
IAEE 2023

**Assessing Potential of Electrified Transport for Enhancing
Flexibility in Integrated Renewable Energy Systems**

Parinaz Aliasghari, Leonard Göke, Ruud Egging-Bratseth



Agenda

1. Overview

2. Methods

3. Results

4. Conclusion

Overview

Background

- ❑ Wind and solar energy, as key renewables for climate neutrality, face integration challenges due to their intermittent nature.
- ❑ To overcome this issue, both the supply and demand sides of the energy system need to be flexible.

Solutions

- ❑ Flexibility on the supply side can be achieved through sector coupling, energy storage infrastructure, and zero-carbon thermal plants.
- ❑ Flexibility on the demand side can be achieved through **battery electric vehicles (BEVs)**, demand response programs, and distributed generation.

Agenda

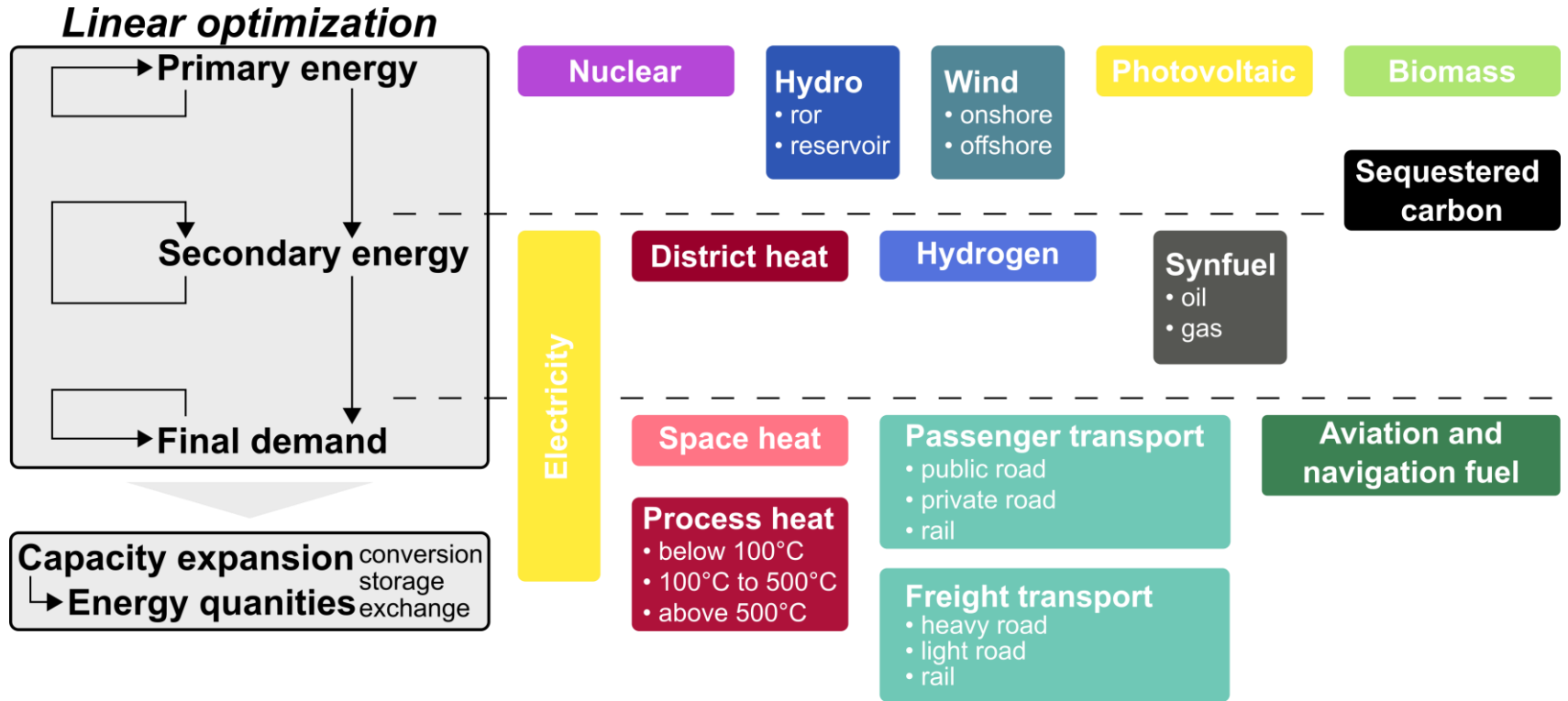
1. Overview

2. Methods

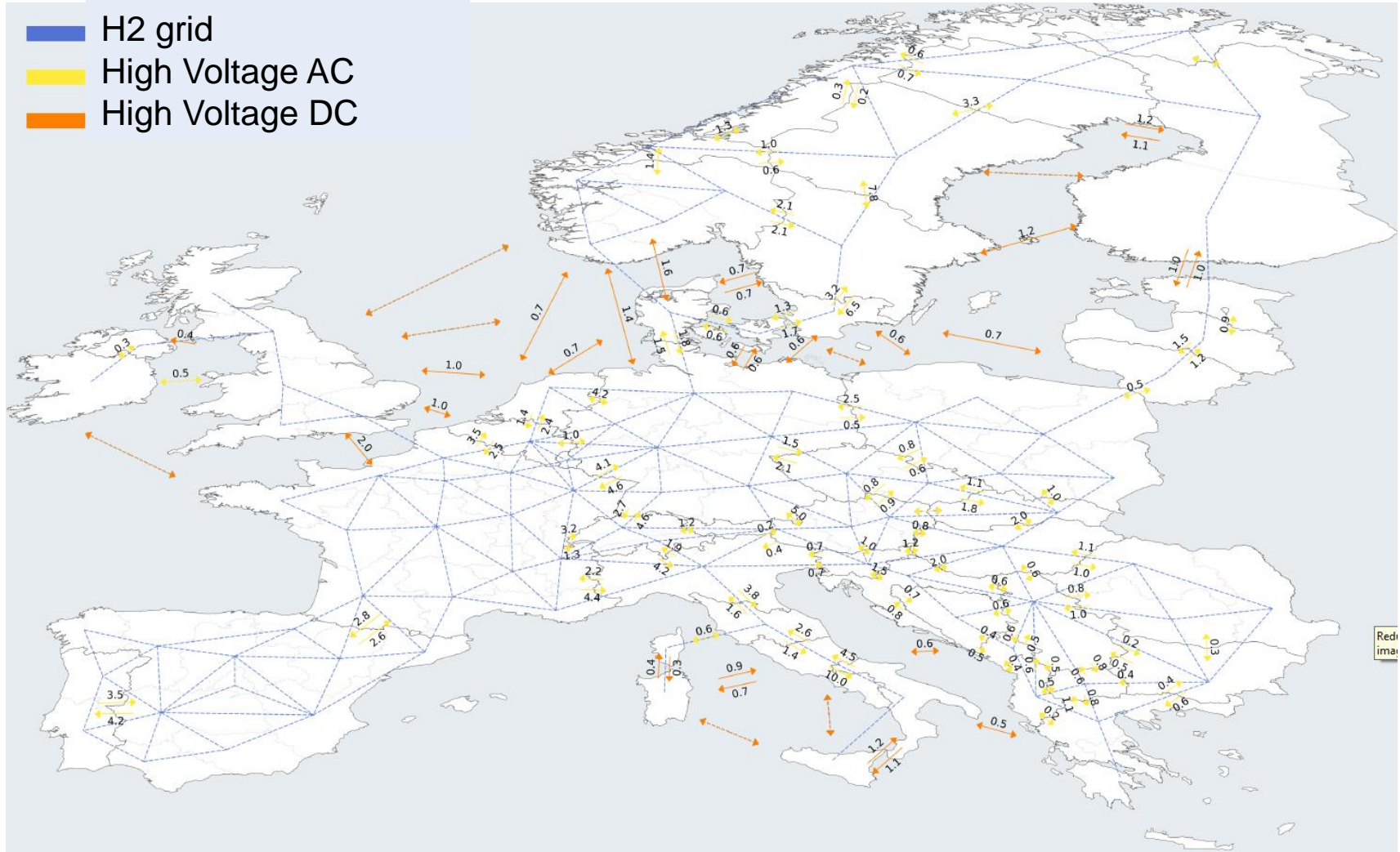
3. Results

4. Conclusion

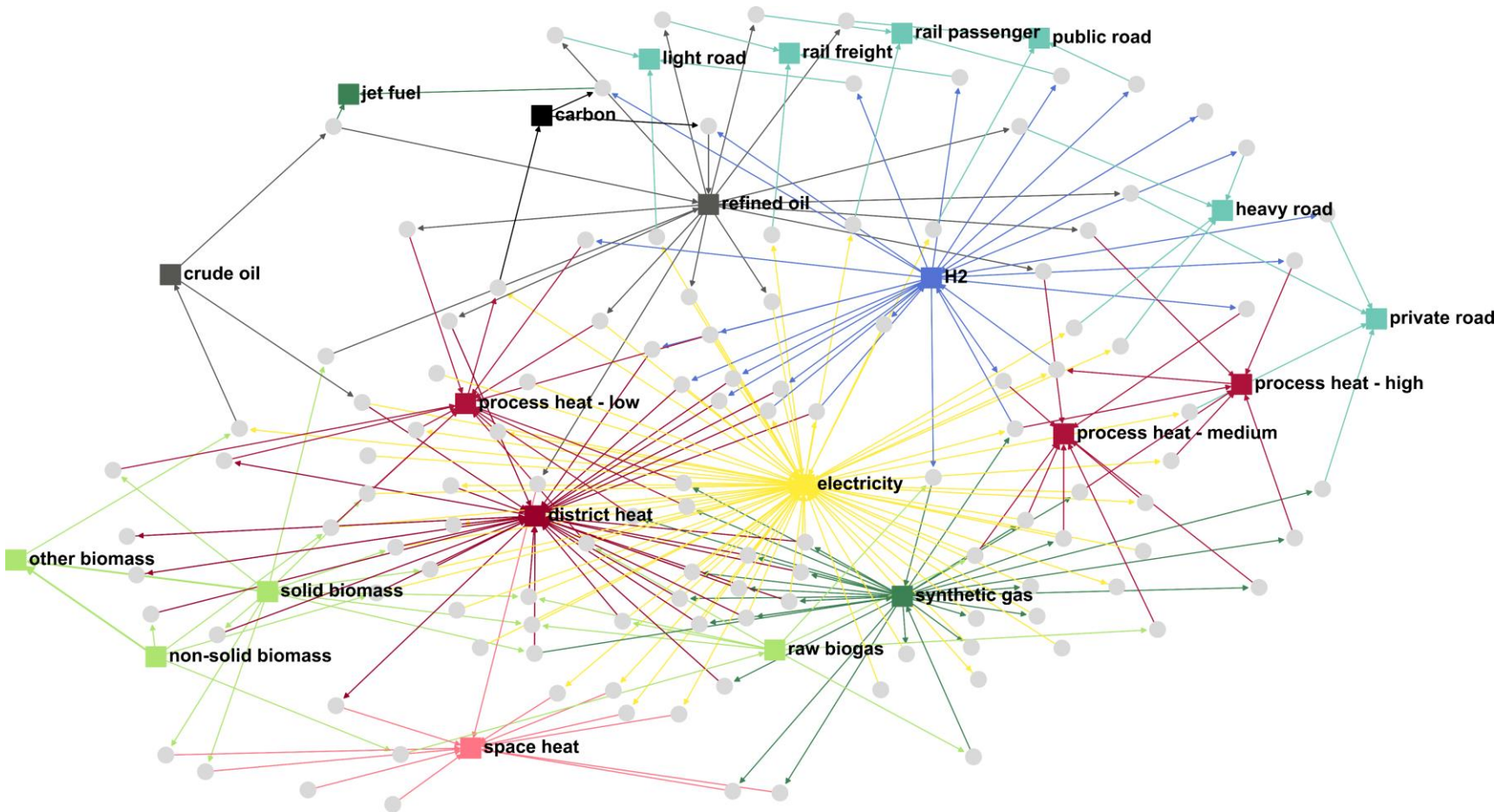
Model overview



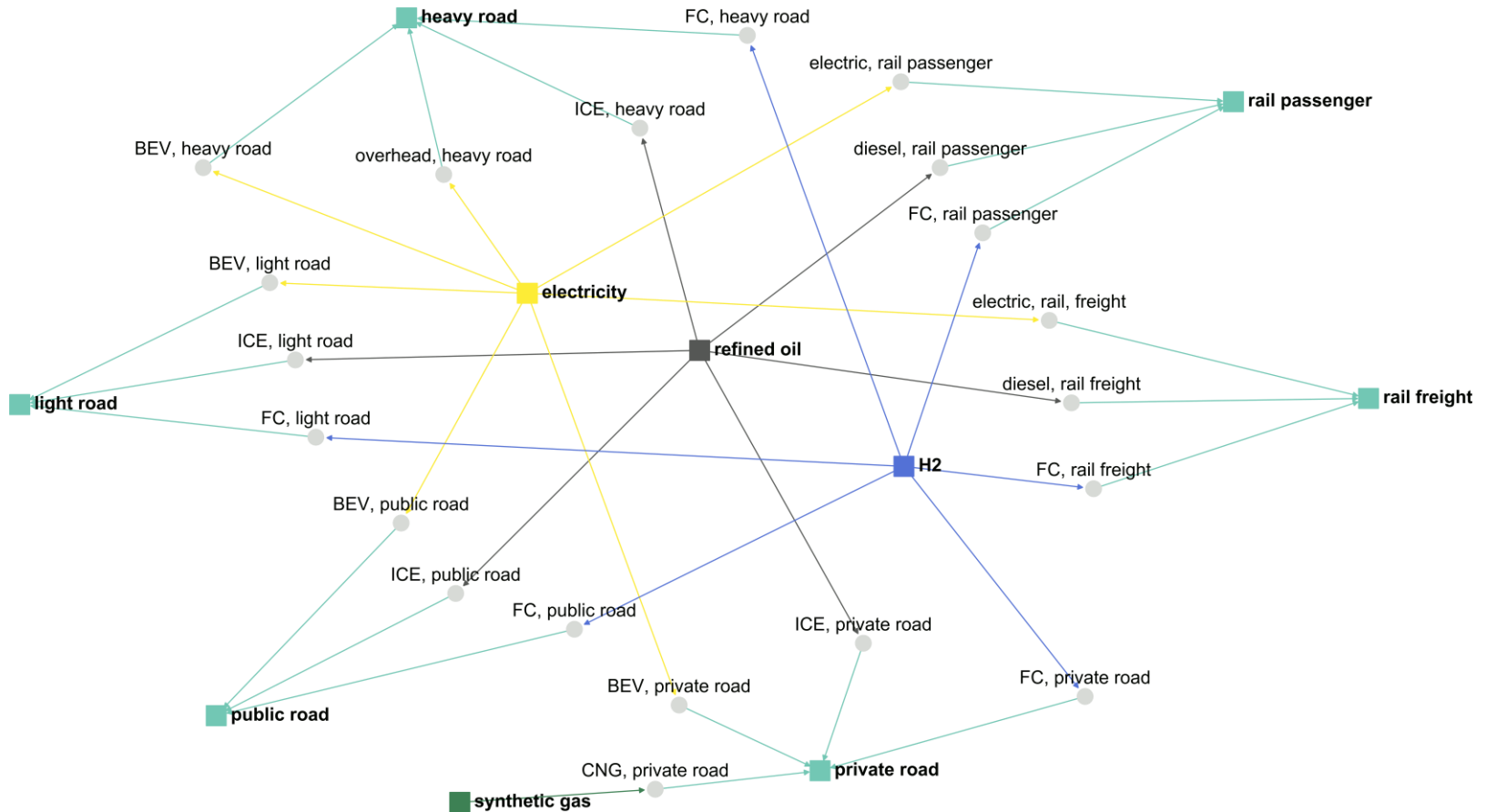
Scope and resolution of applied model



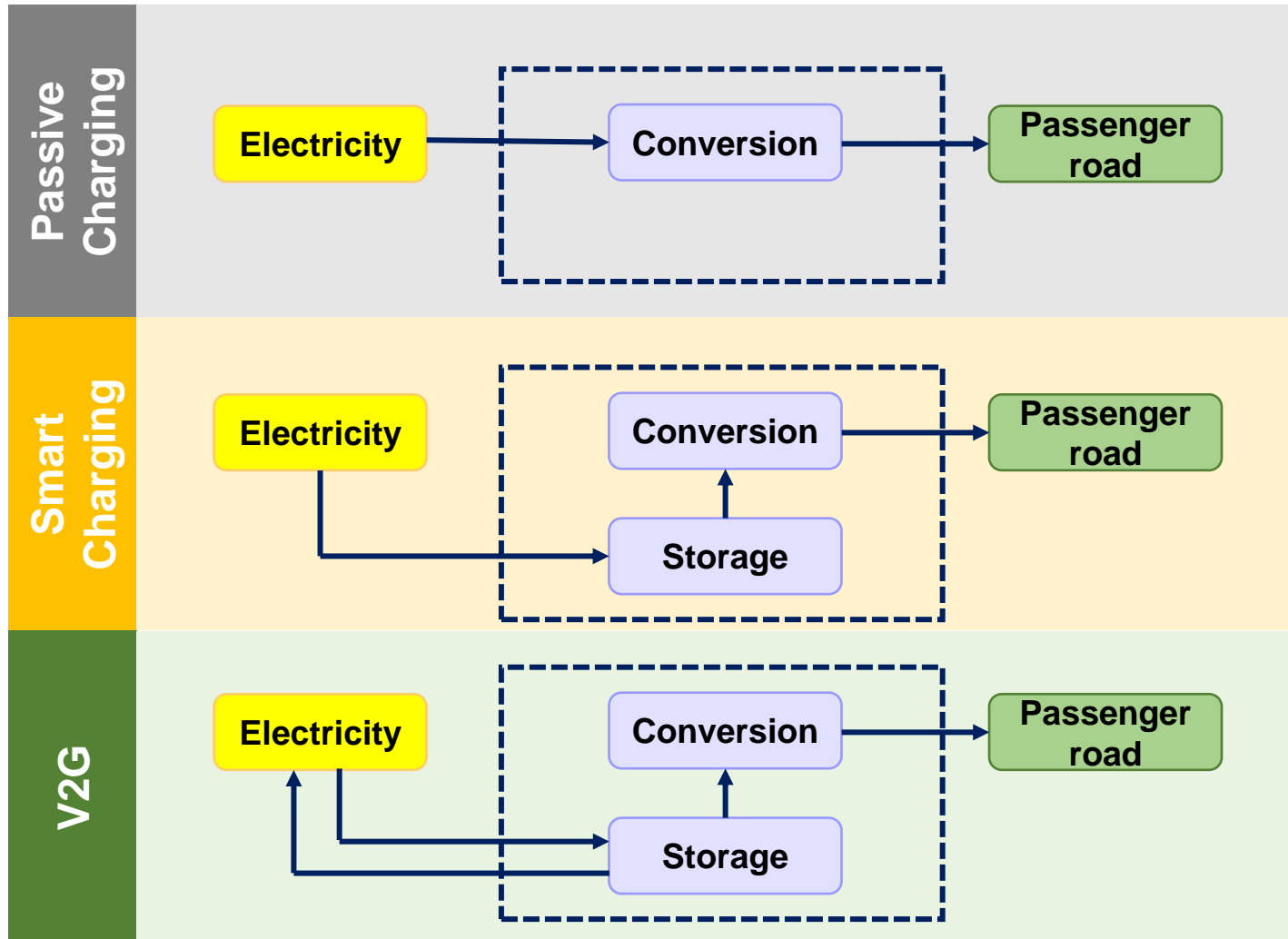
Integrated renewable energy system model



Detailed model graph of transport sector



Modeling of different loading strategies of BEVs



Agenda

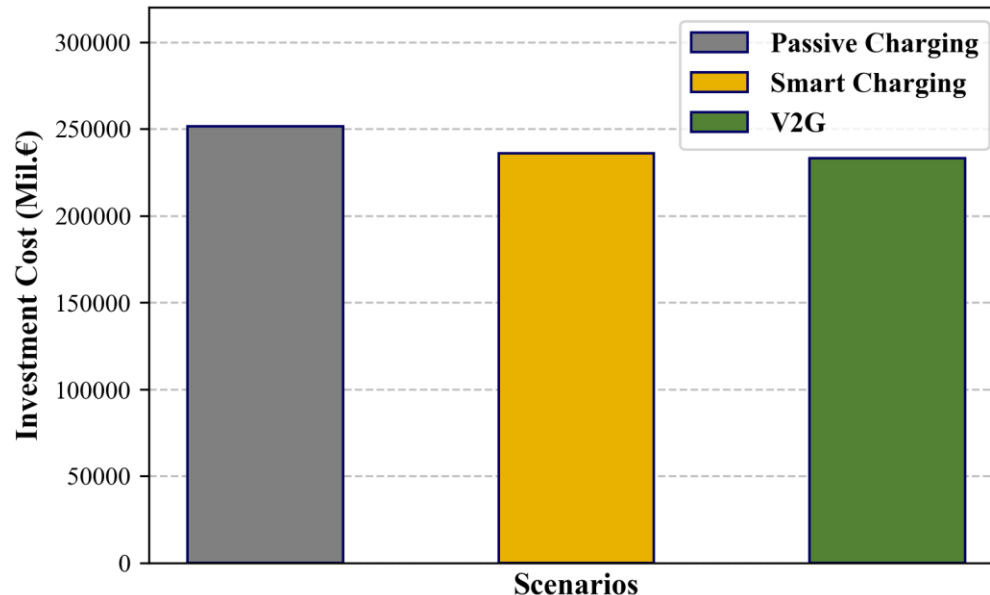
1. Overview

2. Methods

3. Results

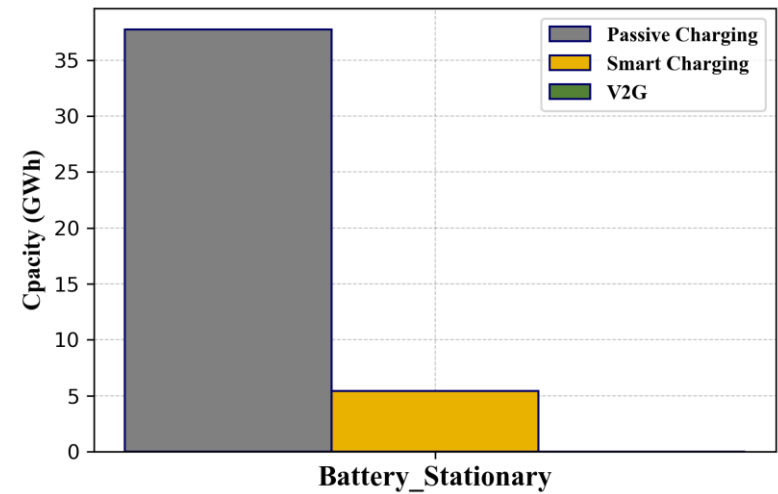
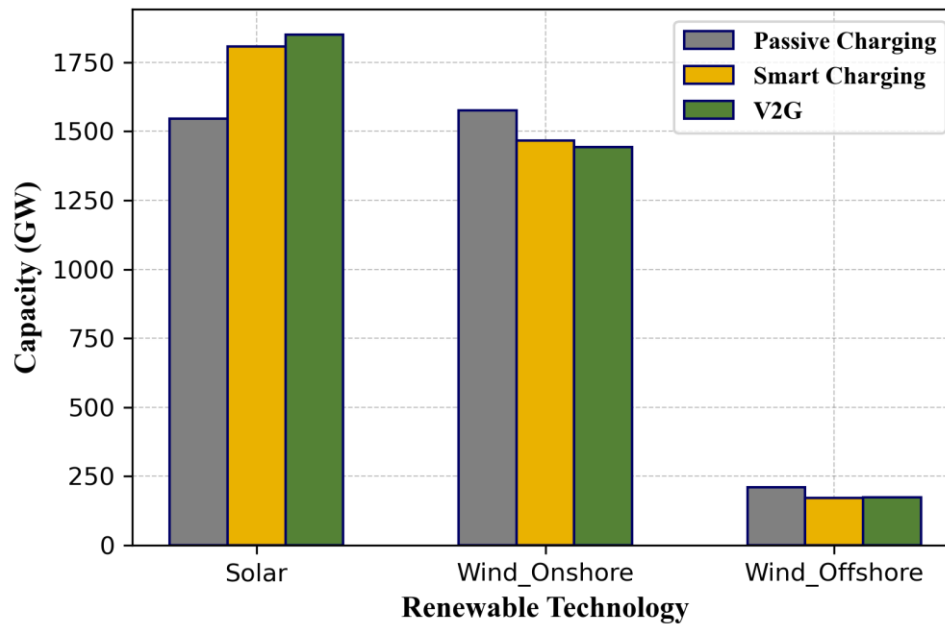
4. Conclusion

Total Investment Cost of Energy System (no BEVs)

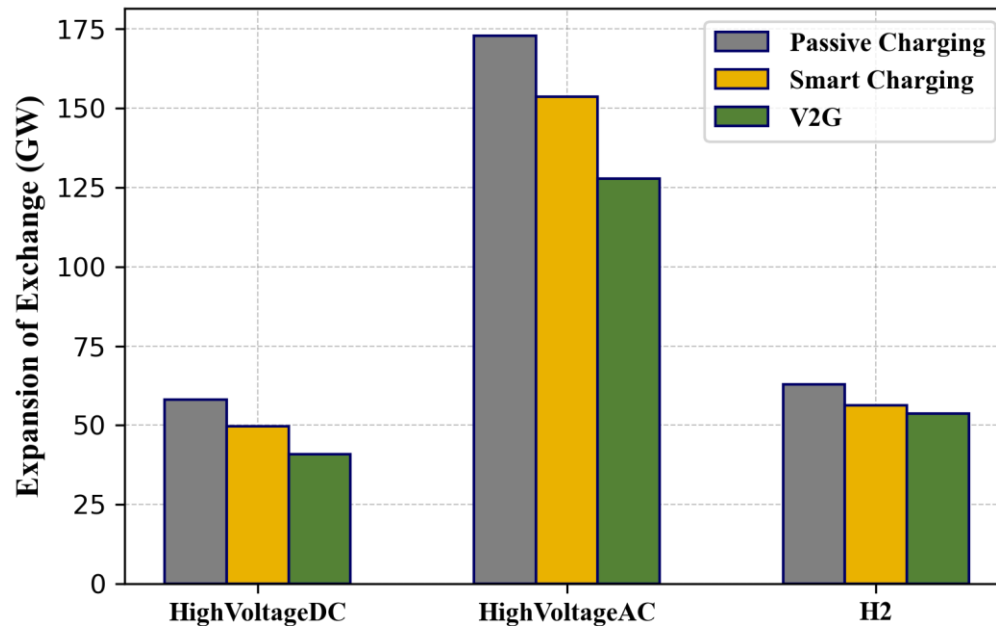


- ❑ **6.3%** and **7.4%** improvement in total investment cost for **smart** and **V2G** charging modes compared to passive charging

Impact on generation and storage investment

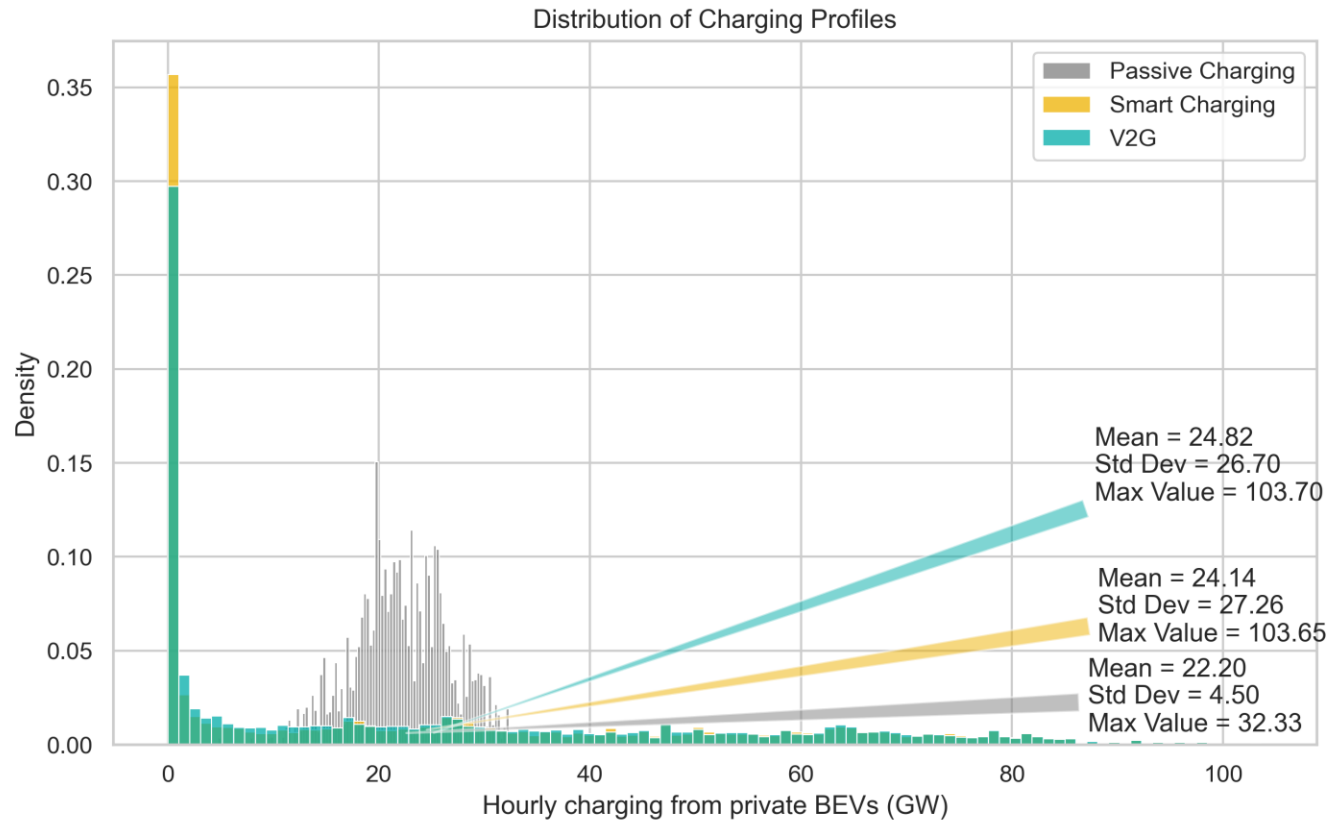


Impact on grid investment

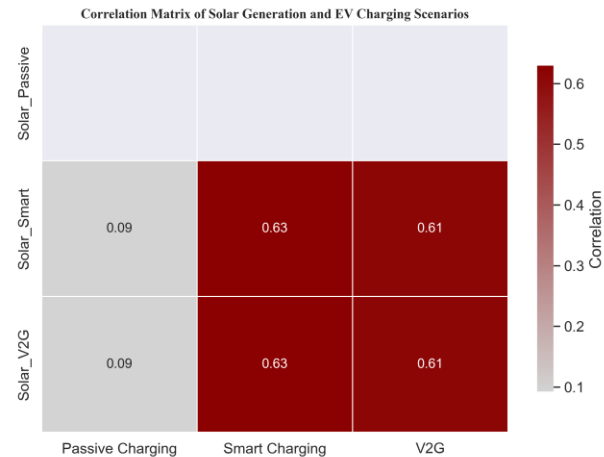
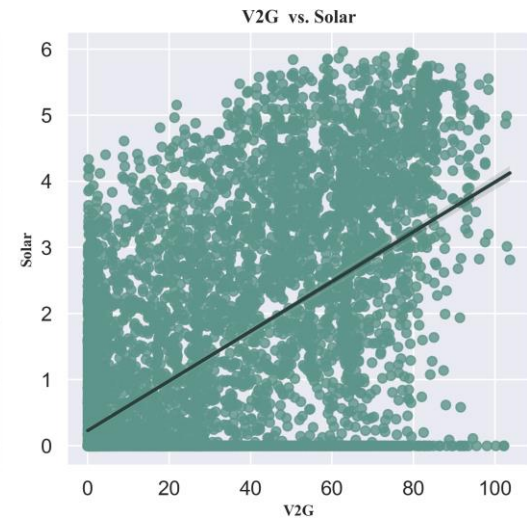
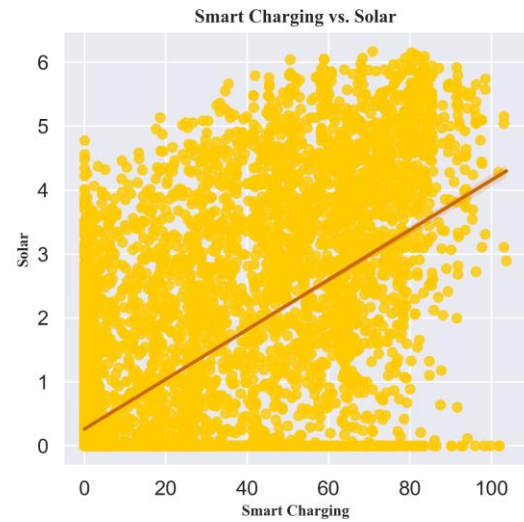
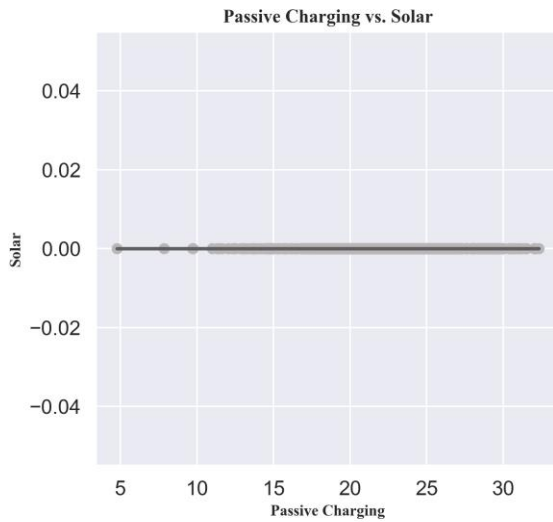


- ❑ In the total energy system, more H2 lines are installed for Smart and V2G charging compared to Passive charging, while for HVDC and HVAC, the capacity of lines mostly changed.

Load from BEV Charging in Germany



Correlation of BEVs Charging vs. Solar_Rooftop Generation in Germany



Agenda

1. Overview

2. Methods

3. Results

4. Conclusion

Conclusion

Findings

- Flexible charging of BEVs aligns with solar generation
- Flexible charging substitutes investments into grid batteries and transmission infrastructure
- Challenge of load management in the distribution grid due to high peak demands

Research outlook

- Study potential of covering demand peaks in the distribution grid with local supply
- Compare different patterns for charging