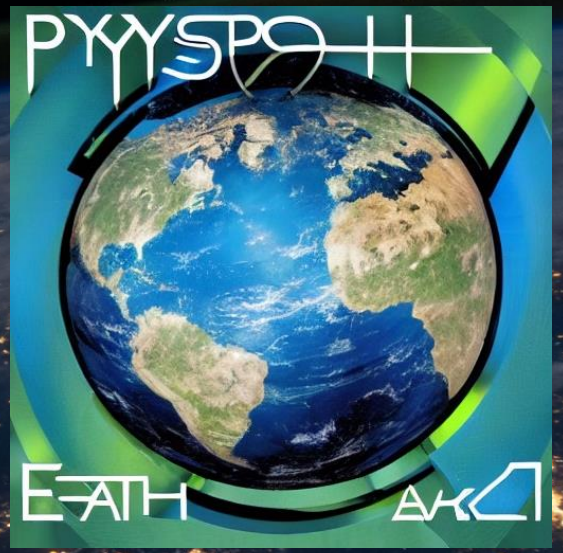
AI 'n' Digital Twins for Net-Zero Energy System Planning



06.03.2023

Maximilian Parzen

PyPSA meets Earth

OPEN Global Independent Research Initiative

SOLVER

Help sustaining

Support developers

Reveal bottlenecks

Initiate new paths

ENERGY SYSTEM MODELS

High resolution

Features

Performant

Problem formulator

Modular

DATA

Creating open data

Predicting data

Data workflow

High resolution

USER AND DEVELOPER COMMUNITY

Open

Collaborative

Dialogue

Training

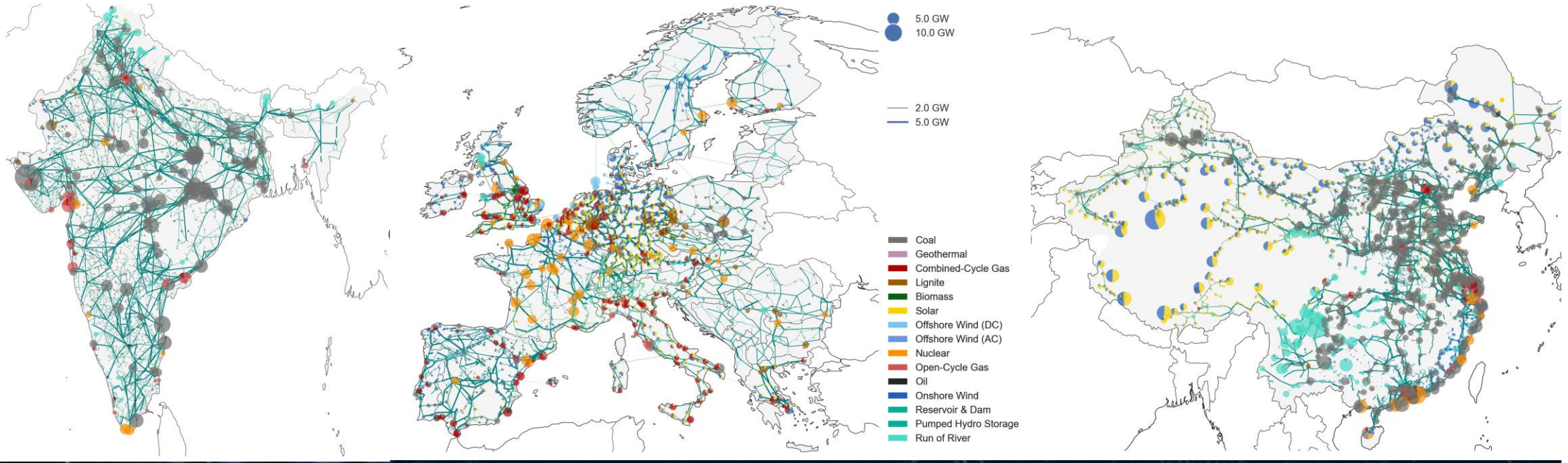
Empower

AI 'n' Digital Twins for Net-Zero Planning

Digital Twins as Planning Foundations

PyPSA meets Earth

THE UNIVERSITY OF EDINBURGH



Own illustrations shared in: https://forum.openmod.org/t/13-power-systems-around-the-world/3528

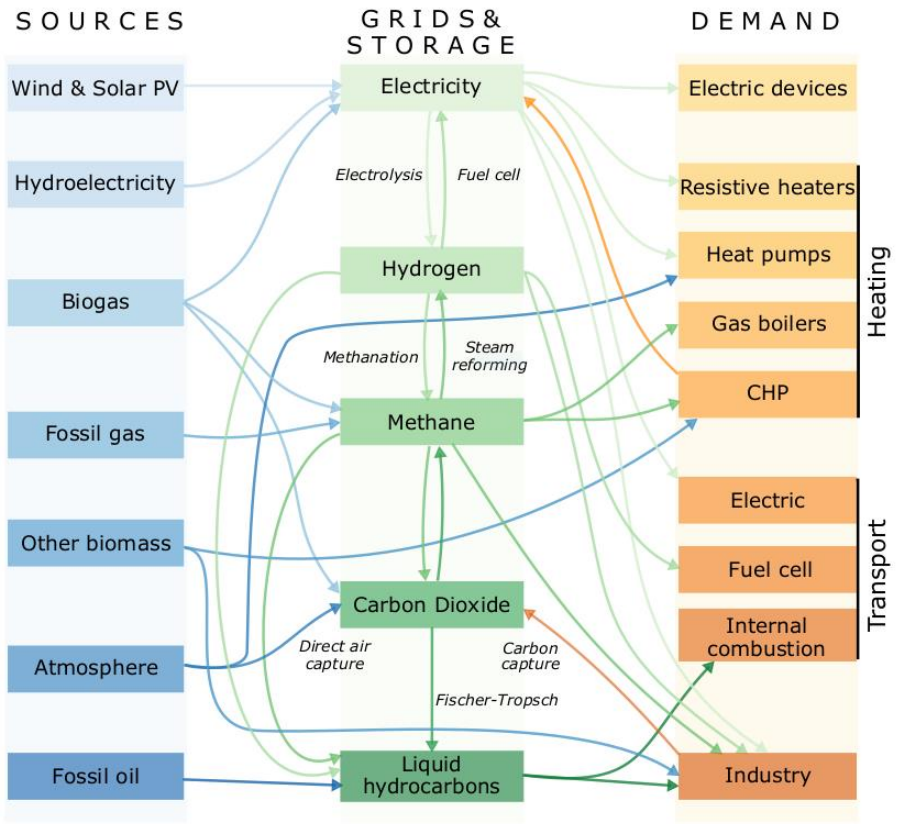
AI 'n' Digital Twins for Net-Zero Planning

What do these models include?

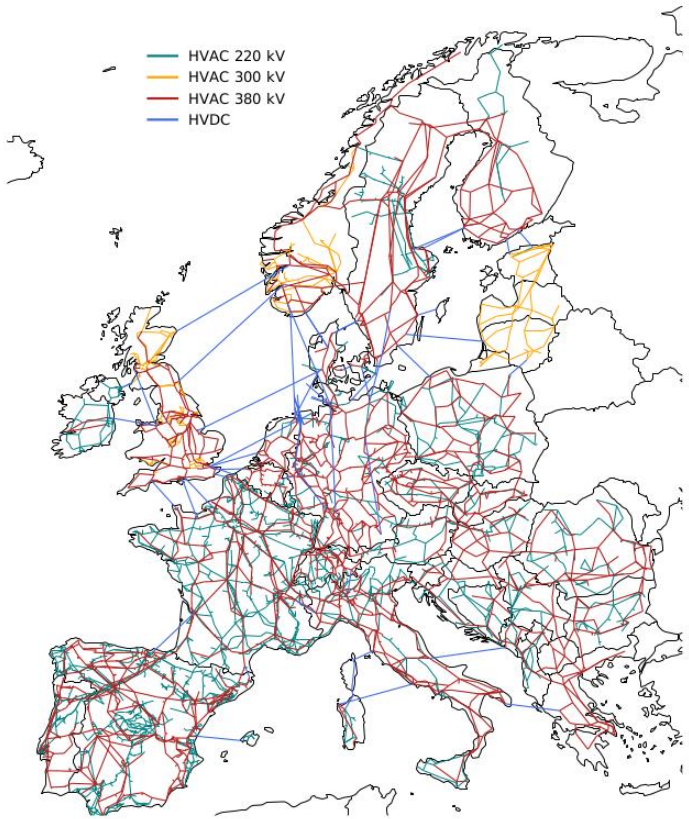
What is PyPSA-Eur-Sec?

Technische Universität Berlin

Model for Europe with all energy flows...



and bottlenecks in energy networks.



PyPSA meets Earth

The University of Edinburgh

AI 'n' Digital Twins for Net-Zero Planning

EXAMPLES

PyPSA meets Earth

PyPSA example: TransnetBW used PyPSA-Eur-Sec

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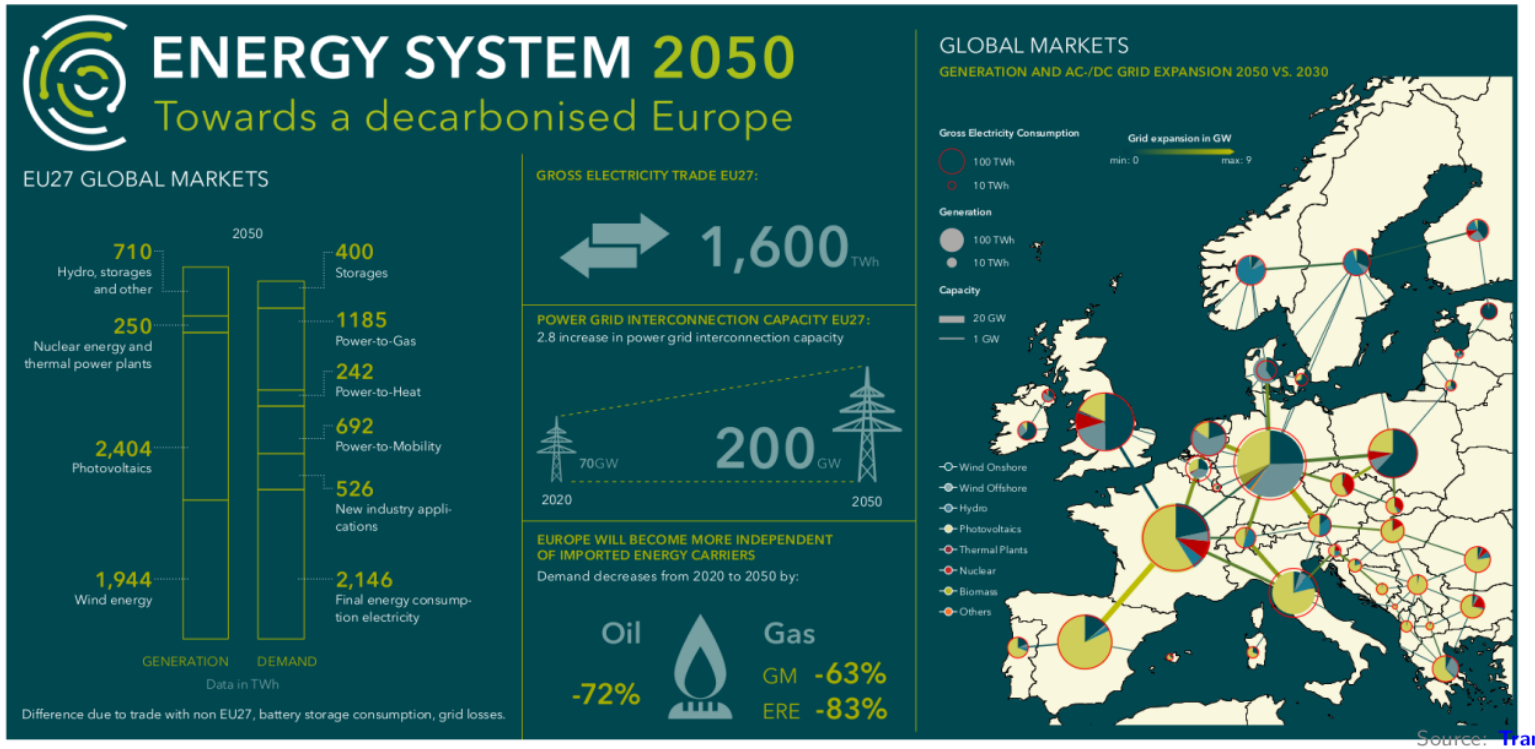
German **Transmission System Operator (TSO) TransnetBW** used an open model (PyPSA-Eur-Sec) to model the European energy system in 2050. Why? Easier to build on an existing model than reinvent the wheel.



Source: TransnetBW, 2022

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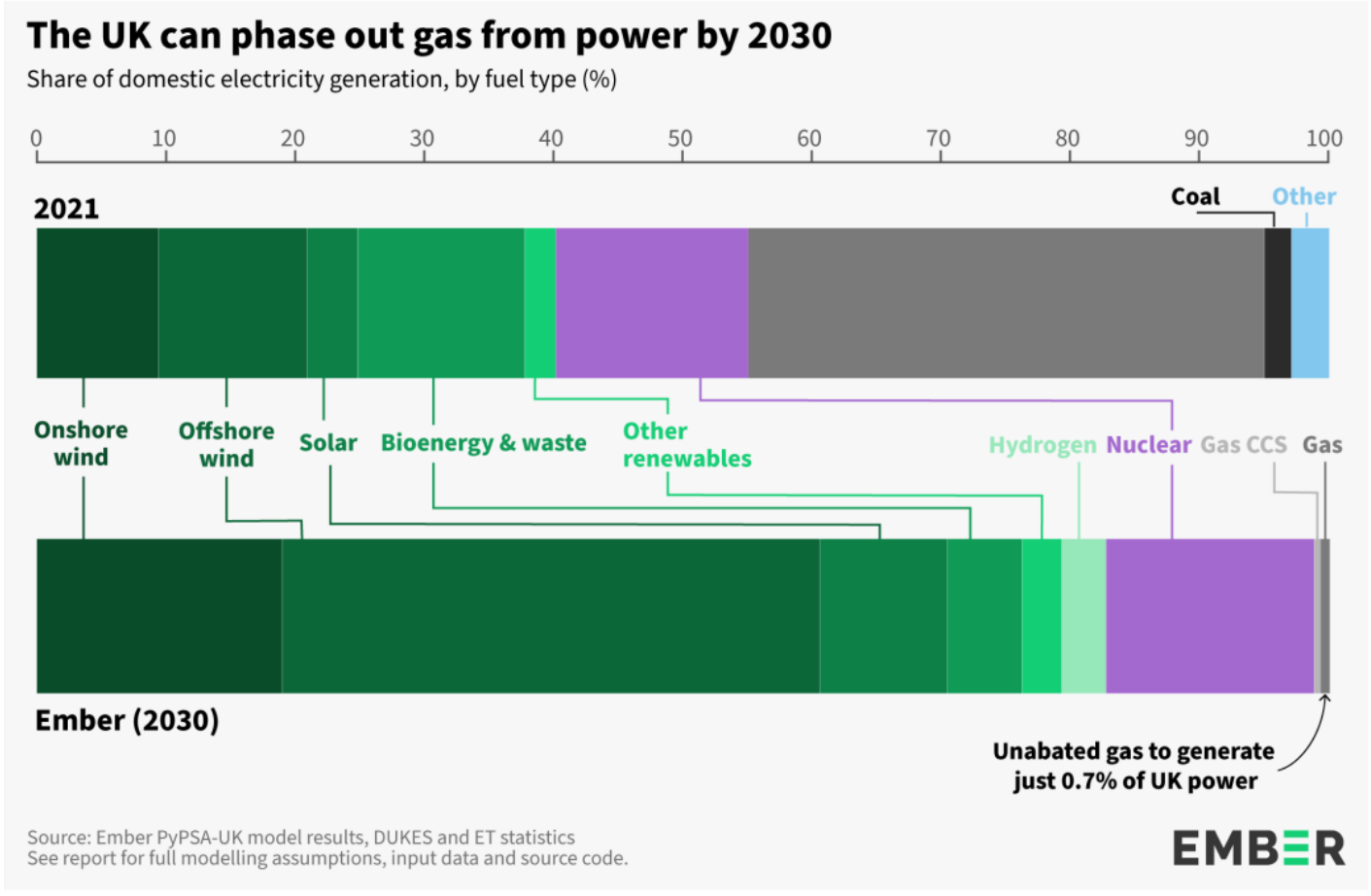
EXAMPLES

NGO Ember used PyPSA to model a gas phase out in the UK by 2030, releasing all code on **github**.



Source: **Ember, 2022**

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EXAMPLES

PyPSA meets Earth

With e-fuel imports instead of autarky

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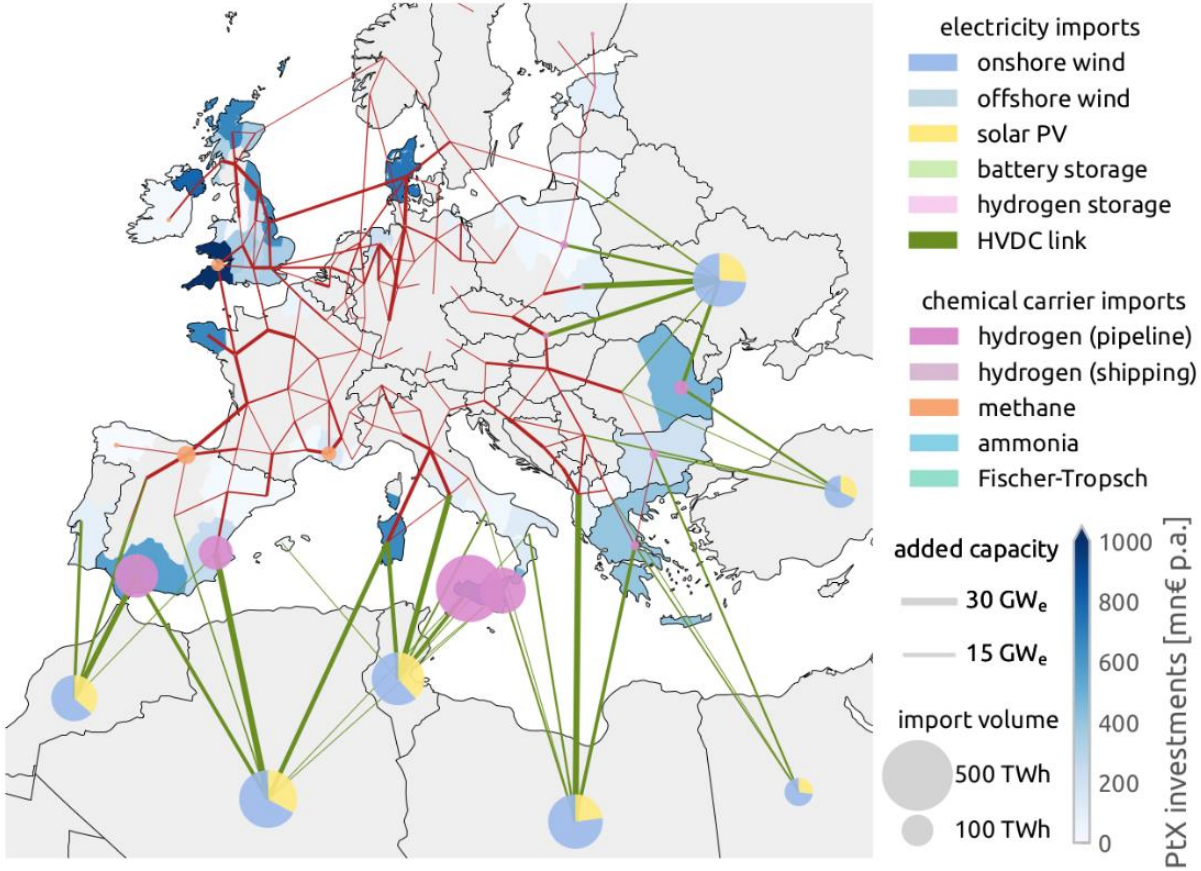

- Allowing imports of electricity, green hydrogen, e-fuels, **changes infrastructure needs completely**
- PtX out-sourced from Europe
- Electricity imported too, providing seasonal balancing

Source: Hampp, Brown, Neumann; 2022/3

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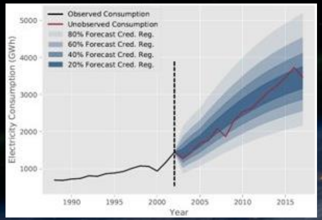
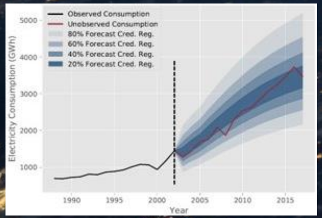
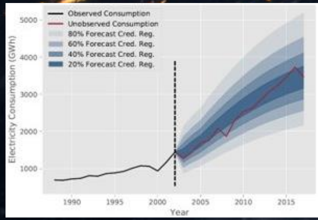
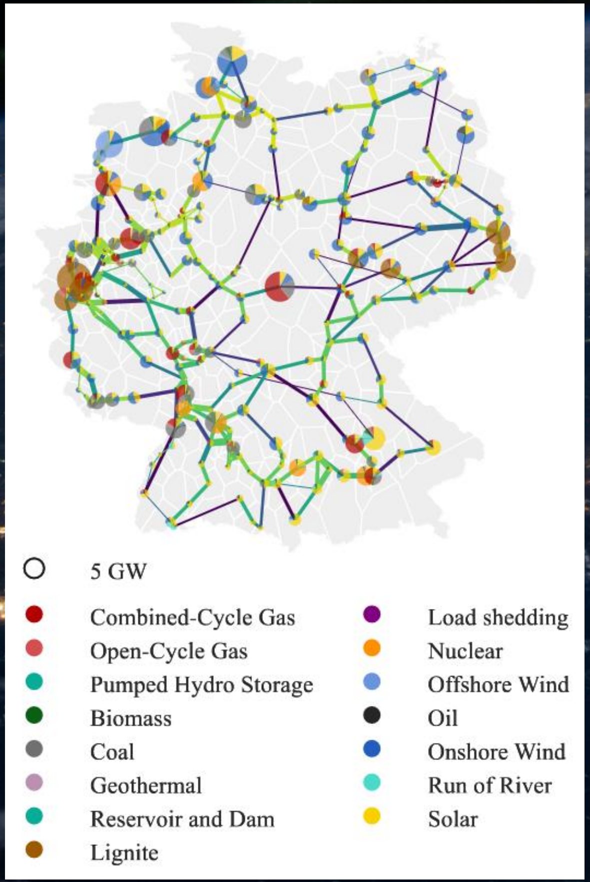
Intelligent Demand Prediction









PROBLEM

- **Energy system planning** in EU based on poor demand data

SOLUTION

- **AI prediction** of electricity demand with big data

IMPACT

- **Faster and better** energy system planning
- **Accelerated** renewable energy expansion
- **More affordable** electricity and energy
- **Reduction** of CO_2 emissions
- **Solution** global useful and improving over time

USERS: UoE, GE, NationalGrid, SSE, UK Gov, ...

AI 'n' Digital Twins for Net-Zero Planning

Scalable Infrastructure Monitoring from Satellites

PyPSA meets Earth

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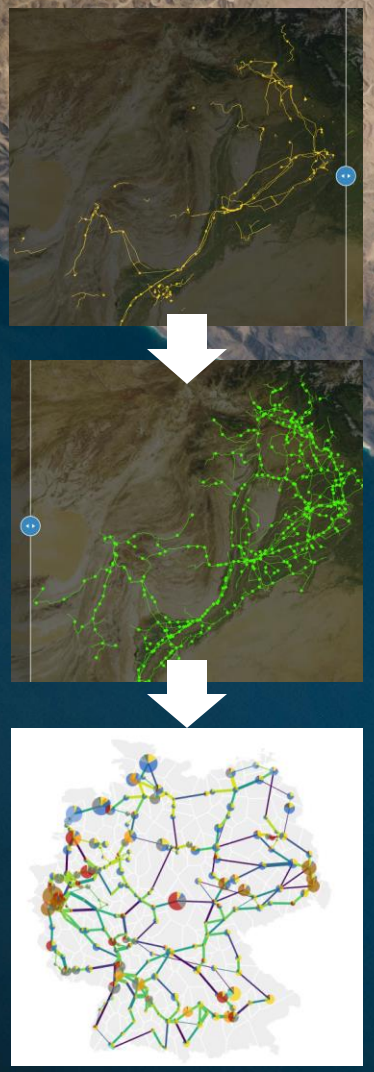

PROBLEM

- **Energy system planning** requires better data

SOLUTION

- **AI object detection** map infrastructure updates

IMPACT

- **Faster and better** energy system planning
- **Accelerated** renewable energy expansion
- **More affordable** electricity and energy
- **Reduction** of CO2 emissions
- **Solution** global useful and improving over time

USERS: UoE, GE, NationalGrid, SSE, UK Gov, ...

YOU ARE ONLY COOL IF YOU USE/CONTRIBUTE TO OPEN DATA 'N' OPEN SOURCE

More details in the manifesto: ttps://openmod--initiative.org/manifesto.html

PyPSA meets Earth

THE UNIVERSITY OF EDINBURGH

Maximilian Parzen

Founder and Co-director of initiative, hosted at University of Edinburgh

Thank you for listening. Contact me at:

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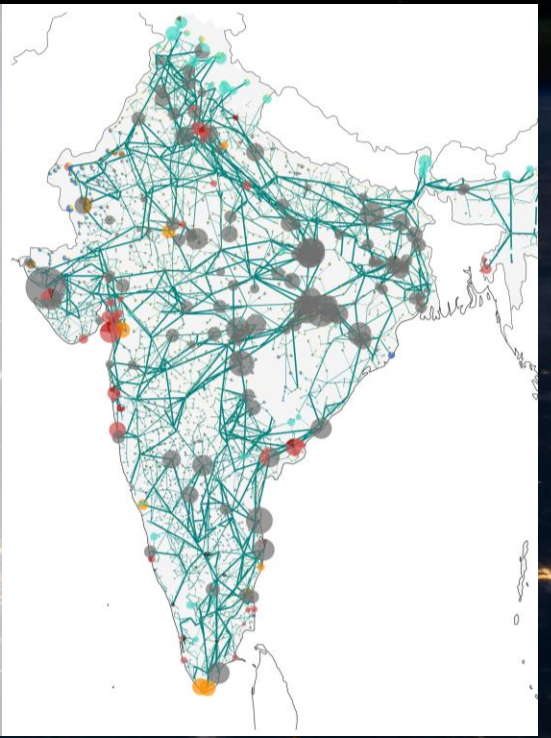
LinkedIn: maximilian-parzen-b047a1126
Website: https://pypsa-meets-earth.github.io/



AI 'n' Digital Twins for Net-Zero Planning

PyPSA meets Earth

What is open modelling?

Technische Universität Berlin

Open energy modelling means modelling with open software, open data and open publishing.

Open means that anybody is free to download the software/data/publications, inspect it, machine process it, share it with others, modify it, and redistribute the changes.

This is typically done by uploading the model to an online platform with an **open licence** telling users what their reuse rights are.

The **whole pipeline** should be open: