

# Term Project

(Theoretical)

## Python-based Investigation of the Potential for Vehicle-to-Grid in a Sector-Coupled Bavarian Energy System

### Description:

Future energy systems will heavily rely on variable renewable energy sources from wind and PV. Therefore, demand flexibility can play a crucial role in shifting excessive electricity to periods of low PV and wind availability. Widely discussed examples are battery storage systems, flexible electrolyzers, or shifting the demand itself. Bidirectional charging for electric vehicles is another promising approach.

Energy system optimization can contribute to assessing transformation pathways toward CO<sub>2</sub> neutrality from global, country-specific, or local perspectives. In this term project, an existing model of the Bavarian sector-coupled energy system, with high temporal and spatial resolution spanning from 2025 to 2050, is to be extended to include vehicle-to-grid (V2G) capabilities. To do so, different representative availability profiles for V2G first need to be extracted from the literature. Additionally, projections for the registration of new electric vehicles in Bavaria are required. After sufficiently implementing V2G, the influence of using different availability profiles is to be investigated. Furthermore, heavy-duty traffic may be integrated as well.

### Prerequisites:

- Python knowledge is strongly recommended
- PyPSA knowledge is a plus

### Work packages:

- Familiarization with PyPSA and the existing model
- Data acquisition for V2G
- Implementing V2G
- Assessing the influence of different availability profiles on the impact of V2G utilization

**Beginn ab:** 01.02.2026

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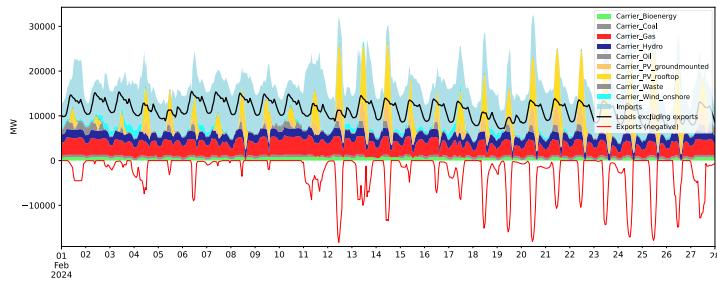


Figure 1 Dispatch profile of a representative winter week

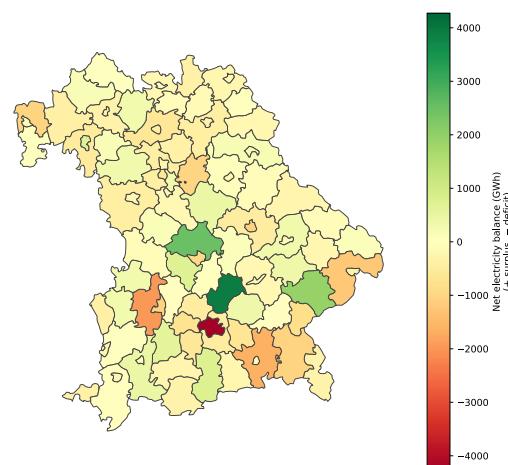


Figure 2 Energy balance of the Bavarian ESM