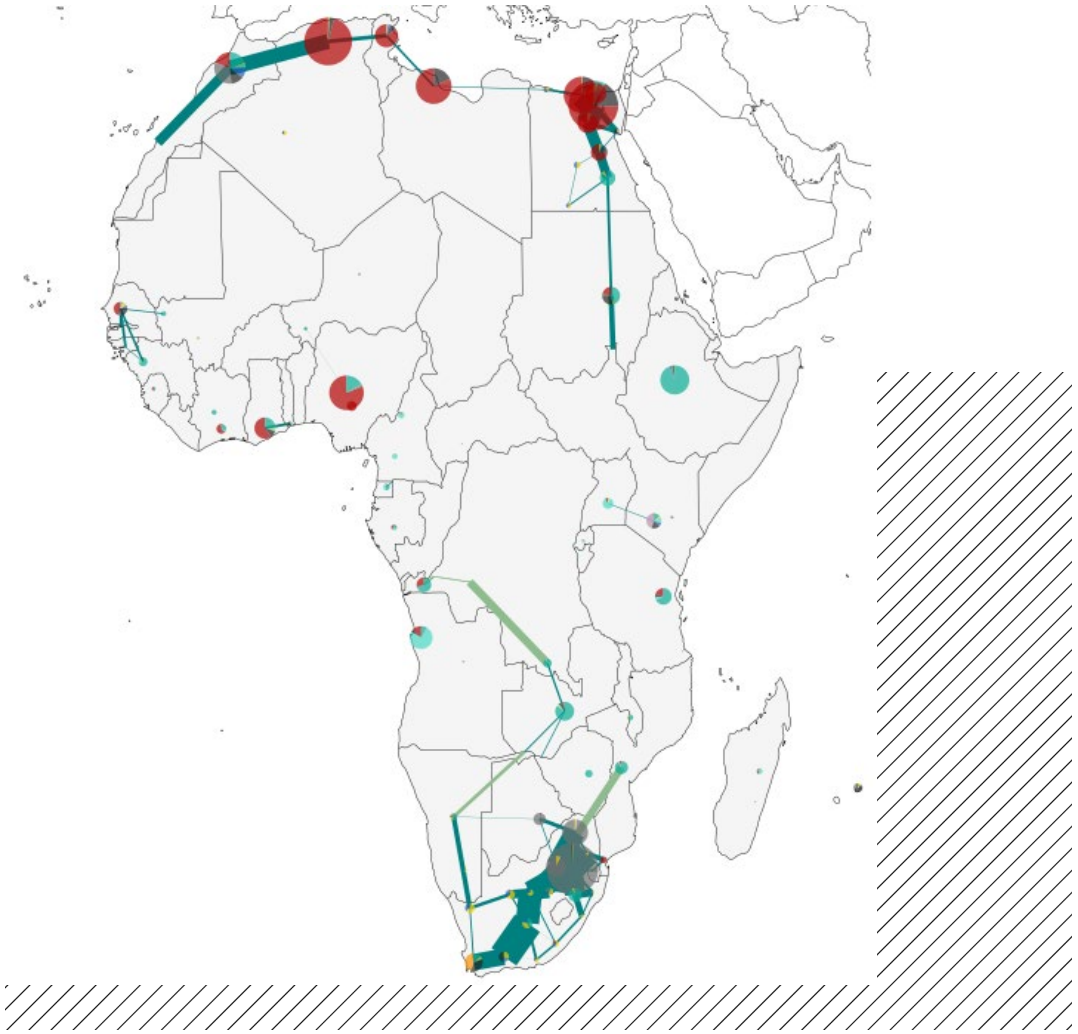

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H2GLOBAL MEETS AFRICA

ANTON ACHHAMMER, M.SC, OTH REGENSBURG

H2Global meets Africa

Bundesministerium für Forschung, Technologie und Raumfahrt

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Key facts

- Period: 01.01.2023 – 30.06.2026
- Budget: 4.2 Millionen €
- Funded by the Federal Ministry of Research, Technology and Space

Project partners

H2Global

Fraunhofer IEE

Associated partners

African Development Bank / African Development Fund

WASCAL West African Science Service Centre on Climate Change and Adapted Land Use

SASSCAL Southern African Science Service Centre for Climate Change and Adaptive Land Management

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Motivation

Energy and climate crisis:

illustrated importance of achieving climate targets and diversifying energy supply
→ for this, a ramp up of the international hydrogen economy is crucial

For this ramp up two factors are elementary:

- Stable international partnerships
- Stable legal and financial framework

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Motivation

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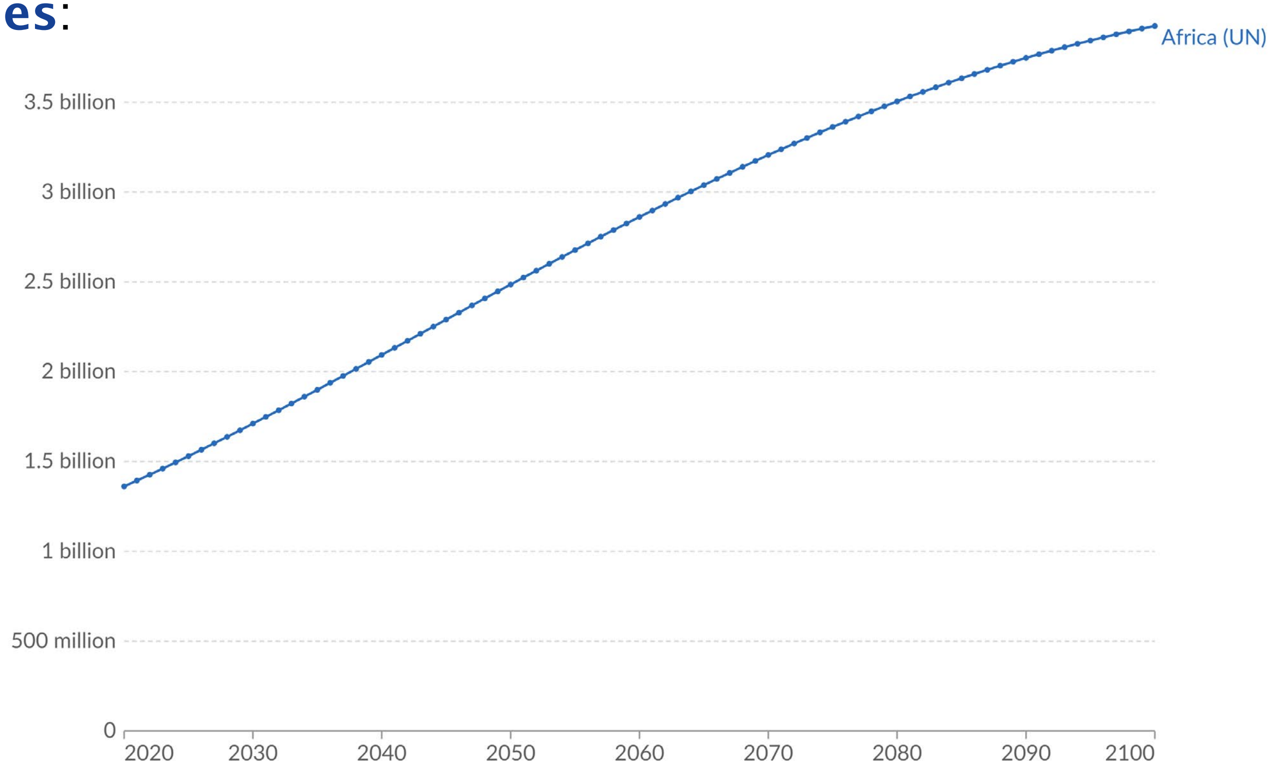
Continent of Africa is facing major challanges:

Population doubles by 2050



Data source: United Nations, World Population Prospects (2022)

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Motivation

Continent of Africa is facing major challanges:

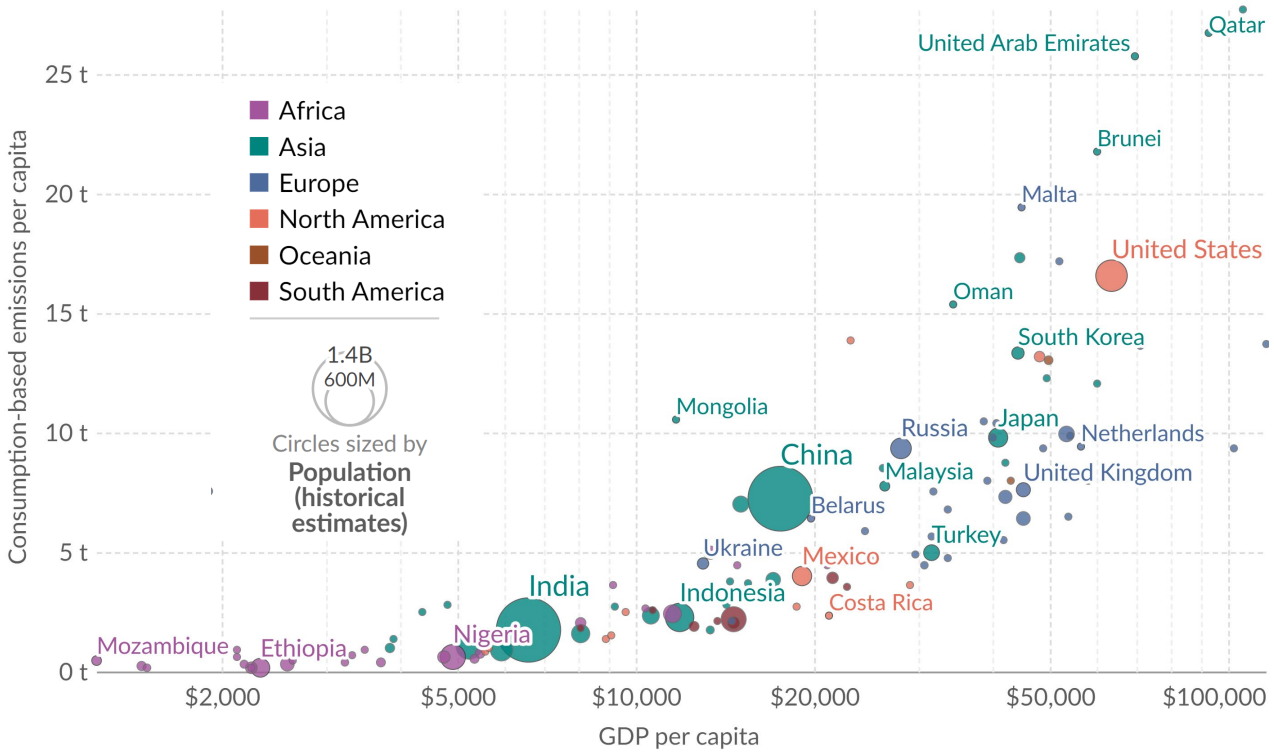
Population doubles by 2050

Average GDP of 2000$ per capita (global average: 10,500$)

Average CO_2 per capita of 0.8 t (advanced economies: 8 t)

The Final Question:

Not if net-zero by 2050 is possible, but how with tenfold economic growth.



Data source: Global Carbon Budget (2023); Population based on various sources (2023); World Bank (2023)
OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

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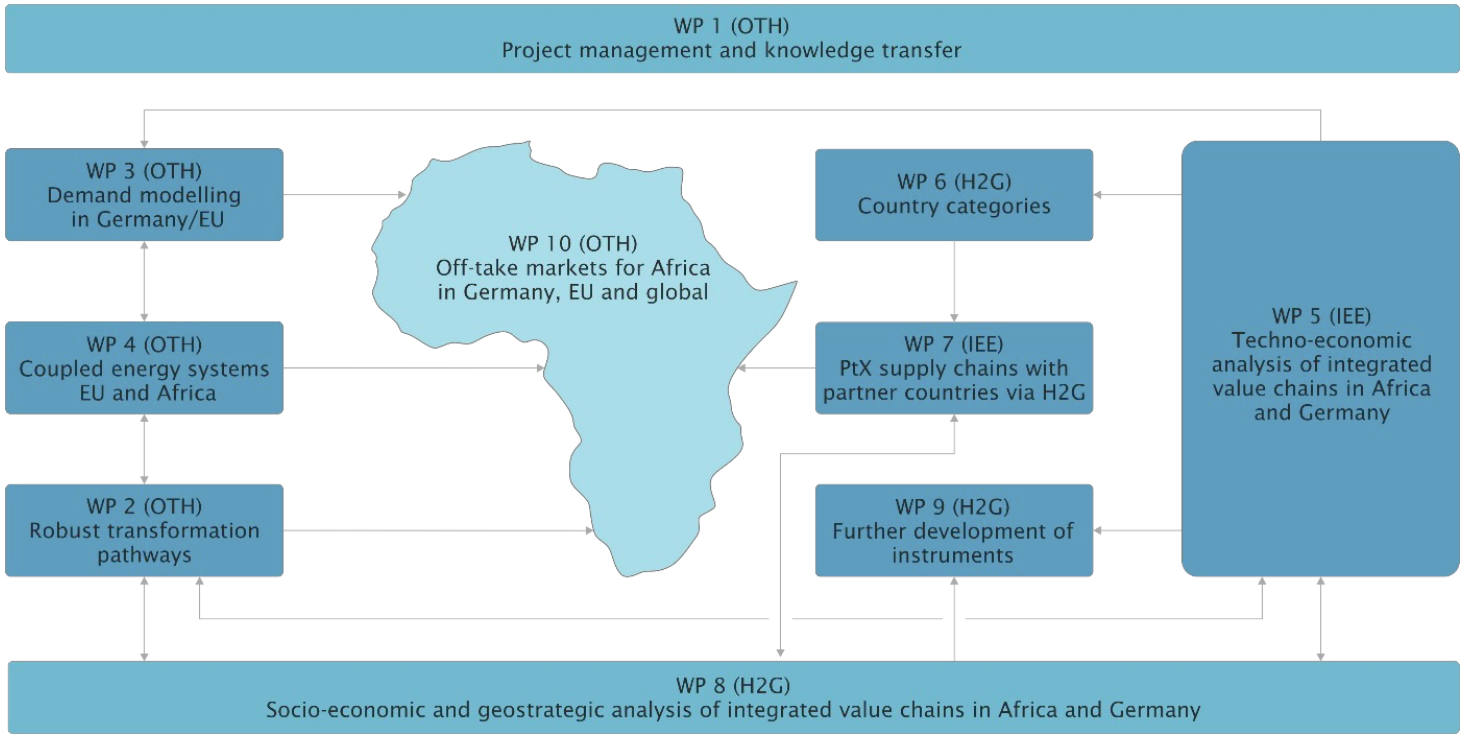
Methodology

Goals:

- Identify possible German-African green hydrogen partnerships
- Bidirectional knowledge transfer
- Evaluating specific H_2/PtX value and supply chains with energy system modelling
- Develop measures to promote market ramp up
- Key project results will be available open source



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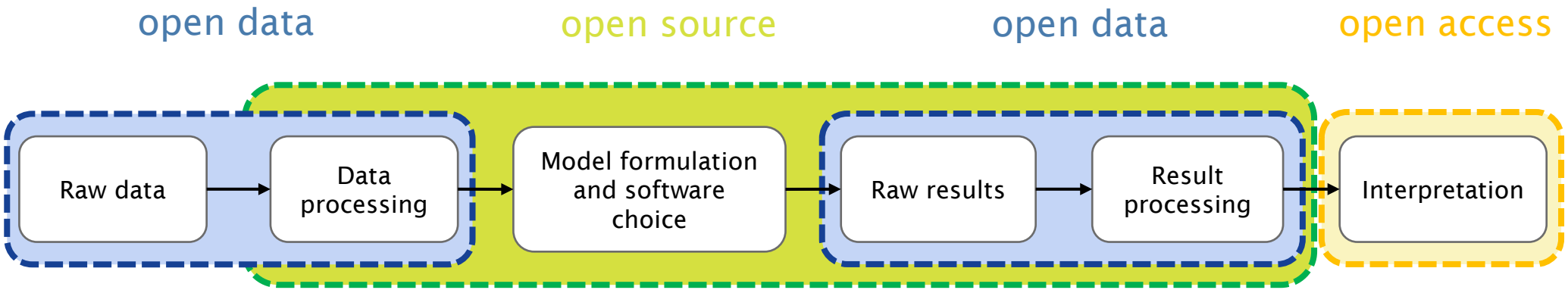
Following the Idea of Open Energy Modelling

The whole chain from raw data to modelling results should be open:



open data + free software → transparency + reproducibility

Quelle: Maximilian Parzen & Dr. Martha Frysztacki, 2023. Summary from Workshop: Stanford Training. Open Energy Transition.

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Energy Transformation Pathways

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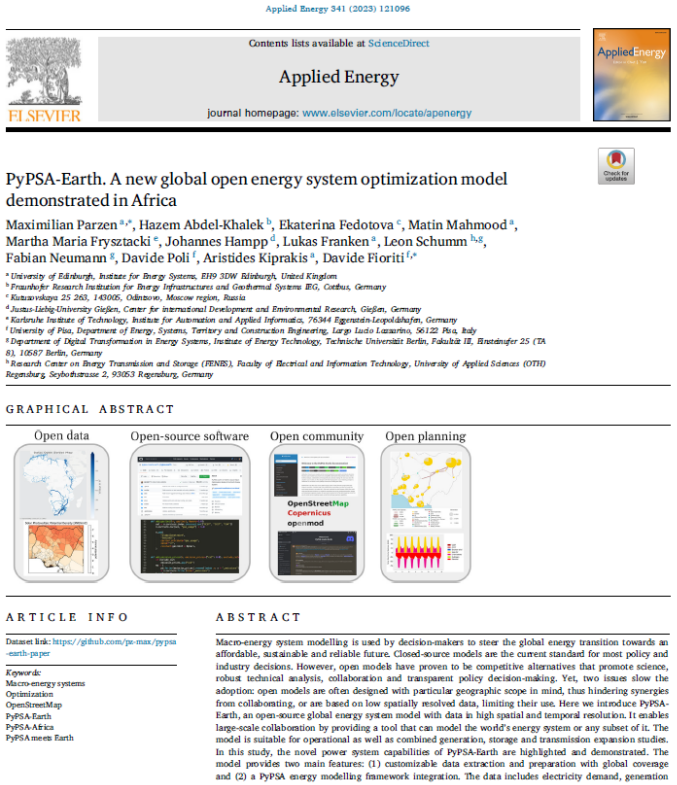
Main Models:

- PyPSA-Earth
- PyPSA-Earth-Sec
- PyPSA-Eur



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PyPSA-Earth. A new global open energy system optimization model demonstrated in Africa

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GRAPHICAL ABSTRACT

ARTICLE INFO

Dataset link: https://github.com/pz-max/pypsa-earth-paper

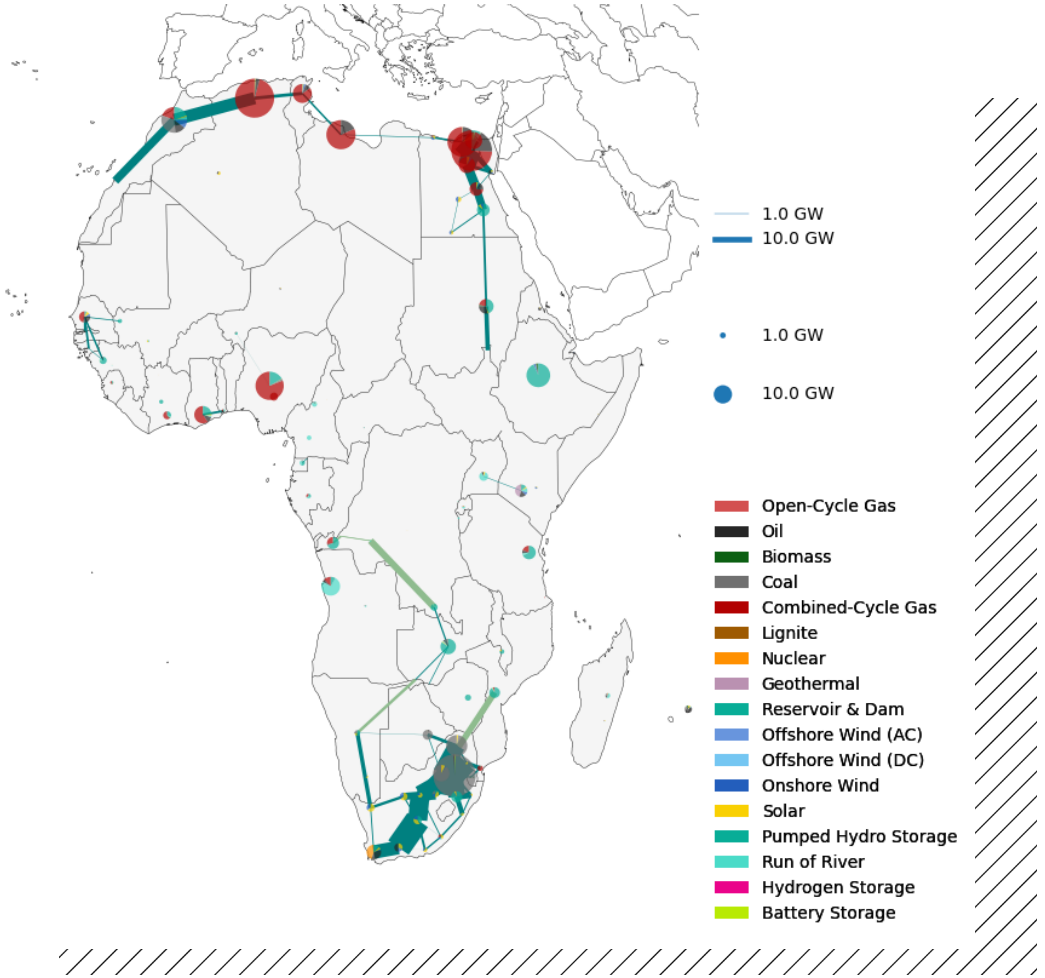
Keywords:
Macro-energy systems
Optimization
OpenStreetMap
PyPSA-Earth
PyPSA-Africa
PyPSA-meets-Earth

ABSTRACT

Macro-energy system modelling is used by decision-makers to steer the global energy transition towards an affordable, sustainable and reliable future. Closed-source models are the current standard for most policy and industry decisions. However, open models have proven to be competitive alternatives that promote science, robust technical analysis, collaboration and transparent policy decision-making. Yet, two issues slow the adoption: open models are often designed with particular geographic scope in mind, thus hindering synergies from collaborating, or are based on low spatially resolved data, limiting their use. Here we introduce PyPSA-Earth, an open-source global energy system model with data in high spatial and temporal resolution. It enables large-scale collaboration by providing a tool that can model the world's energy system or any subset of it. The model is suitable for operational as well as combined generation, storage and transmission expansion studies. In this study, the novel power system capabilities of PyPSA-Earth are highlighted and demonstrated. The model provides two main features: (1) customizable data extraction and preparation with global coverage and (2) a PyPSA energy modelling framework integration. The data includes electricity demand, generation

Check out PyPSA-Earth here:

Check out PyPSA-Earth-Sec here:



Quelle: Erstellt mit PyPSA-Earth und https://github.com/pypsa-meets-earth/documentation/blob/main/notebooks/viz/regional_transm_system_viz.ipynb

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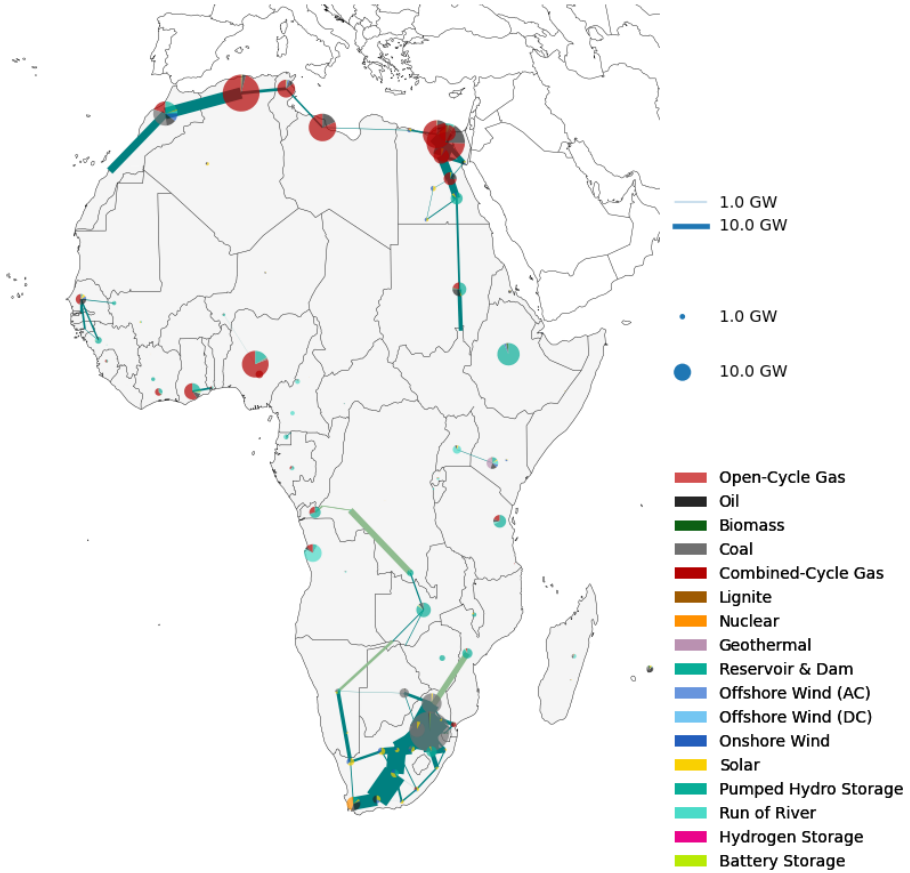
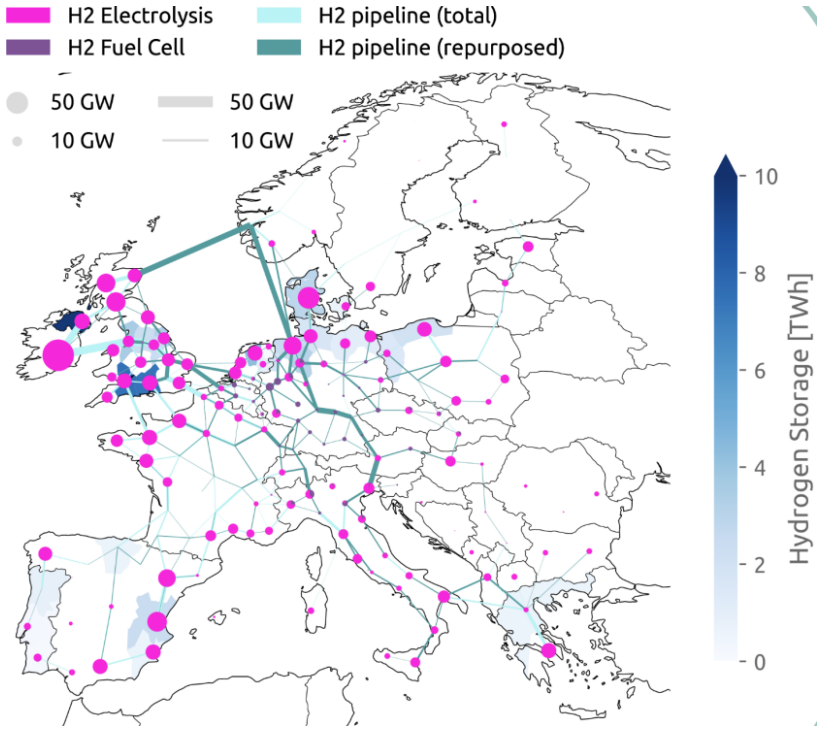
Model coupling Africa/Europe



Quelle: Erstellt mit PyPSA-Earth und https://github.com/pypsa-meets-earth/documentation/blob/main/notebooks/viz/regional_transm_system_viz.ipynb

Direct model coupling

Common optimization of selected countries



Quelle: Neumann, Fabian; Zeyen, Elisabeth; Victoria, Marta; Brown, Tom (2022): Benefits of a Hydrogen Network in Europe

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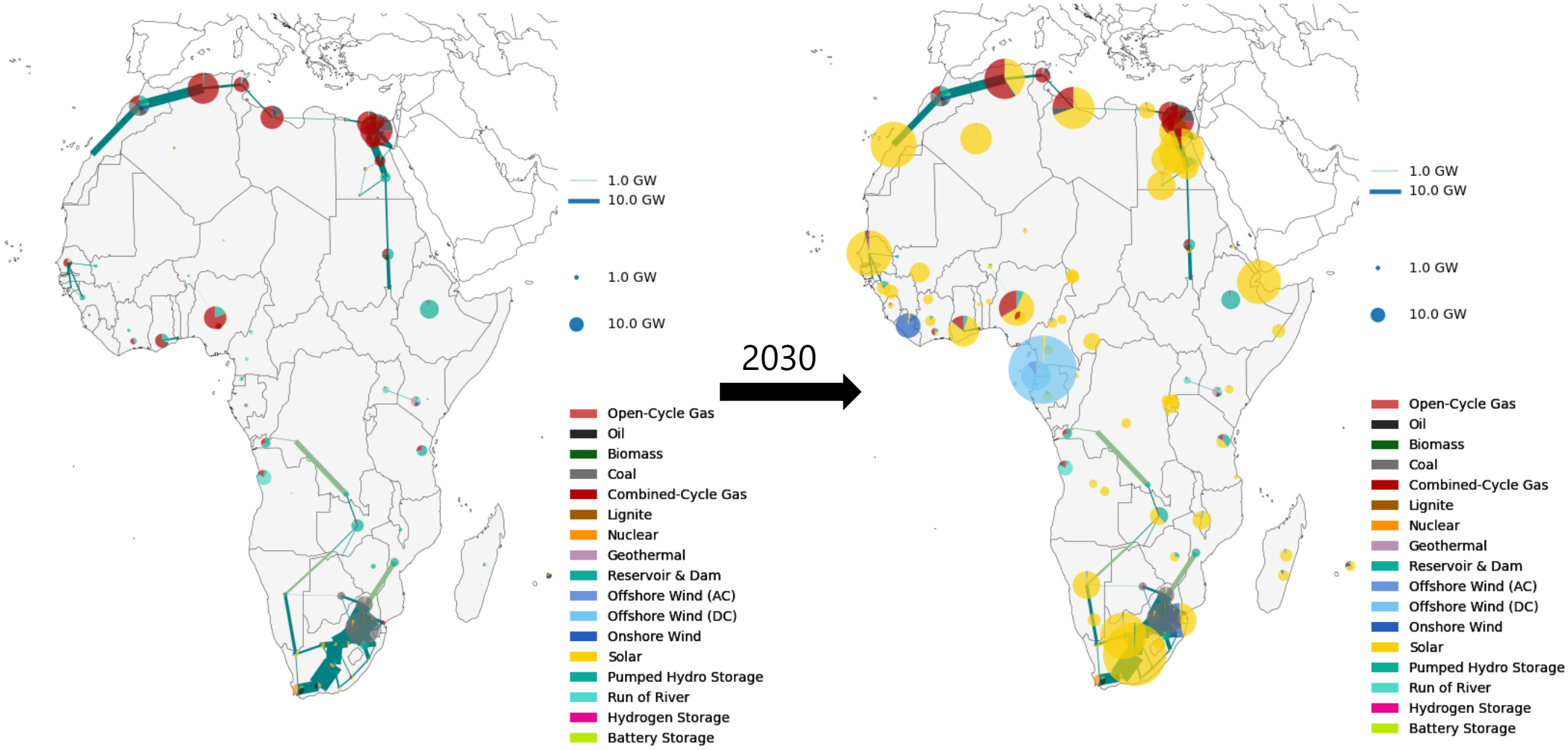
Results



Check out PyPSA-Earth here:

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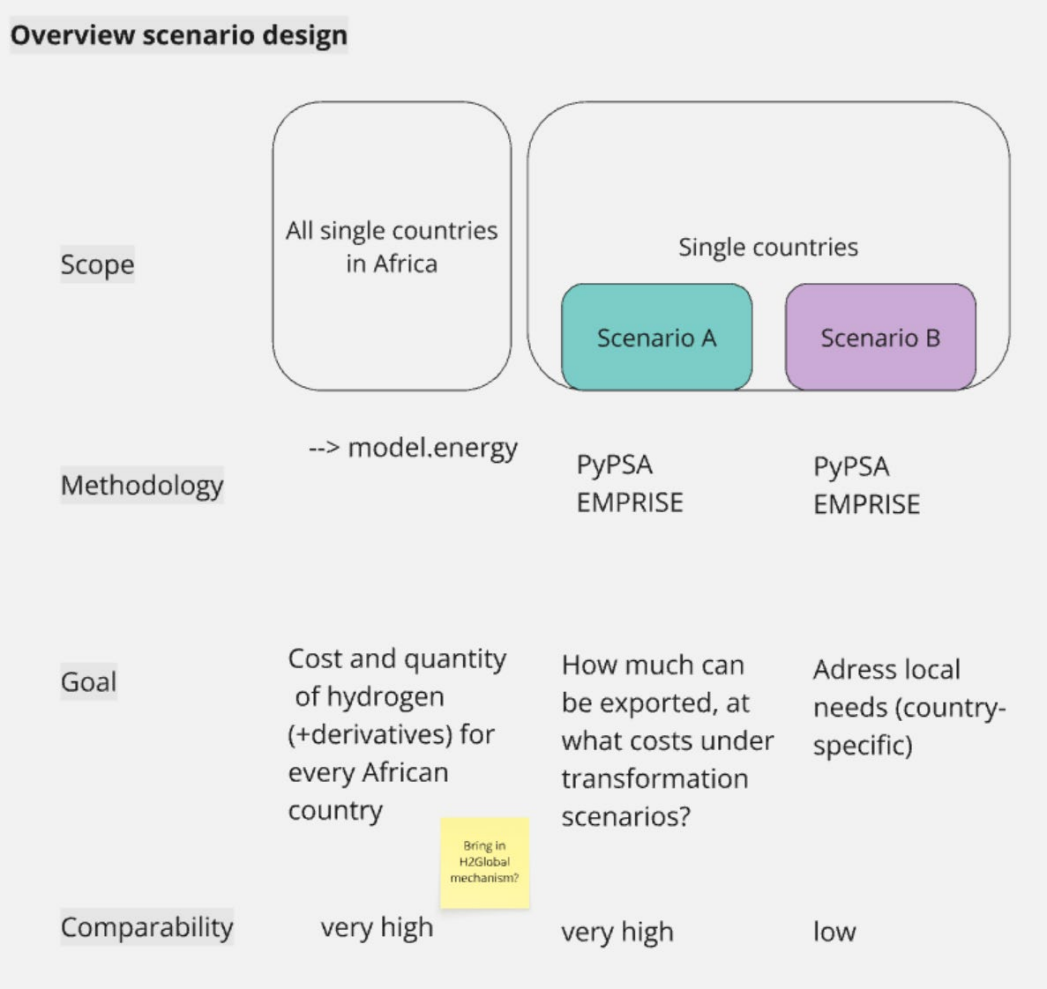
Scenario definition



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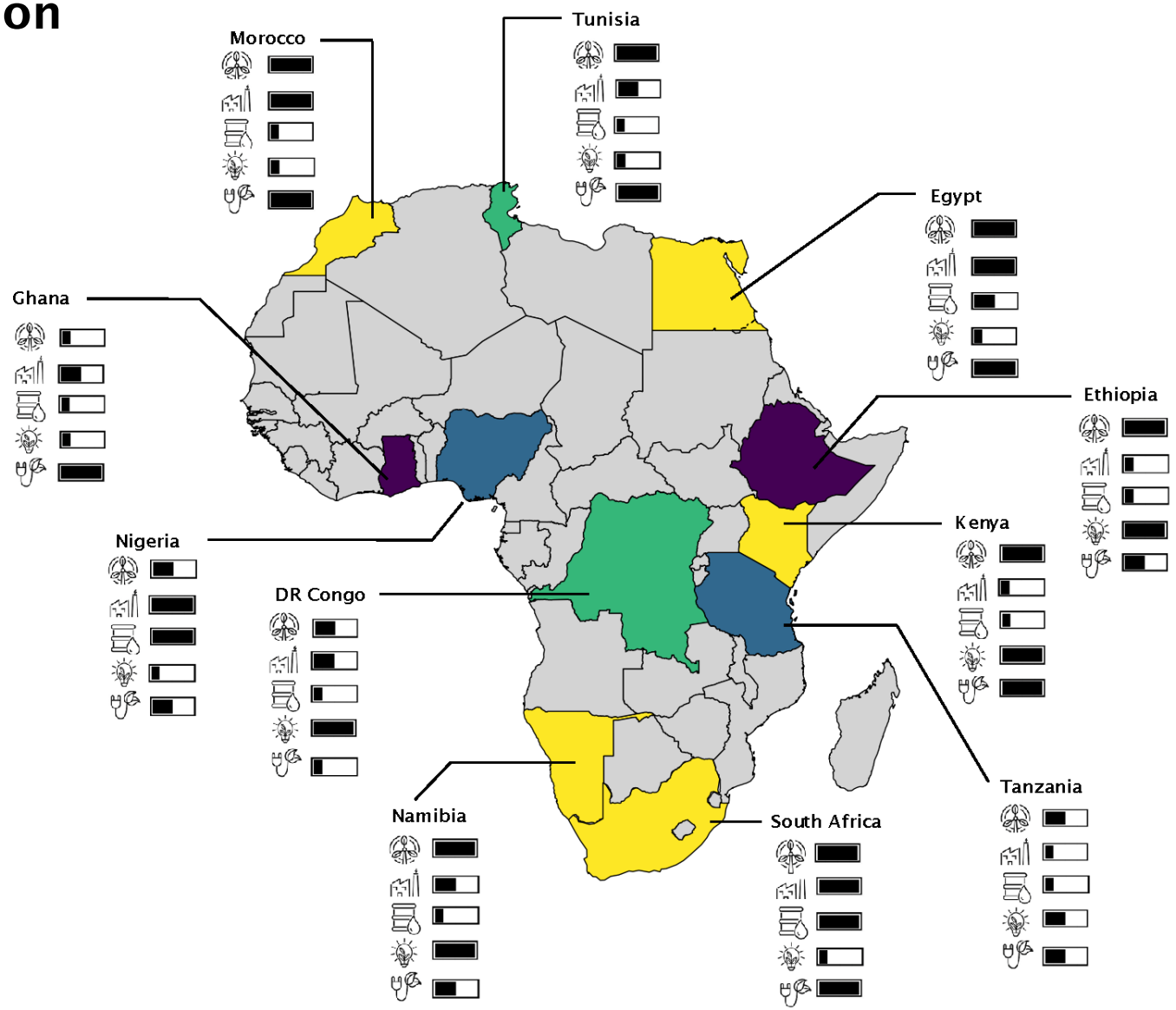
Country selection



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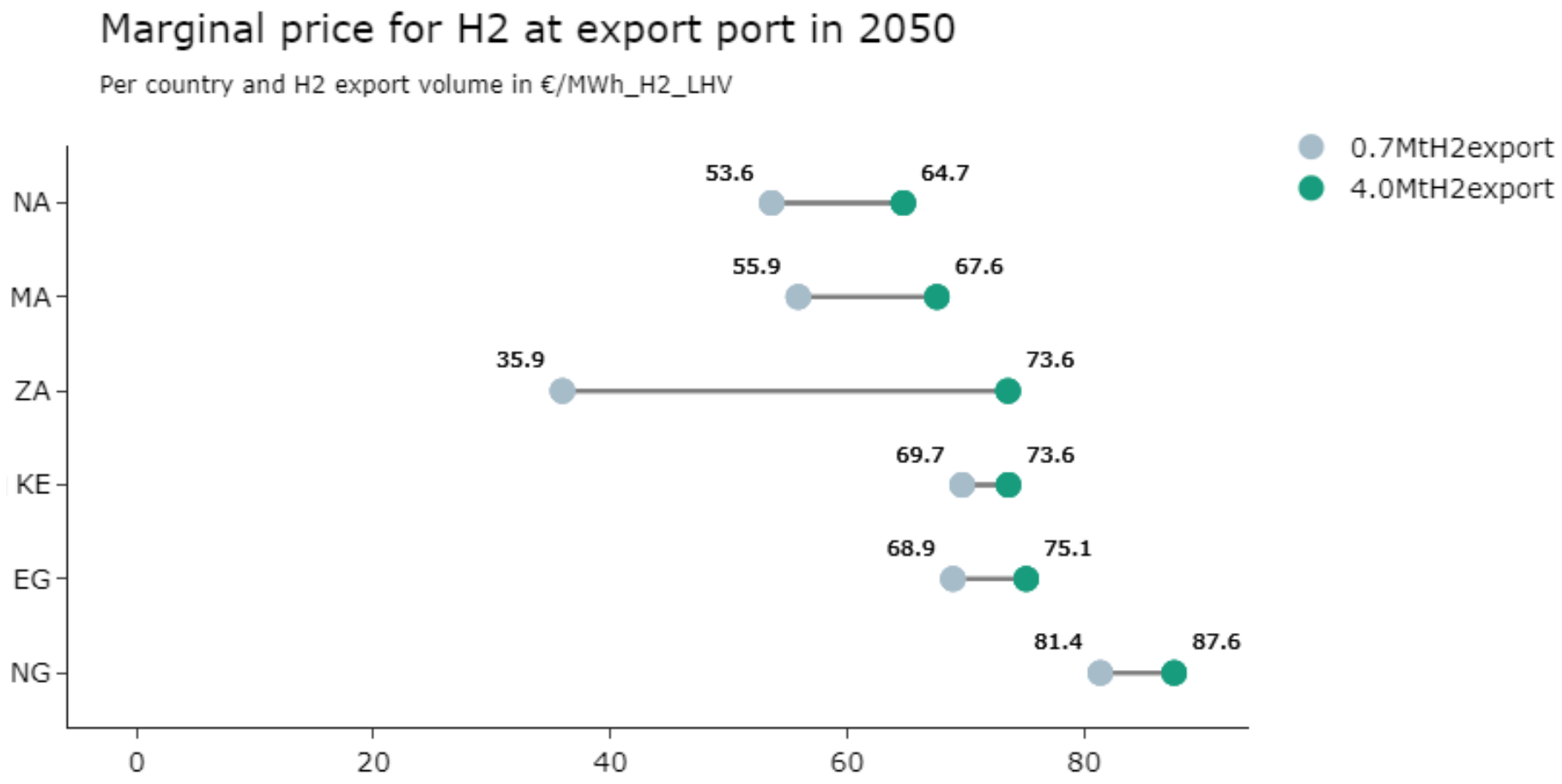
Initial results



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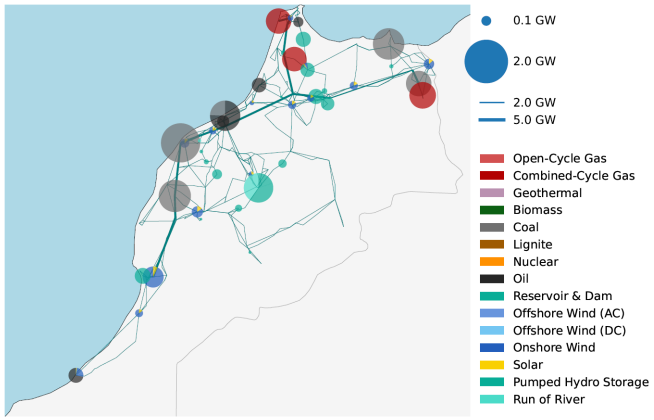
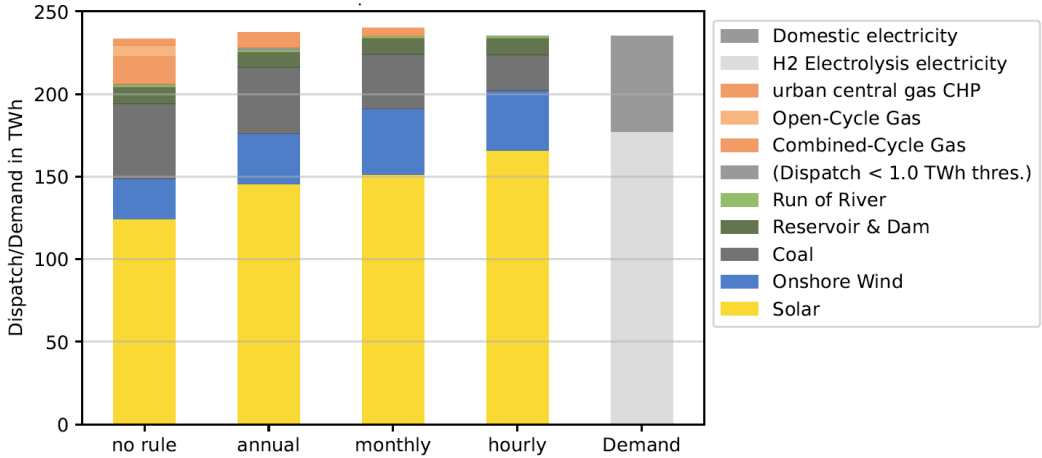
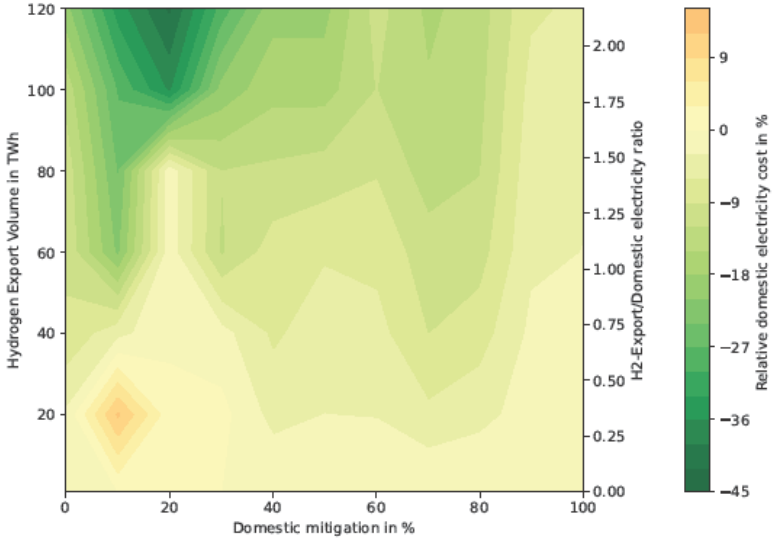
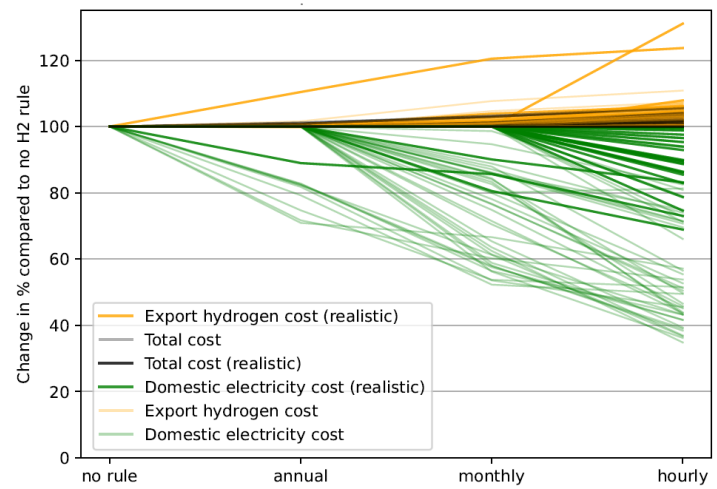
Country stories – Sneek peak









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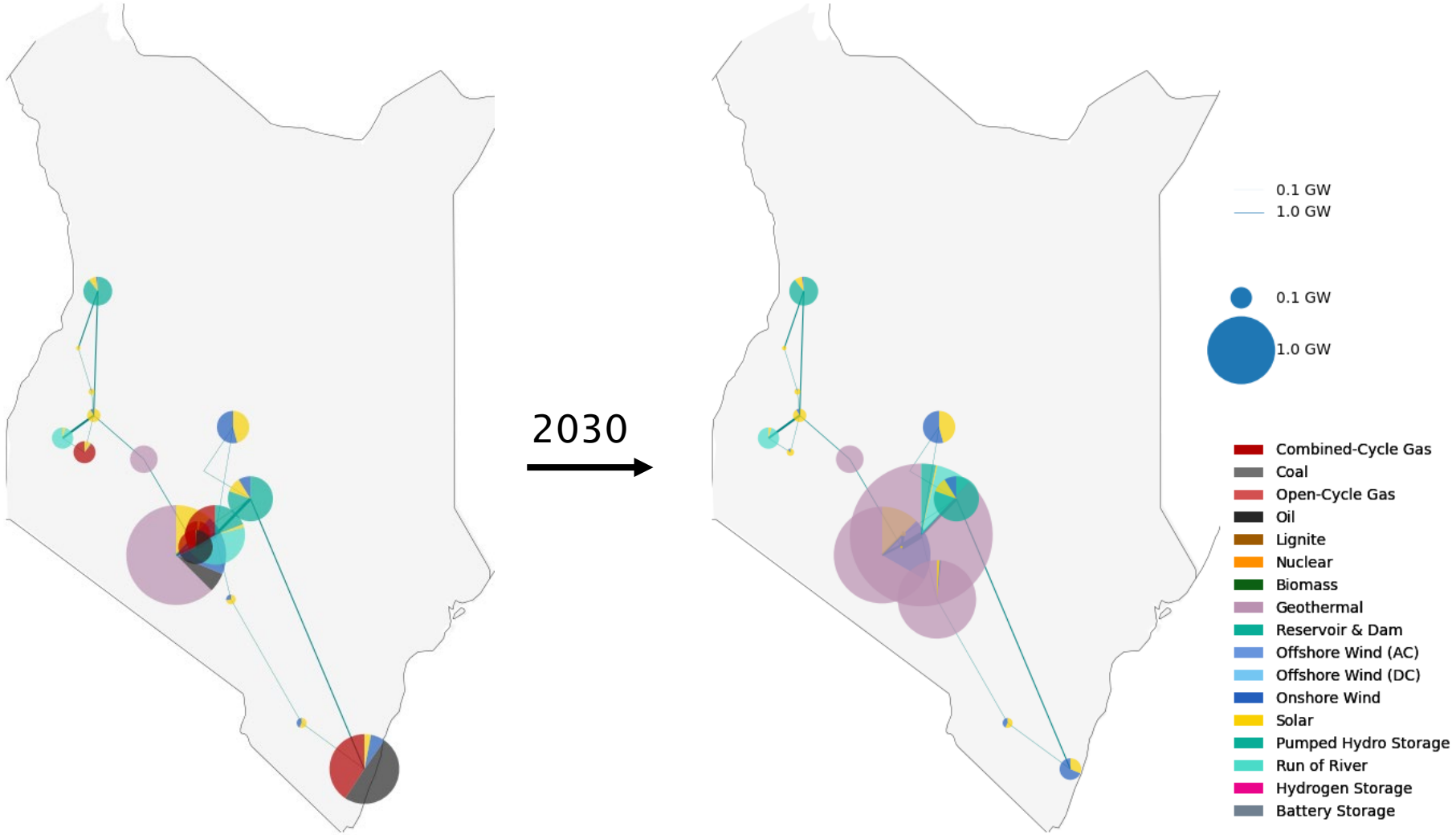
Country stories – Sneek peak



Additional 3.3 GW geothermal plant in Great Rift Valley

Cheapest source of energy

Potential use of the Great Rift Valley:

4.3 out of 10 GW

Source:: KenGen 2022.

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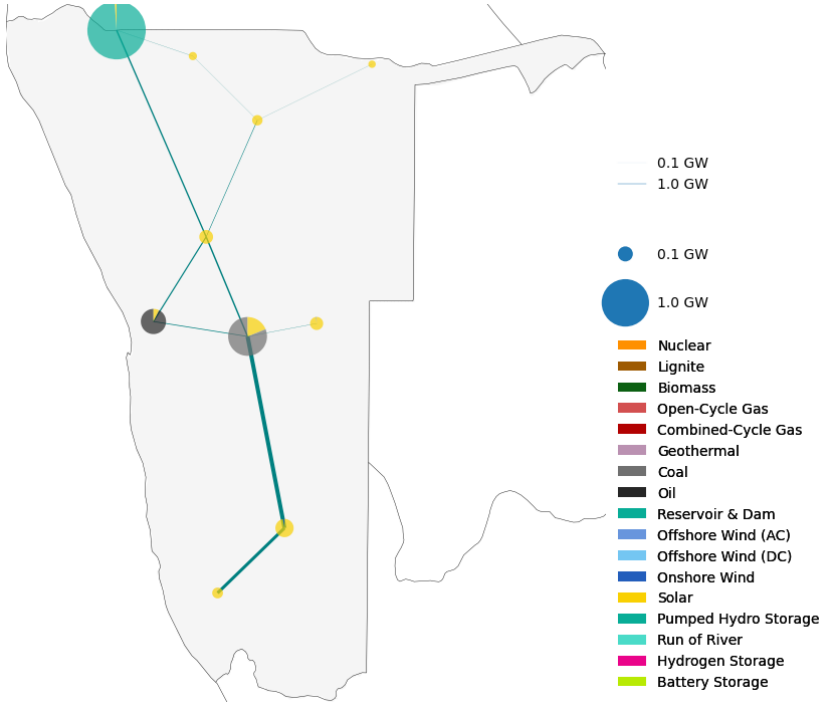
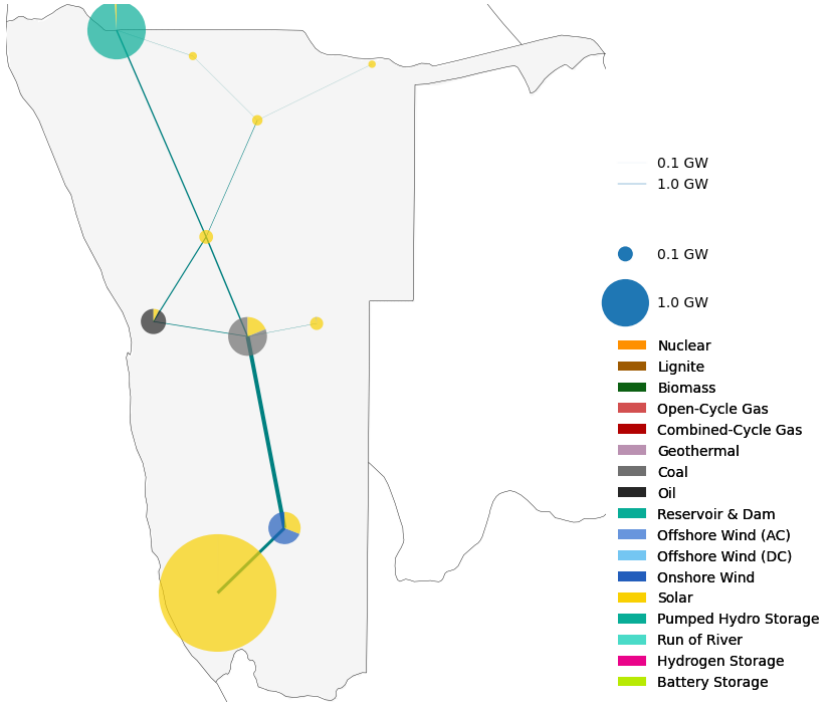
Country stories – Sneek peak



2030



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