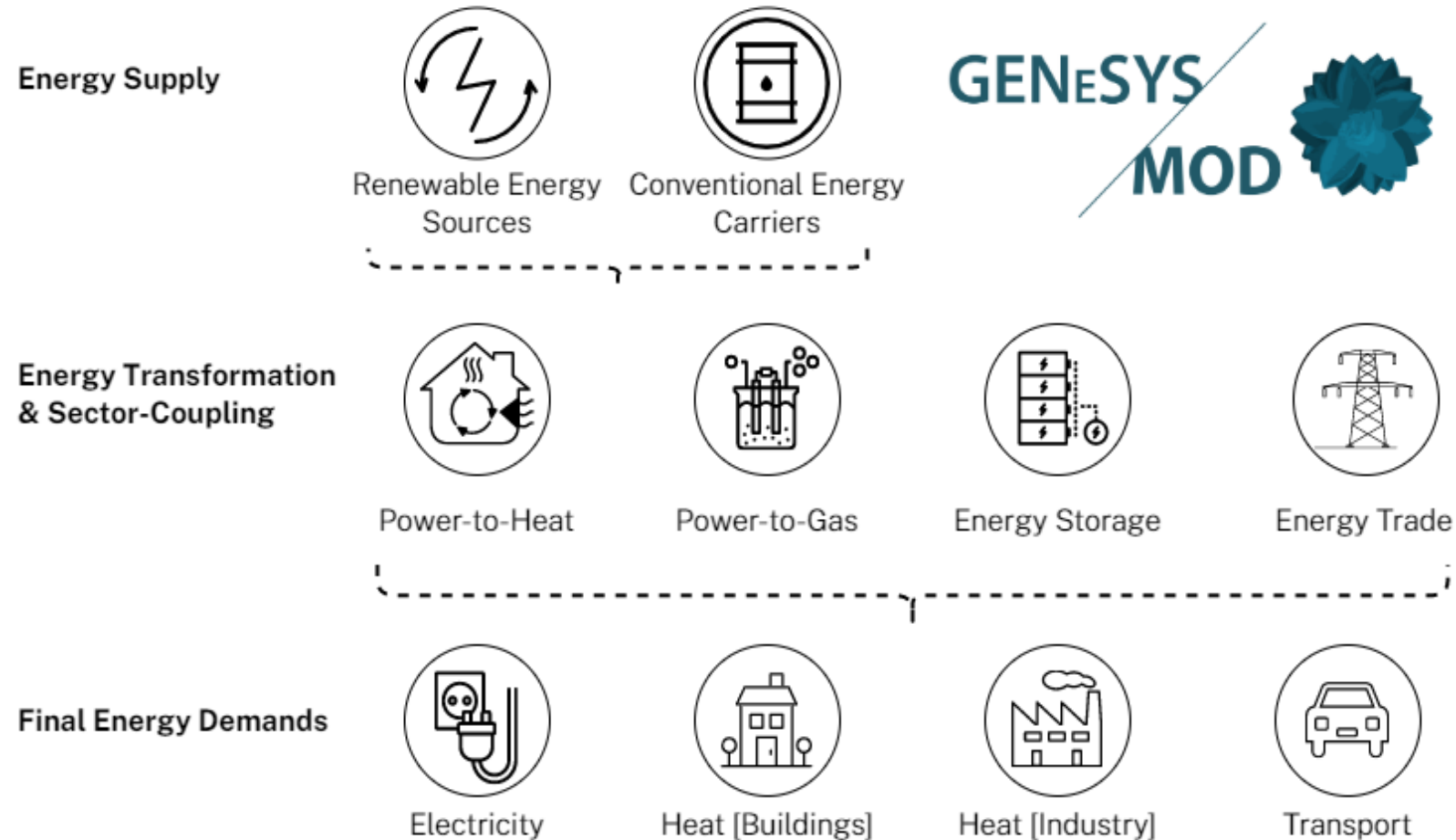
3 Employment Scenarios

4 Preliminary Results

5 Conclusion

GENeSYS-MOD – Global Energy System Model

Linear, cost optimizing, open-source energy system model



GENeSYS-MOD v3.0 - Public release

Assets

- Source code (zip)
- Source code (tar.gz)
- Source code (tar.bz2)
- Source code (tar)

Evidence collection

- genesysmod3.0-evidences-1.json (2f4c9c71) (Collected 2 months ago)

GENeSYS-MOD - The Global Energy System Model

Version 3.0

Including source code, documentation, and Middle-East sample data set.

DOWNLOAD

Documentation (also included in release files):

- QUICK-START GUIDE
- TECHNICAL MANUAL

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GENeSYS-MOD Community

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July 26, 2022 (v1) Preprint Open Access View

Identifying policy areas for the transition of the transportation sector

Hainisch, Karlo.

Abstract: Being the only energy sector where emissions are still at 1990 levels, the German transportation sector requires rapid decarbonization to achieve ambitious climate targets. Policy makers need to put the framework in place which enables and supports this transition. This work analyzes which

Uploaded on July 26, 2022

July 26, 2022 (v1) Dataset Open Access View

GENeSYS-MOD Transport Sensitivities: Data and model code for Hainisch (preprint): Identifying policy areas for the transition of the transportation sector

Hainisch, Karlo.

Community

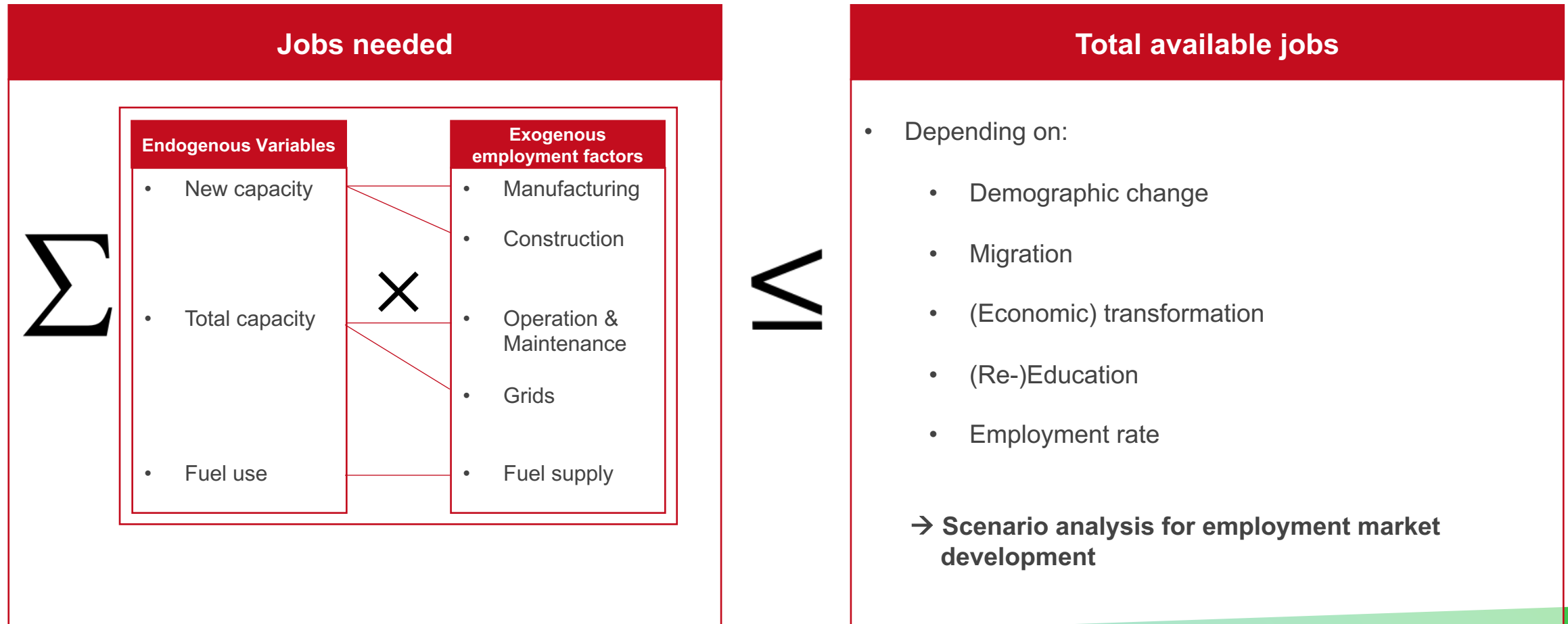
GENeSYS MOD

GENeSYS-MOD Community

The Global Energy System Model (GENeSYS-MOD) is a cost-optimizing linear program based on the Open Source Energy Modelling System (OS-EMOSYS).

Model extension - Labor market constraints

Equations limit the addition and operation of capacity



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Labor market scenarios for Germany

Development of employment in Germany

Germany's aging population will lead to a decrease of employment unless:

- Employment rate increases
- Migration increases

→ Currently 3 scenarios to filter out the effects

Low employment scenario

- No migration
- Constant employment rate

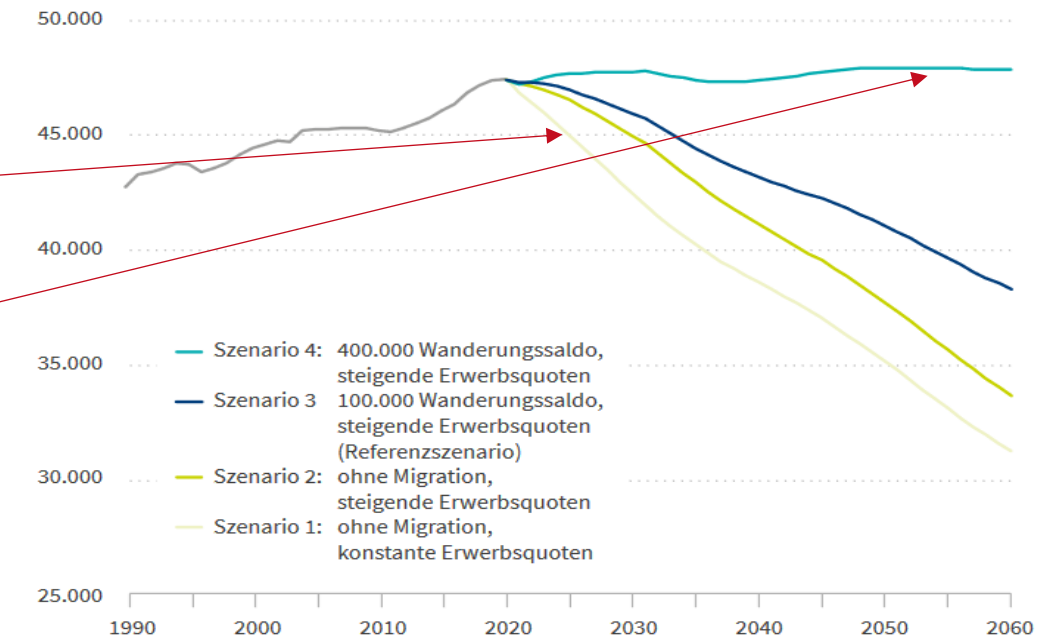
High employment scenario

- High migration
- Increasing employment rate

Unconstraint scenario

- No employment constraint
- Serves as base line to compare

Szenarien für die Entwicklung des Erwerbspersonenpotenzials bis 2060
in 1.000 Erwerbspersonen, Inländerkonzept



Anmerkung: Der angegebene Wanderungssaldo ist die jährliche Differenz aus Zu- und Fortzügen von Personen im Alter von 0 bis 110 Jahren (also nicht nur Arbeitskräfte).

Quelle: Eigene Berechnungen. © IAB

Source: IAB (2021).

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Preliminary Results

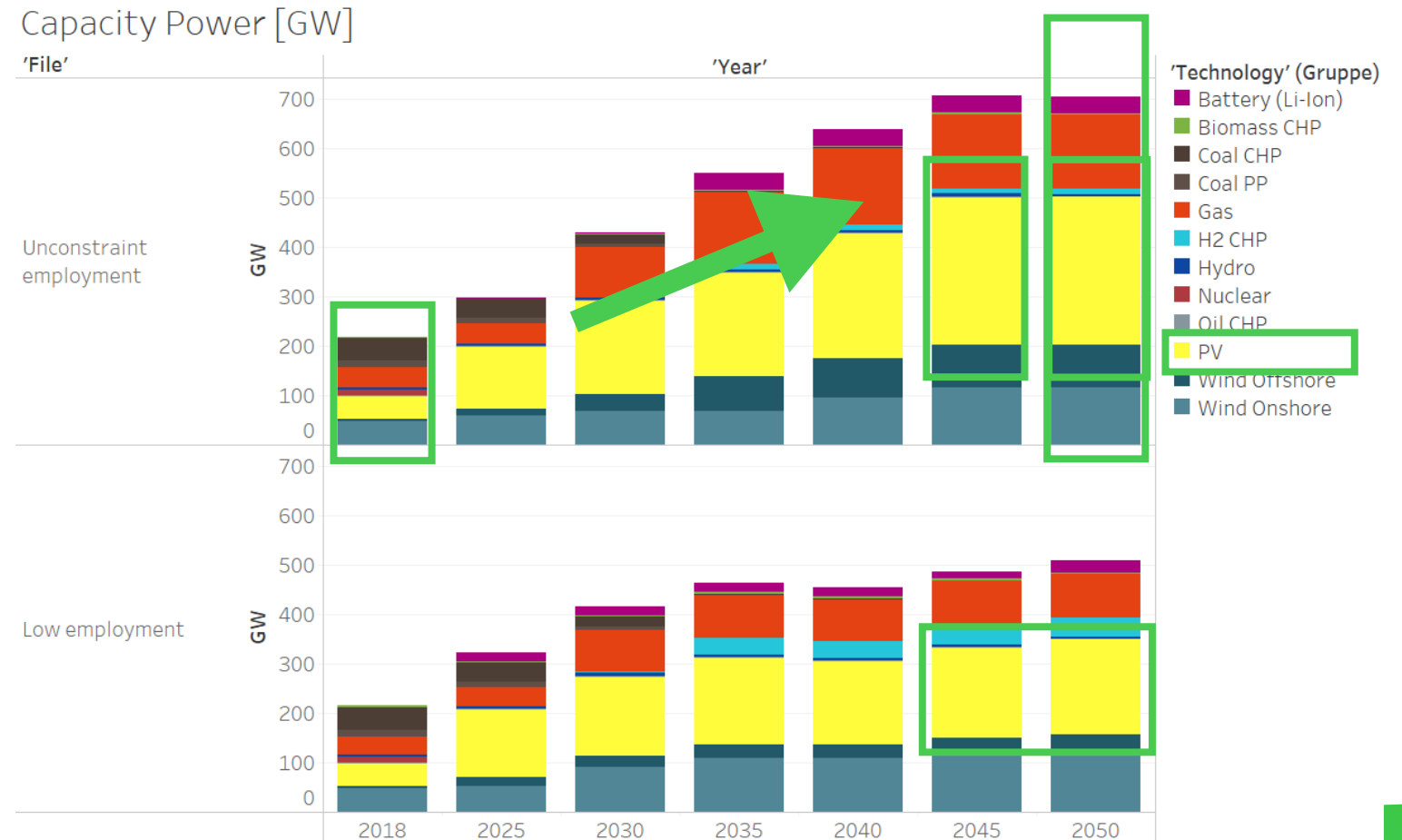
Job constraints might decrease installed power capacity

Unconstraint Scenario

- High capacities in electrification → around 40% more installed capacity compared with constraint case
- Higher PV shares

Constraint Scenario

- Lower deployment of PV due to high labor intensity compared to other technologies



Preliminary Results

Job constraints decrease renewable power production

Unconstraint Scenario

- Increasing electrification
- Main electricity production via PV and Wind
- Domestic hydrogen production

Constraint Scenario

- Lower increase of electrification
- Higher shares of H2 in power generation
- Almost no domestic hydrogen production

Power Production [PJ]



Preliminary Results

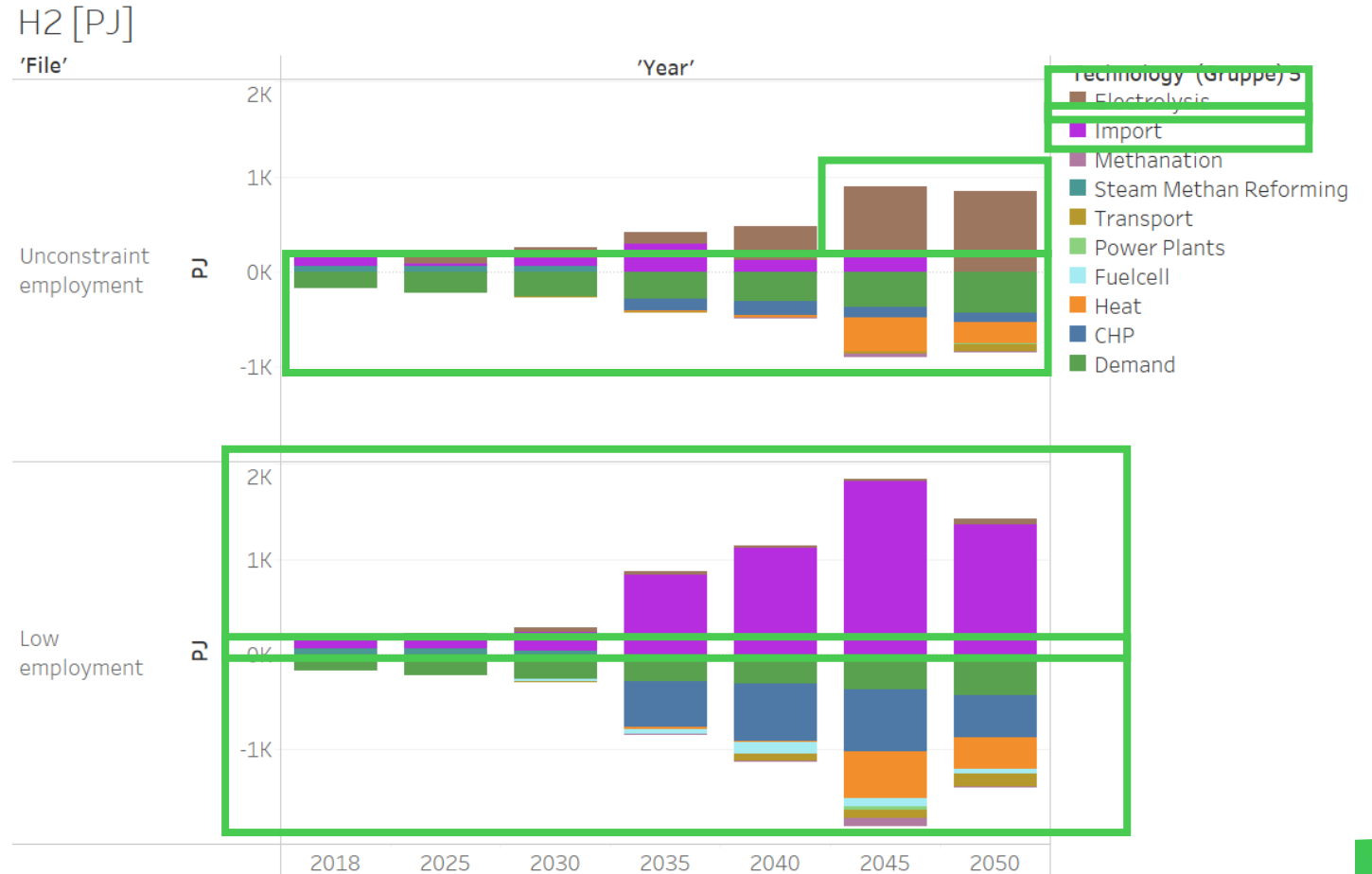
Job constraints increase H2 import dependencies

Unconstraint Scenario

- Limited hydrogen use
- Mainly domestic H2 electrolysis

Constraint Scenario

- Significant hydrogen use
- Mainly imported H2 import
→ import dependency



Preliminary Results

Jobs

Unconstraint Scenario

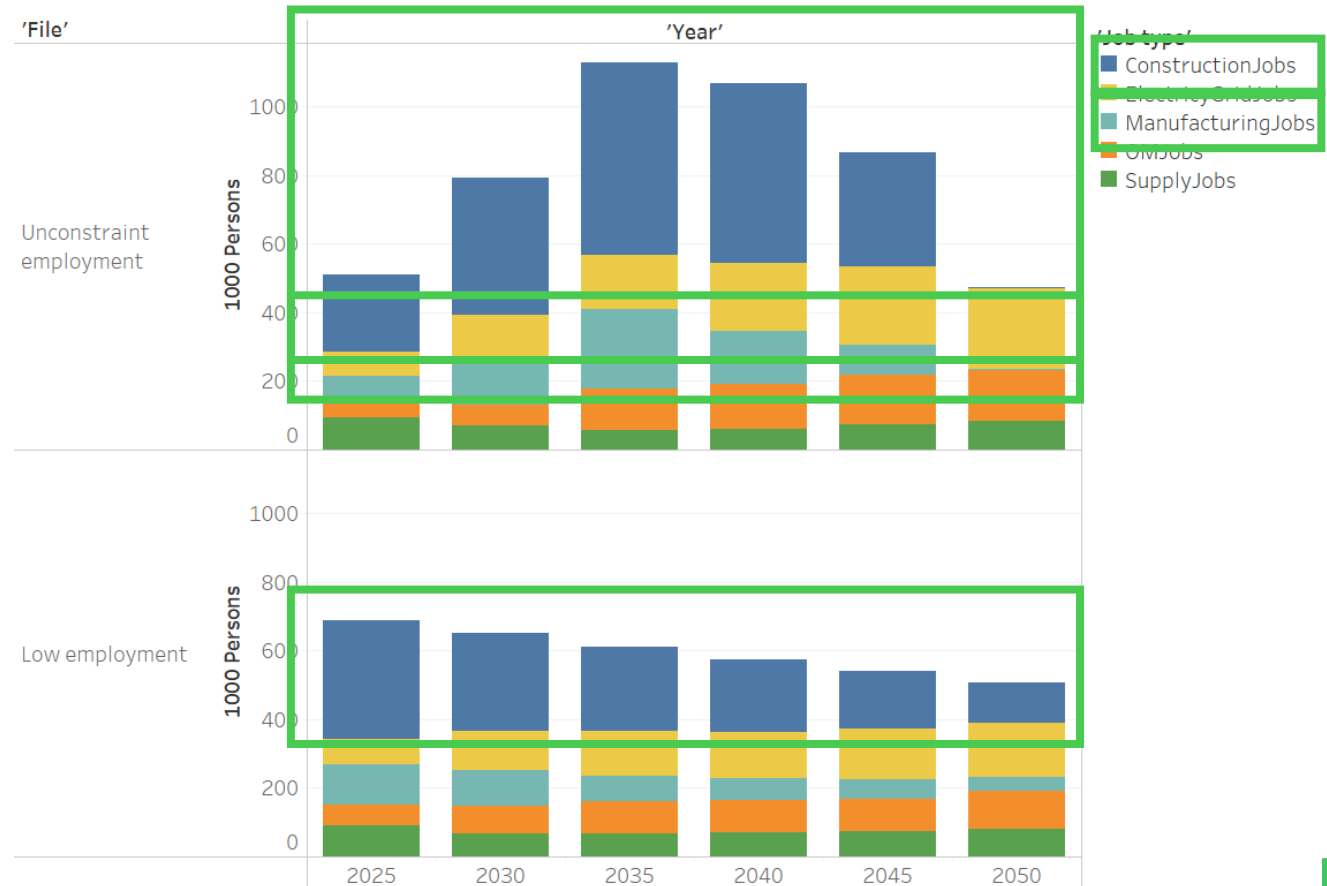
- Most jobs needed for construction
- More domestic manufacturing if employment is unconstrained

Constraint Scenario

- Model shifts construction to earlier years since then there is more employment available

Jobs

'File'



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Shortcomings & next steps

Refine employment factors

- **Role of technological progress for employment factor** (esp. AI and automatization)
- **Employment factors in literature have a large bandwidth** → possible further scenarios/sensitivities

Inclusion of more technologies

- **Heating sector** needs to be included
- **Role of transformation for available workers** → e.g. change of ICE to E-mobility

H2 import quantities not restricted and import at production costs

- **Exercition of market power** may lead to withholding quantities and **higher prices** due to mark-ups → Model coupling with global hydrogen model

Conclusion

Policies and research needed to reduce import dependencies

Introducing jobs constraints may lead to low electrification and high import dependencies

- Russia's attack on Ukraine and its effects on the energy markets have shown the **security implications of energy dependencies**
- Enabling **energy independence** needs to be of **high importance** and include **efforts on the labor market**

Migration necessary for keeping employment high and reduce import dependencies

- Politics in Germany enabled **easier integration of foreign workers** into labor market
- However, **political climate in Germany** shifts right → efforts needed to change not only for society but also for **German economy and energy transformation**

More research needed on the transformation especially in the automotive sector and its effects on employment in Germany

- Possible **early reeducation programs** for teaching relevant skills for jobs needed for the transformation of the energy sector

Thank you for your attention!

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