

H2GLOBAL MEETS AFRICA

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H2Global meets Africa

Key facts

- Period: 01.01.2023 – 31.12.2025
- Budget: 4.2 Millionen €
- Funded by the Federal Ministry of Education and Research

Project partners



Associated partners





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

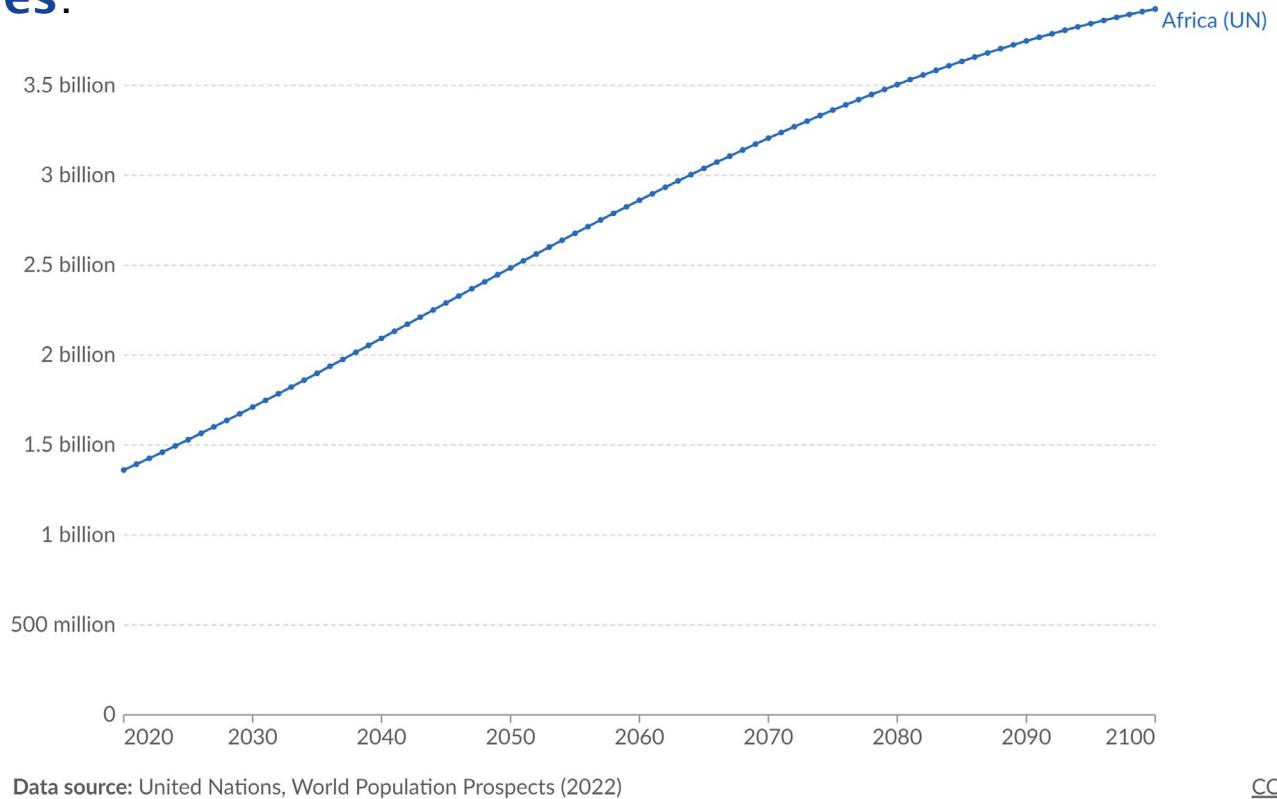
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Motivation

Continent of Africa is facing major challenges:



Population doubles by 2050



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Motivation

Continent of Africa is facing major challenges:



Population doubles by 2050



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



Average CO₂ per capita of 0.8 t
(advanced economies: 8 t)

The Final Question:

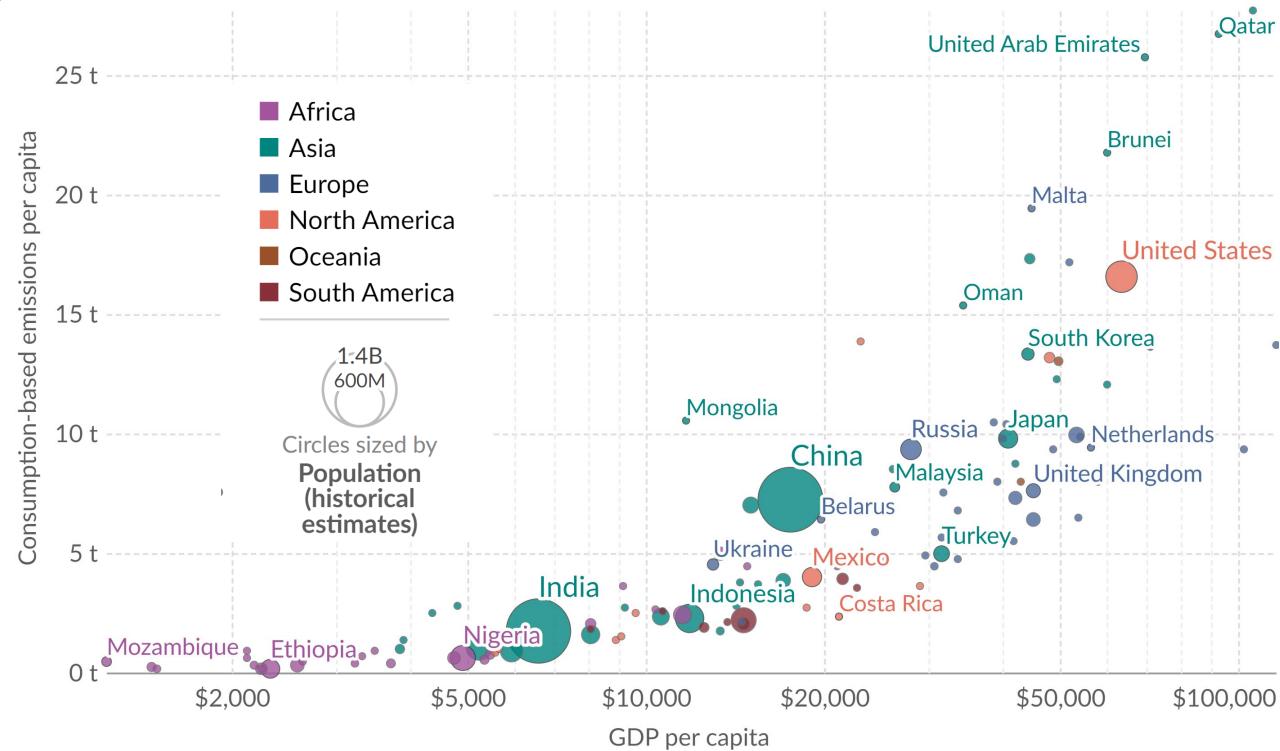
Not if net-zero by 2050 is possible, but how
with tenfold economic growth.

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

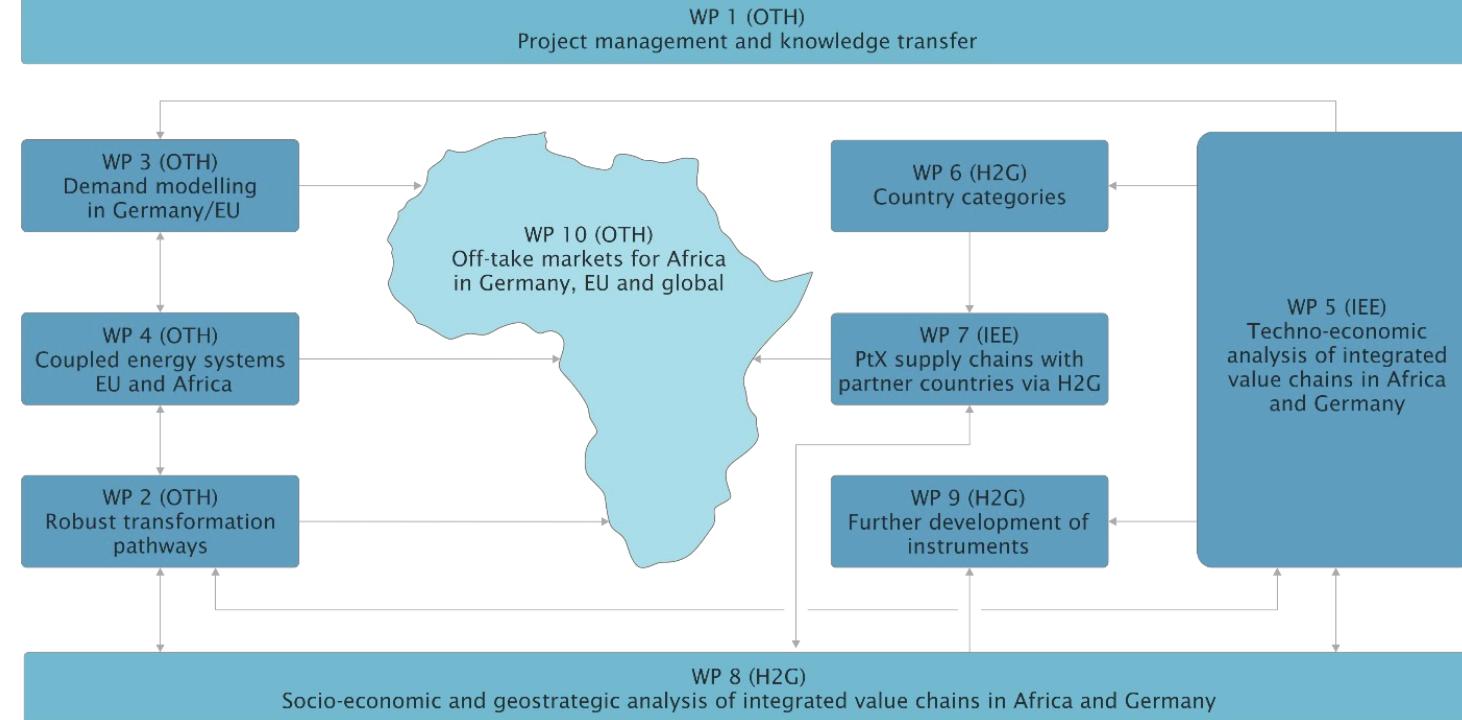
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Methodology

Goals:

-  Identify possible German-African green hydrogen partnerships
-  Bidirectional knowledge transfer
-  Evaluating specific H₂/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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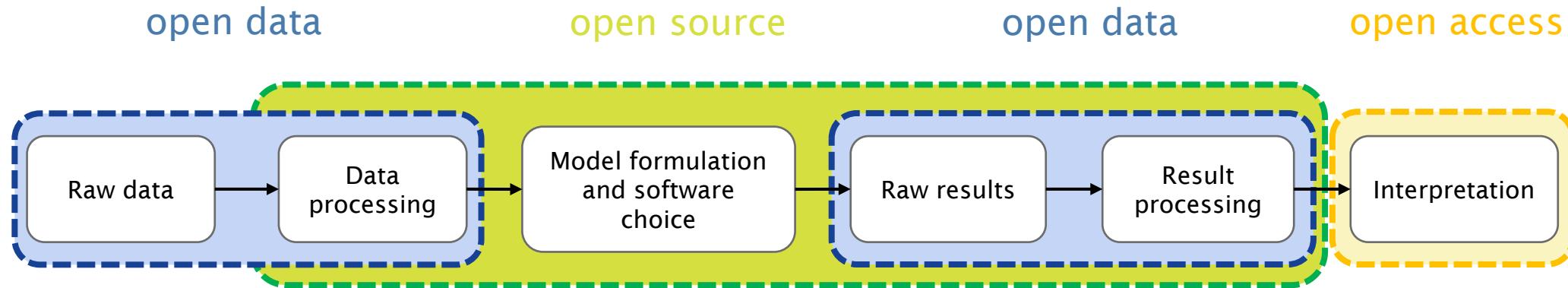
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Following the Idea of Open Energy Modelling

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



open data + free software → transparency + reproducibility

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Energy Transformation Pathways

Main Models:

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



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

Maximilian Parzen ^{a,*}, Hazem Abdel-Khalik ^b, Ekaterina Fedotova ^c, Matin Mahmood ^d, Martha Maria Fryszakli ^e, Johannes Hampf ^f, Lukas Franken ^a, Leon Schumm ^{h,g}, Leon Neumann ^g, Davide Poli ⁱ, Aristides Kiprakis ^j, Davide Fioriti ^{f,k}

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GRAPHICAL ABSTRACT



ARTICLE INFO

Dataset link: <https://github.com/pe-max/pypsa-earth-paper>

Keywords

Macro energy systems

Optimization

OpenStreetMap

PyPSA-Earth

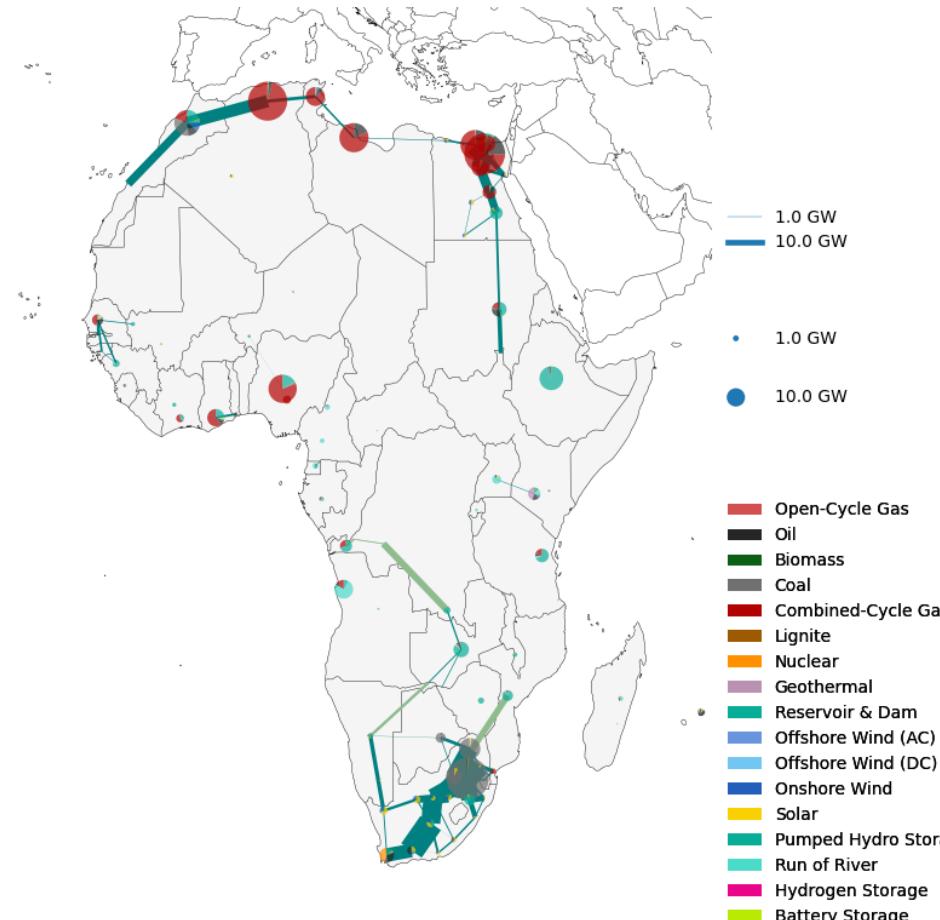
PyPSA-Africa

PyPSA-meets-Earth

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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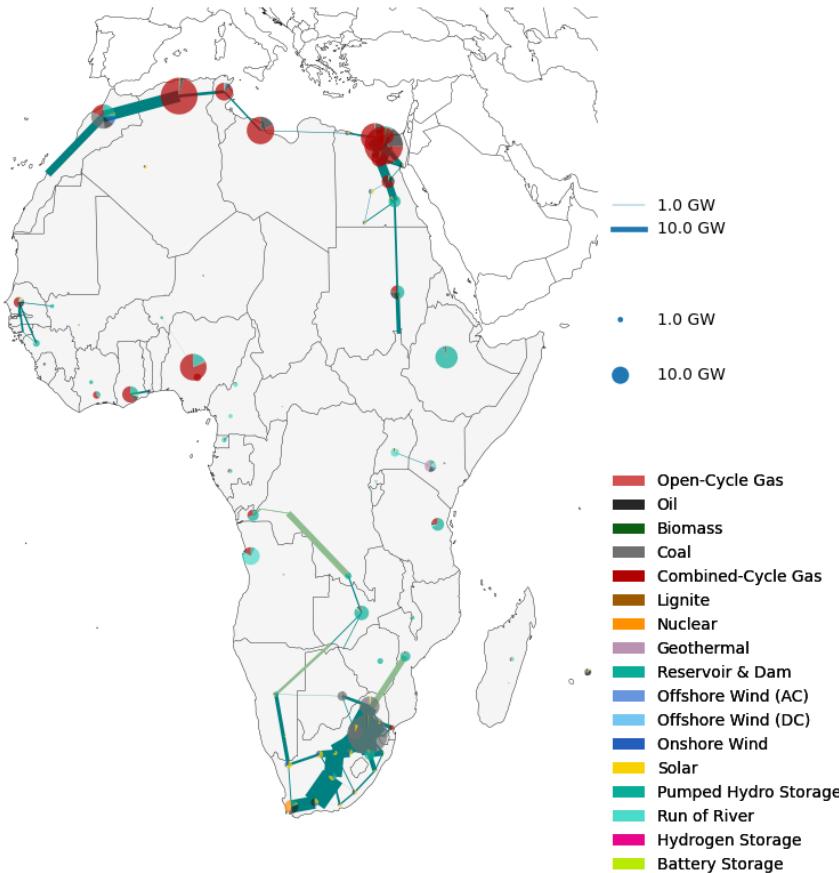
Model coupling Africa/Europe

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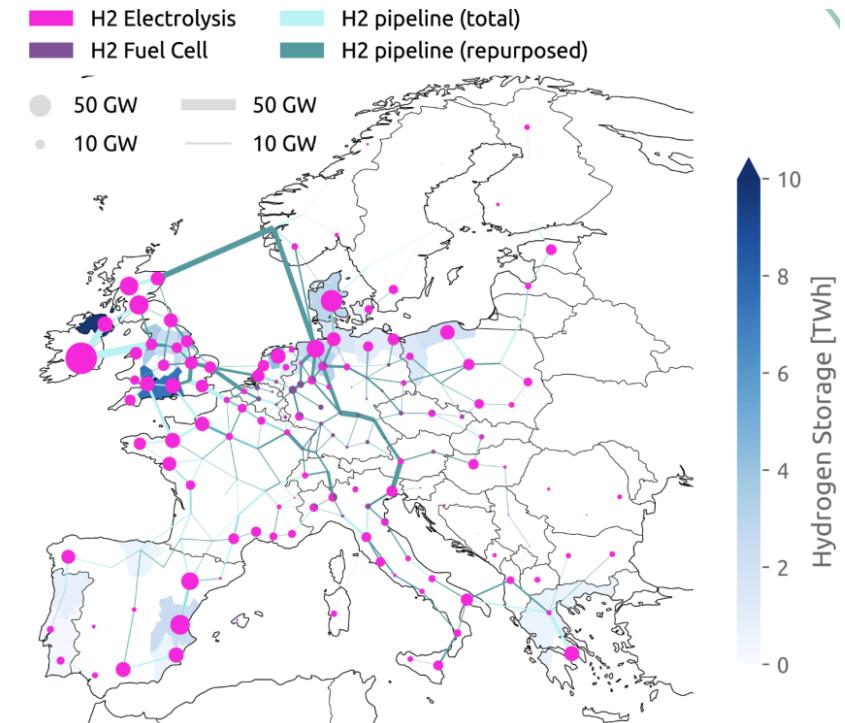


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Direct model coupling
↔
Common optimization of
selected countries



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

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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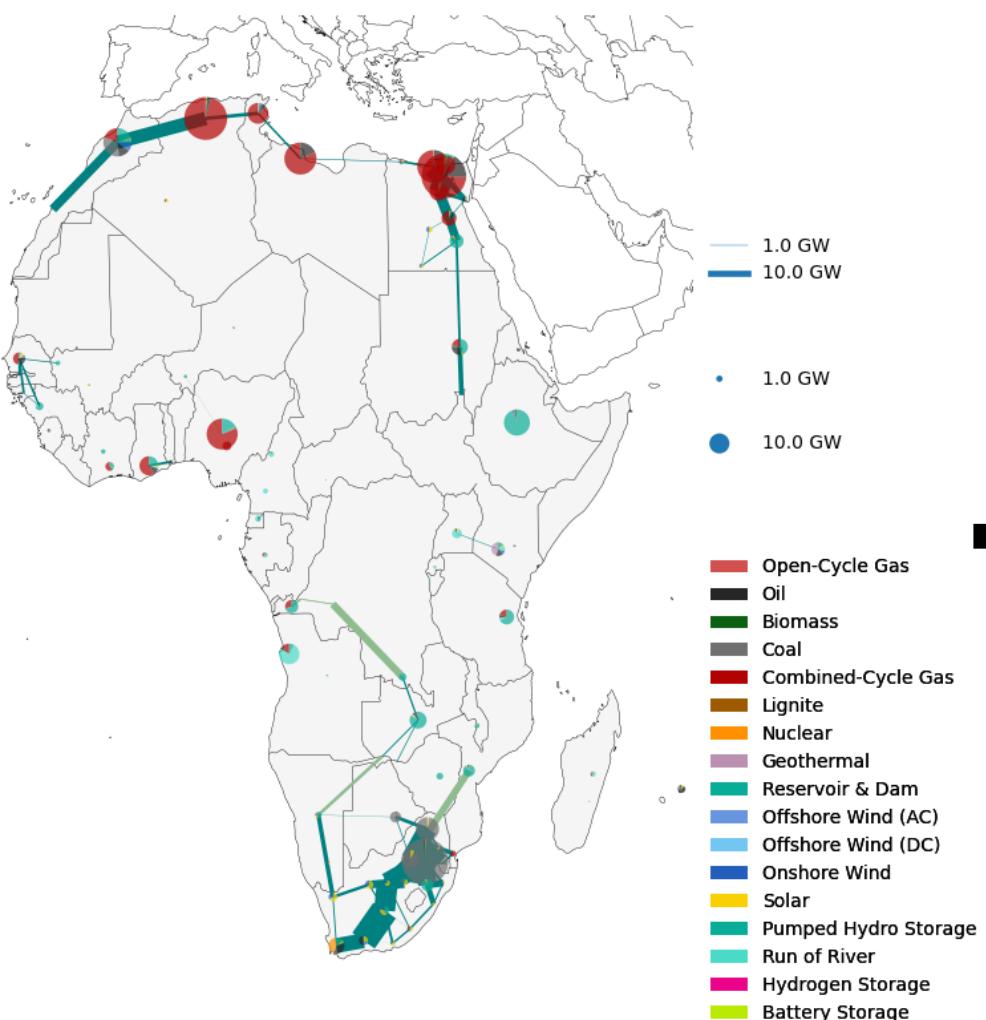
Results

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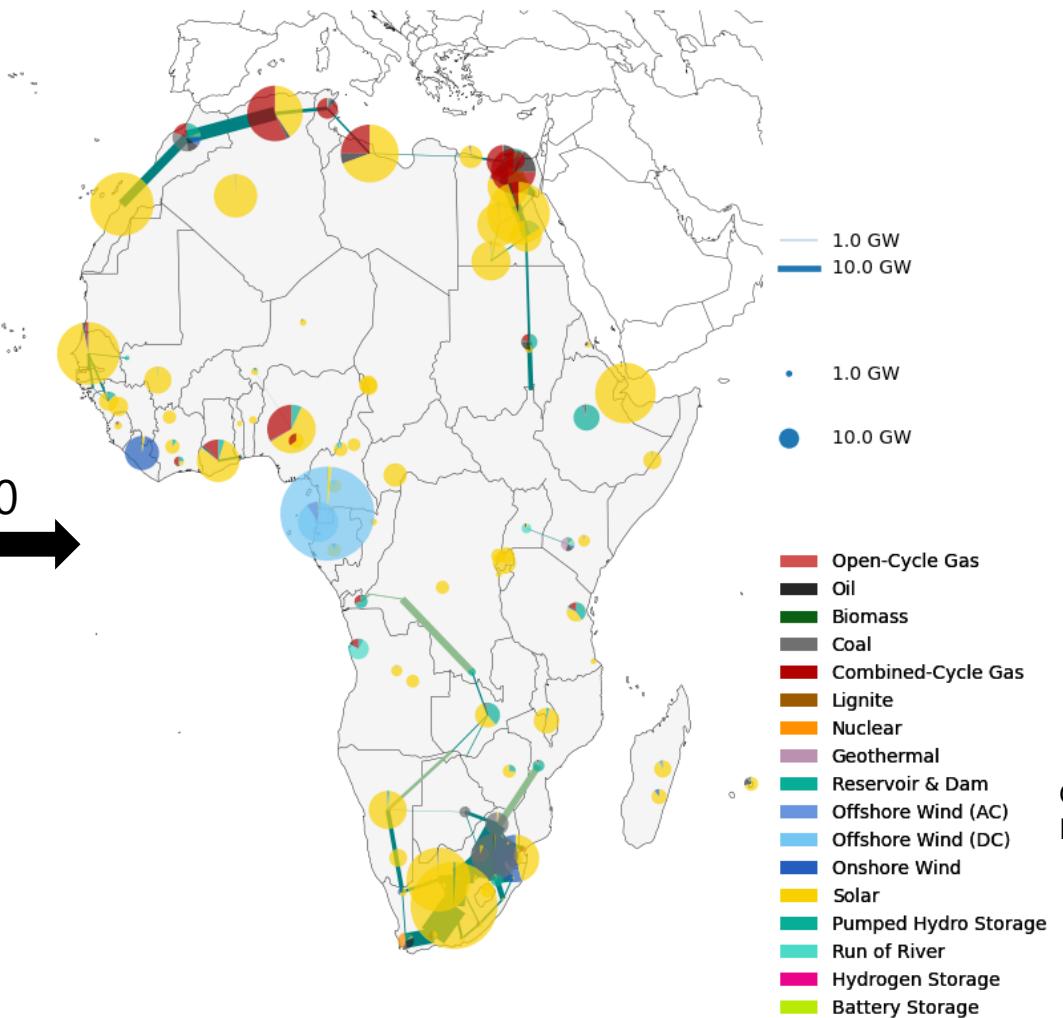
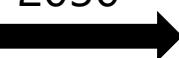


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2030



Check out
PyPSA-Earth here:



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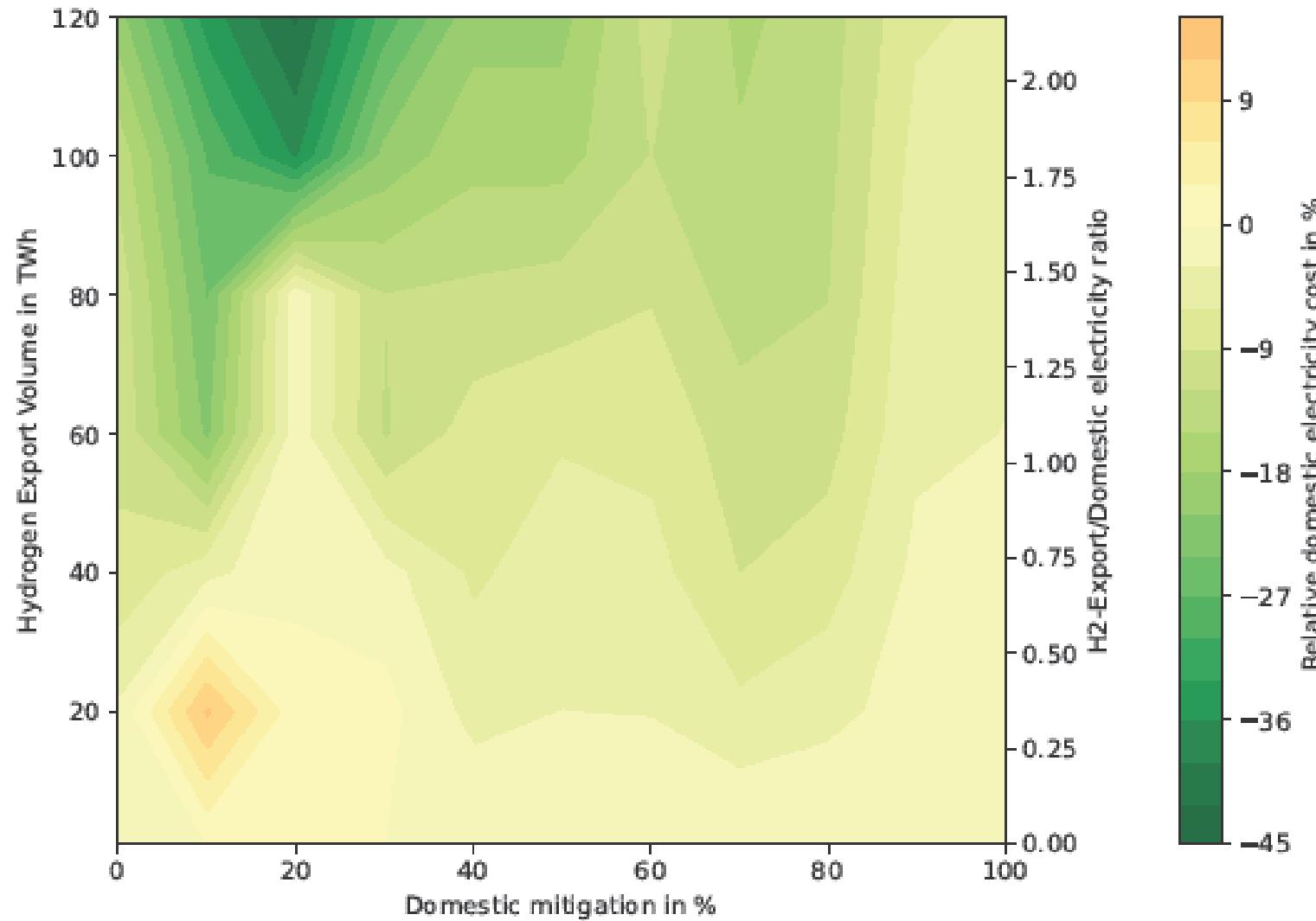
Results

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... a few more points

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Personal next steps:



Integrating desalination into PyPSA-Earth, apply it to **Namibia** and investigate the potential influence to fair partnerships.



Integrating GIS based hydrogen underground storage into PyPSA-Earth, apply it to **Tunisia** and investigate the influence of hydrogen underground storage on hydrogen exports.



Investigate hydrogen production in landlocked countries with regards to export difficulties and difficulties in water access (no desalination) for the case of **Ethiopia** with a focus on local value chains.

Further question to the audience:



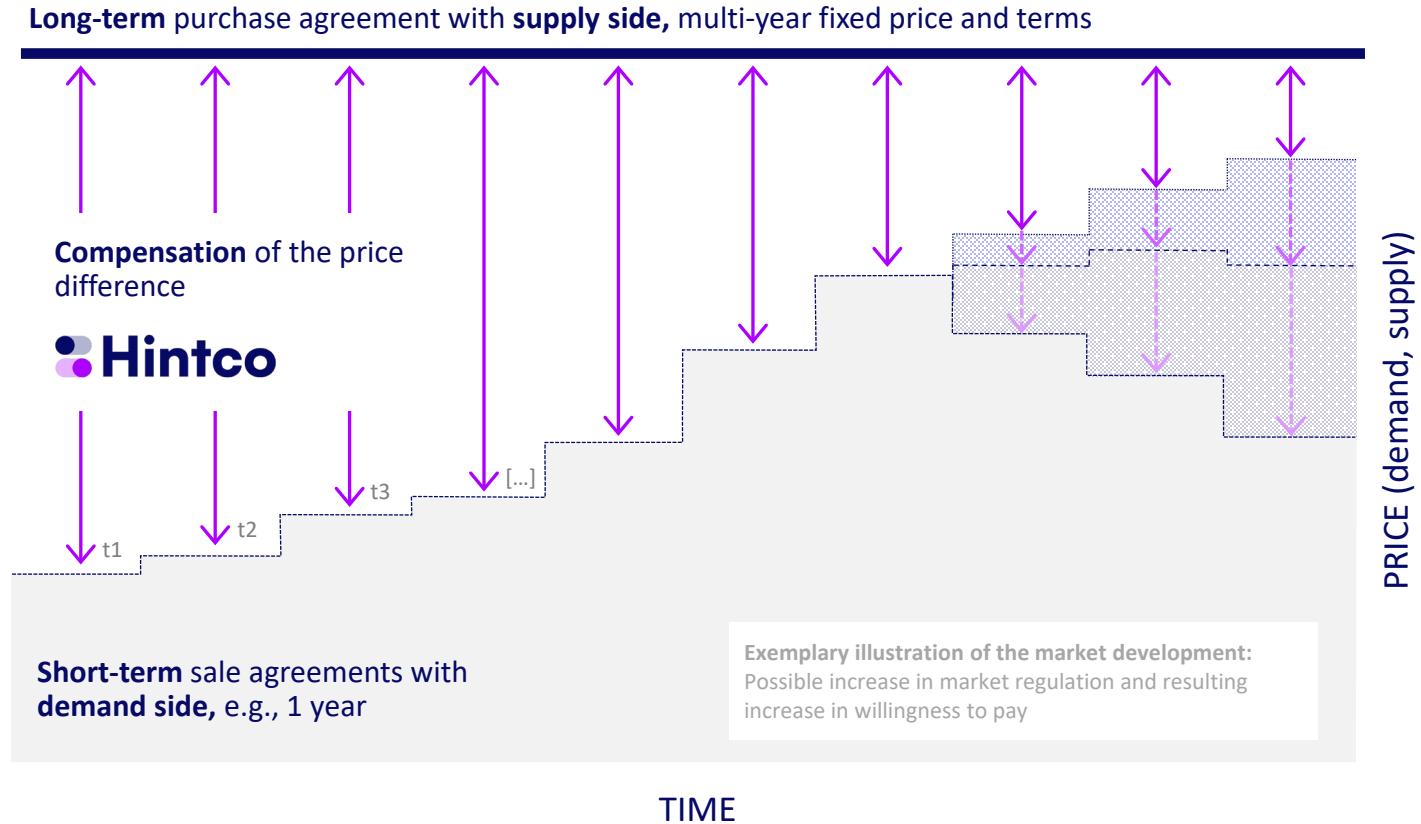
New EU > 90 % RE green hydrogen regulatory:
Does this regulation play any role in the choice of location for project planners?

The H2Global market-driven compensation mechanism ensures the most efficient use of funds for maximum impact

Core value of H2Global's auction design:

H2Global auctions **uncover supplier and offtake pricing dynamics.**

To create **liquidity** and support market development, **short-term and broad-based price signals** are **decisive**.



H2Global Foundation

First Results of Country Clustering

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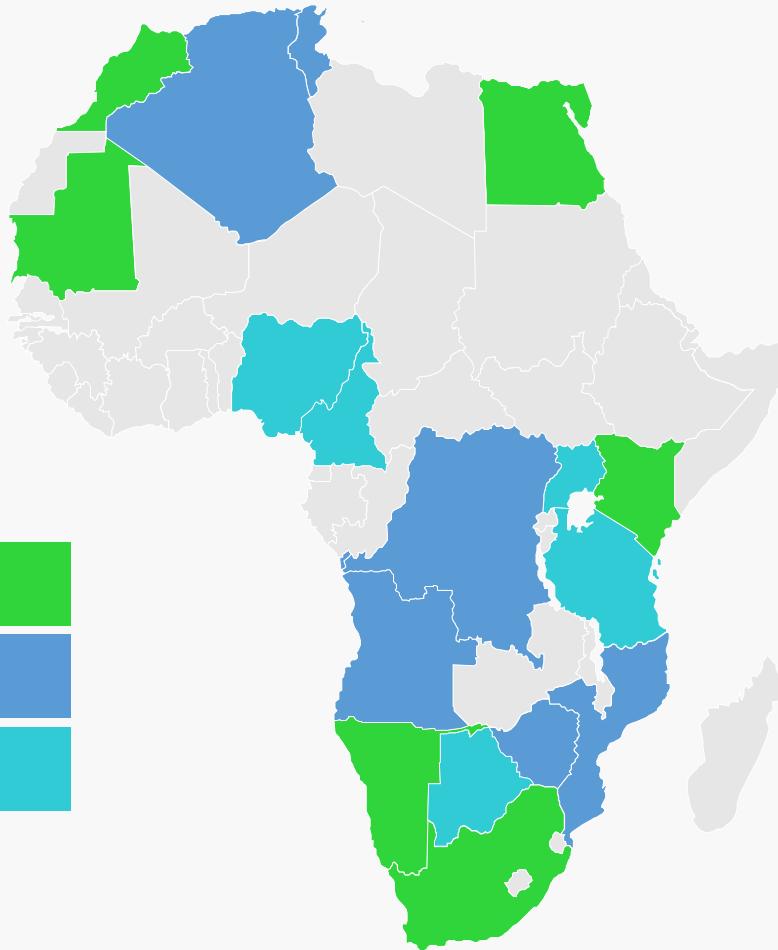


Federal Ministry
of Education
and Research

Front runners

Upcoming stars

Strong Foundation



Country Clustering

Based on socio-economic potential to produce renewable hydrogen.

Six Dimensions

- Renewable hydrogen commitment
- Renewable energy potential & water availability
- Domestic anchor demand
- Terminals
- Sea access
- Country risk

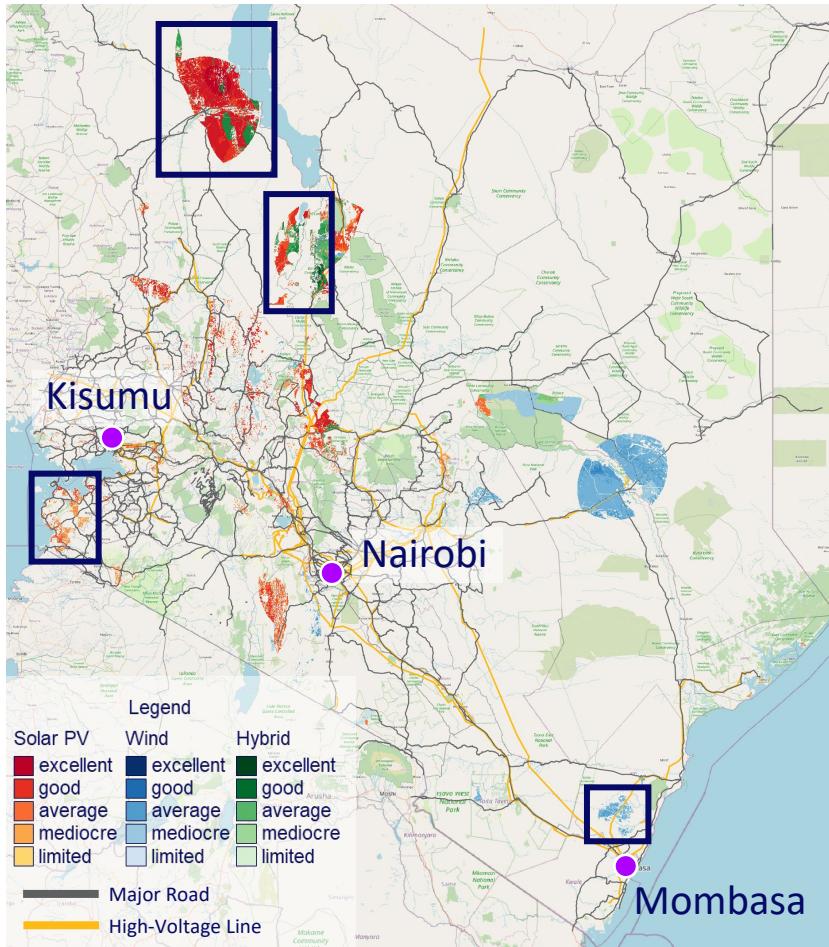
Clustering Approach

- Method: Hierarchical clustering
- Agglomeration of 55 countries in seven steps
- Final cluster step results in four clusters

- Collaboration with the African Development Bank through a short-term research consultant
- Stakeholder workshop in Cape Town planned for Q1 2025 to discuss finance for clean H2 projects in partnership with World Bank

H2Global Foundation

Working on a White Paper about Kenya



Title: “Techno-economic Assessment of the Potential to Produce Hydrogen in Kenya”

- 1** GIS-based land eligibility analysis for Kenya conducted by Fraunhofer.
- 2** Stakeholder engagement rounds to validate and select case studies.
- 3** Site optimization, i.e., installed capacities, conducted by IEE Fraunhofer.
- 4** Financial modeling by H2Global to evaluate economic viability.
- 5** Discussion of “hydrogen opportunities” and potential support instruments

Consortium



H2Global

Fraunhofer
IEE



**Center on
Global Energy
Policy**

Planned publication: Early 2025

Fraunhofer Institute for Energy Economics and Energy System Technology (IEE)

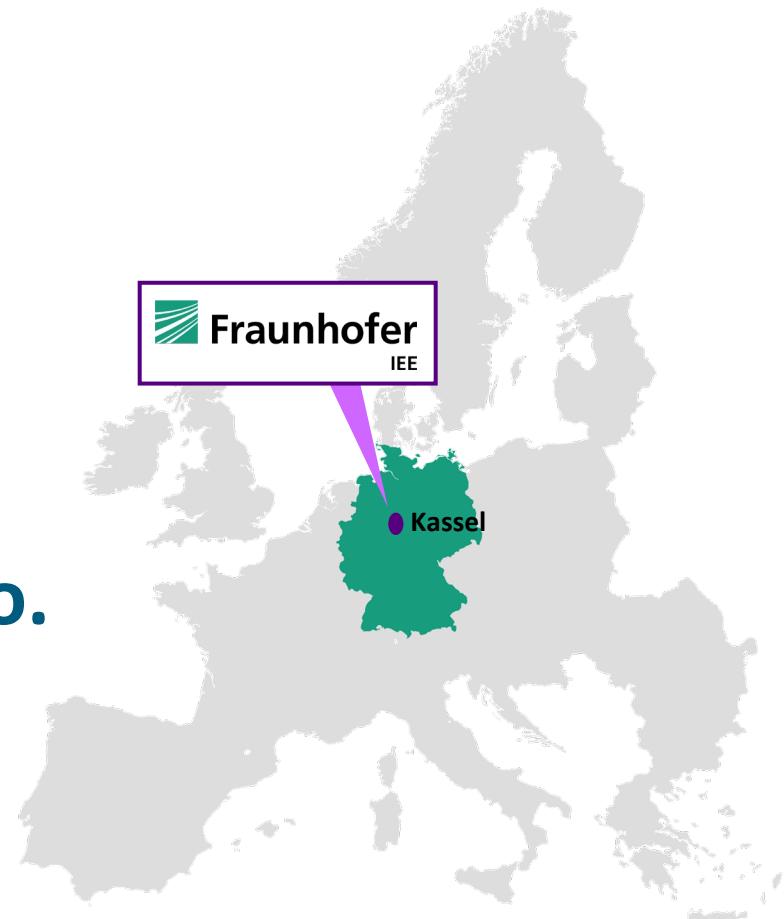
We develop technical and economic solutions for the energy system transformation.



About **450**
Employees



€ 30 Mio.
Annual Budget



The Fraunhofer-Gesellschaft is a leading applied research association.
It consists of 74 institutes in Germany. In addition, there are further associated organisations worldwide.



Grid Planning and Grid Operation

Grid Stability and
Power Converter Technology

Energy Process
Engineering

Thermal Energy
Technology

Energy Informatics

Energy Economics and
System Analysis

Energy Meteorology and Renewable
Resources



Fraunhofer IEE is responsible for the work packages 5 & 7

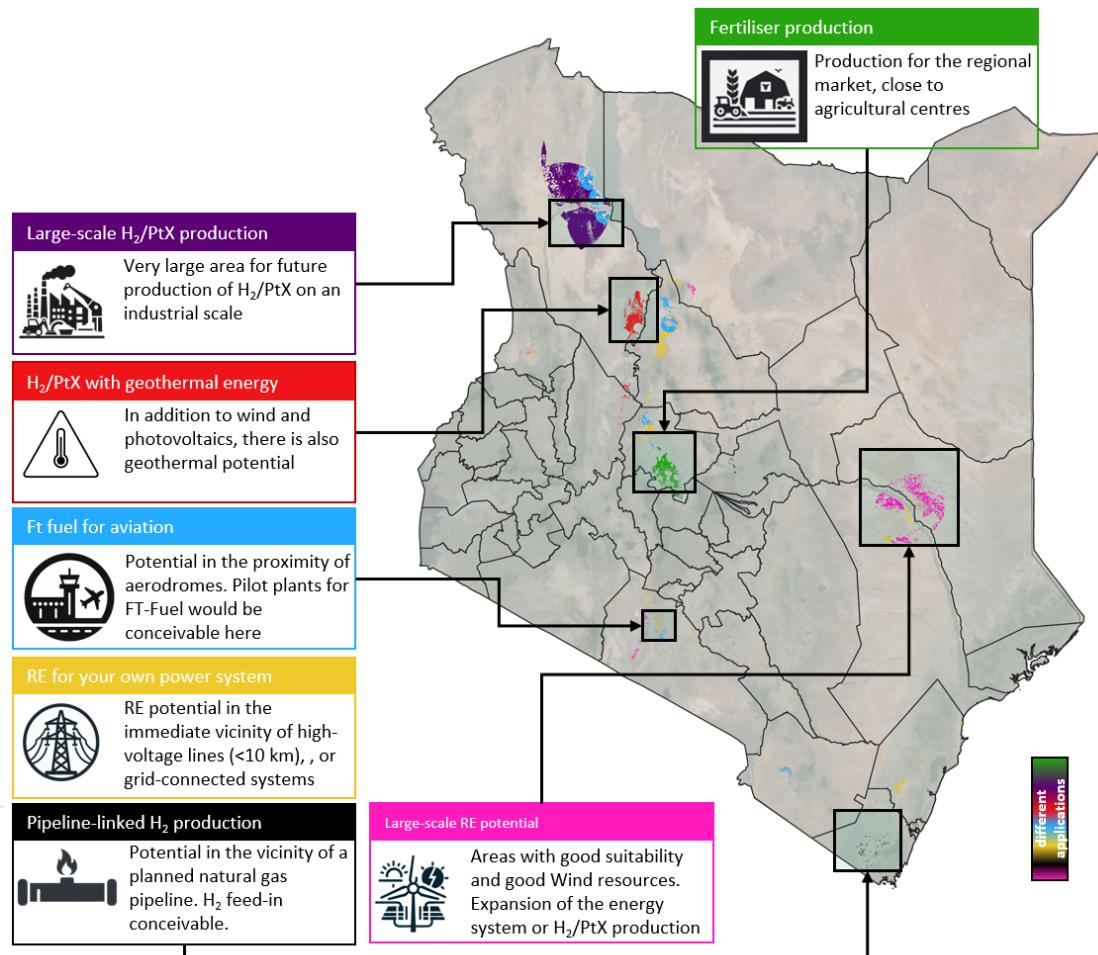
WP5: Techno-economic analysis of integrated value chains in Africa and Germany

- * GIS-based area analysis and GIS-based EE time series generation
- * Suitability assessment of PtX production regions
- Determination of product quality level
- Techno-economic analysis of large-scale island systems
- * National and international transport of PtX fuels
- Transformation path of the EU gas system
- Shifting effects in the PTX value chain

WP7: PtX supply chains with partners countries via H2G

- Model construction for plant expansion at the reference site
 - Short-term Ammonia, Methanol and Power-to-Liquid
 - Analyse infrastructure requirements in the short and medium term

GIS-based area analysis and GIS-based EE time series generation; Suitability assessment of PtX production regions



National and international transport of PtX fuels

Evaluation of PtX transport options between Africa and Germany (pipeline, shipping) from an Energy System Analysis perspective

Focus on mid-term (2035): Ammonia and Methanol

In the long-term (2050) also other derivatives

Methodological: Consideration of transport delay; engagement of port infrastructure; intermediate storage

H2Global meets Africa

Contact us!

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