PyPSA meets BZR data

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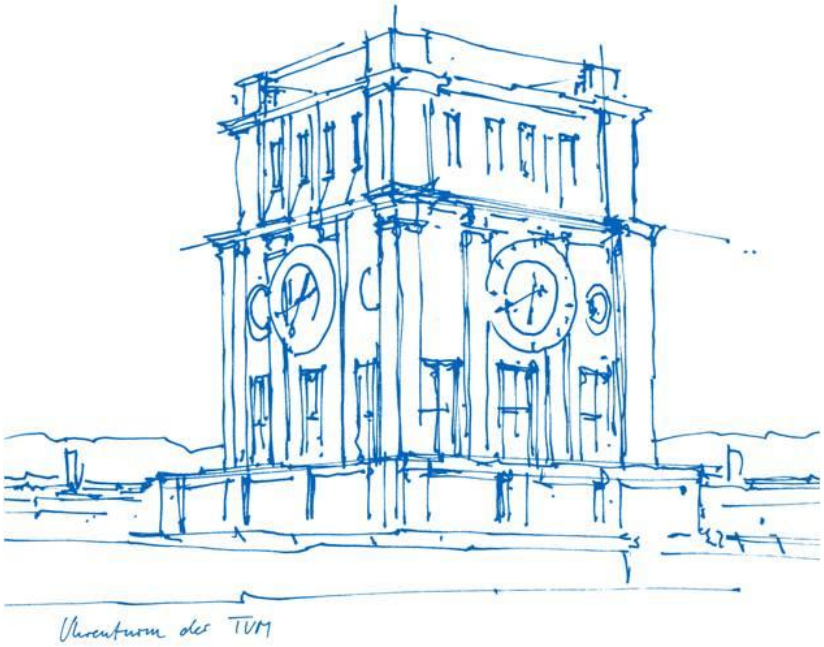


The Problem:

Lacking Data for my Thesis:

- "Rethinking Bidding Zones: Reviewing Clustering Techniques for Finding Uniform Price Zones in Germany"
- BZR result data without geolocation

The Solution:

Recreating the BZR for Germany with PyPSA

Why recreate and why PyPSA?

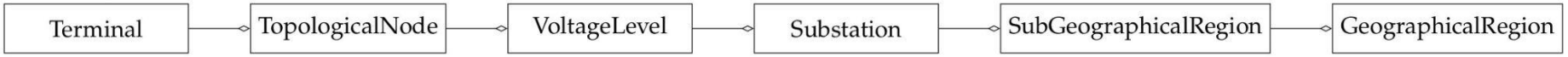
- It is reproducible, Knörr et al. 2025, in R
- No open-source, reproducible nodal-pricing models using BZR data

- Marginal prices for each bus
- Scalable for a large Network
- Active development & community
- Open TYNDP with PyPSA

- The initial plan was to first import to pandapower and then to PyPSA
  - Problems arose with 3-winding Transformers and switches

The BZR Data

- Public: Results and Input data
  - Cleared Demand, Generation, Storage
  - Constraints and Welfare
  - Input for the generation and load for climate years and study year
- Not public: Network grid model
  - Under NDA
  - Data Format: CGMES
  - Hierarchical, structured data model



Model Construction and Optimisation

The Problem:

- Only 6 SubGeograpical Regions

The Solution:

- Kindly ask ENTSO-E for more Data

Model Construction and Optimisation

The Problems:

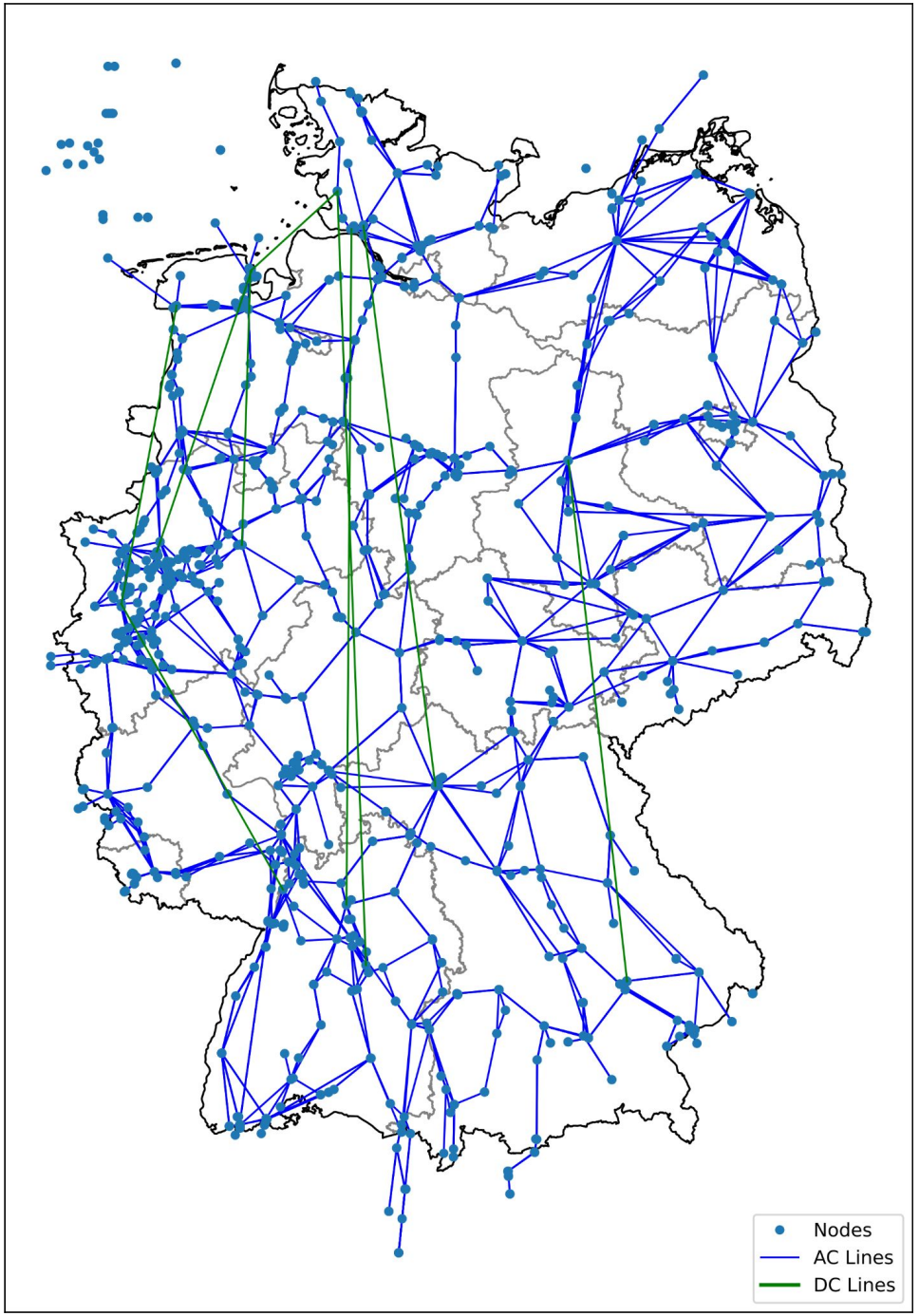
- Only 6 SubGeograpical Regions
- ENTSO-E declined on security grounds

The Solutions:

- Kindly ask ENTSO-E for more Data
- Reading the data and some creative thinking
  - Some Substations in the BZR data have human readable names
  - The exact line length between the substations is variable
  - OSM and openInfraMap provides geographical data
  - A bit of code and manual work leads to 834 localised substations

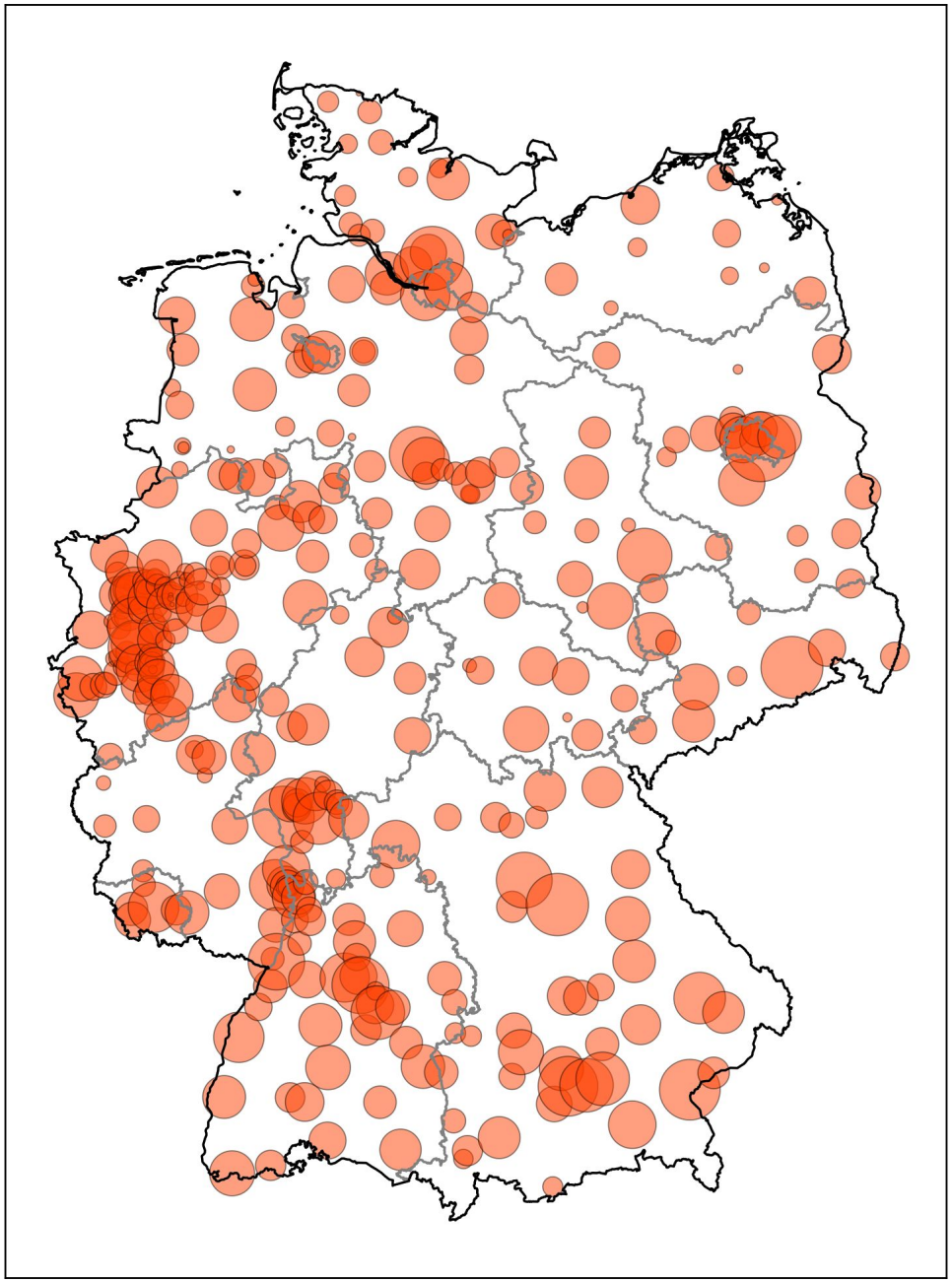
Grid Topology

- 2543 AC Lines
- 26 HVDC Lines
  - 2 GW capacity
- Switchgear
  - 584 Breakers
  - 494 Disconnectors
- 4 Series Compensators
- Transformers
  - 191 3-winding
  - 573 2-winding



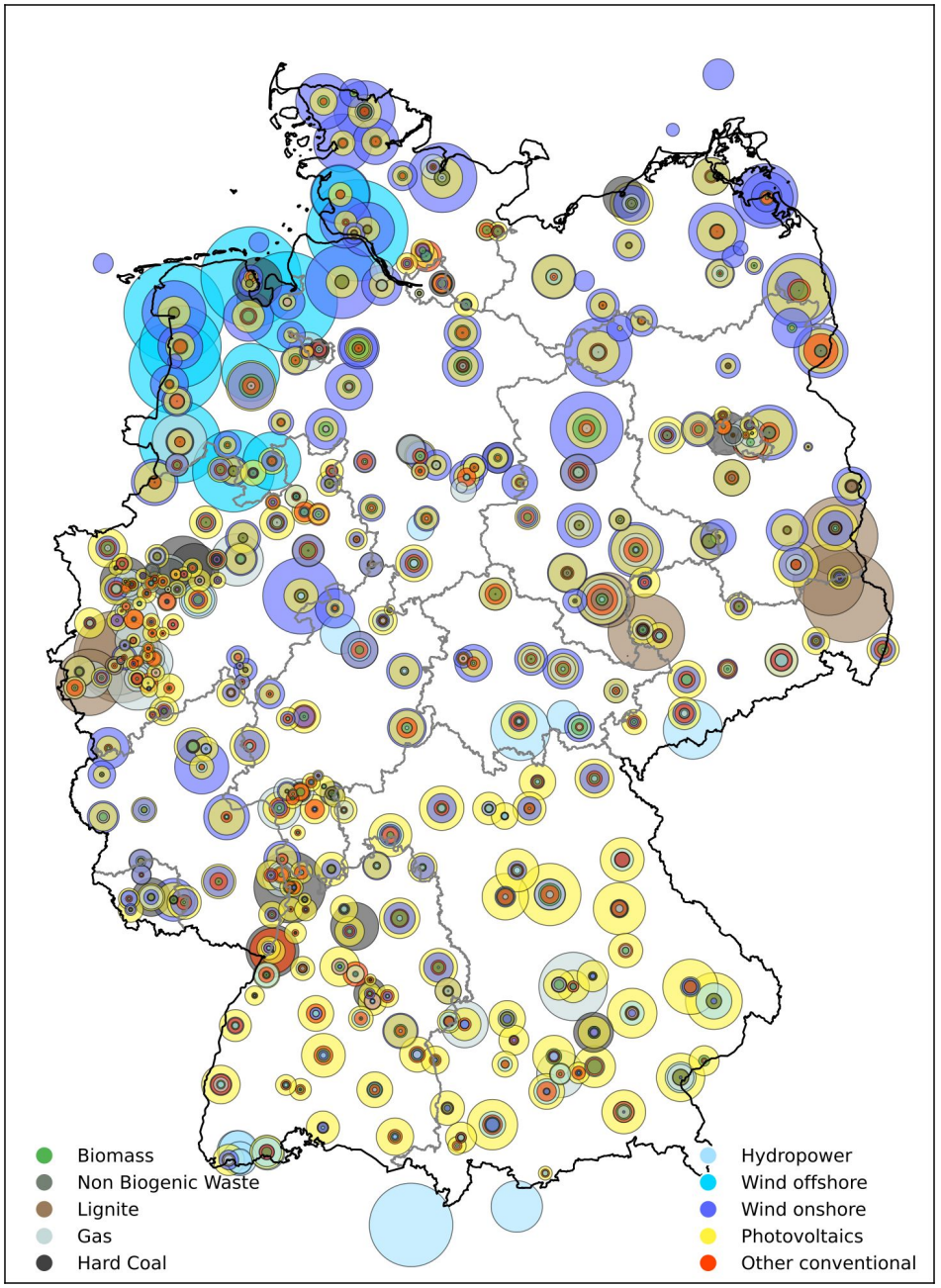
Loads

- 1444 Loads
- Peak active Power demand 76.2 GW



Generation

- 4 Thermal Categories
  - 60.4 GW
- 773 Photovoltaic 74.26 GW
- 769 Biomass 7.61 GW
- 22 Non-Biogenic Waste 0.5 GW
- 25 Offshore Wind 23.58 GW
- 653 Onshore Wind 66.77 GW



Conclusio

- Using the model I optimised 155 days of the 168 days under consideration
- The model made it possible to solve for the entire year 2024 using the data from the transparency platform
  - This is contrary to the Main Report (April 2025), where the outdated input data is acknowledged.
- The lack of transparency from ENTSO-E made it necessary to include assumptions into the model
- Seeing as critical data is already accessible publicly, rethinking the approach of sharing data with researchers is necessary

Thank you for your attention!

For follow-up questions please contact me via the Forum!