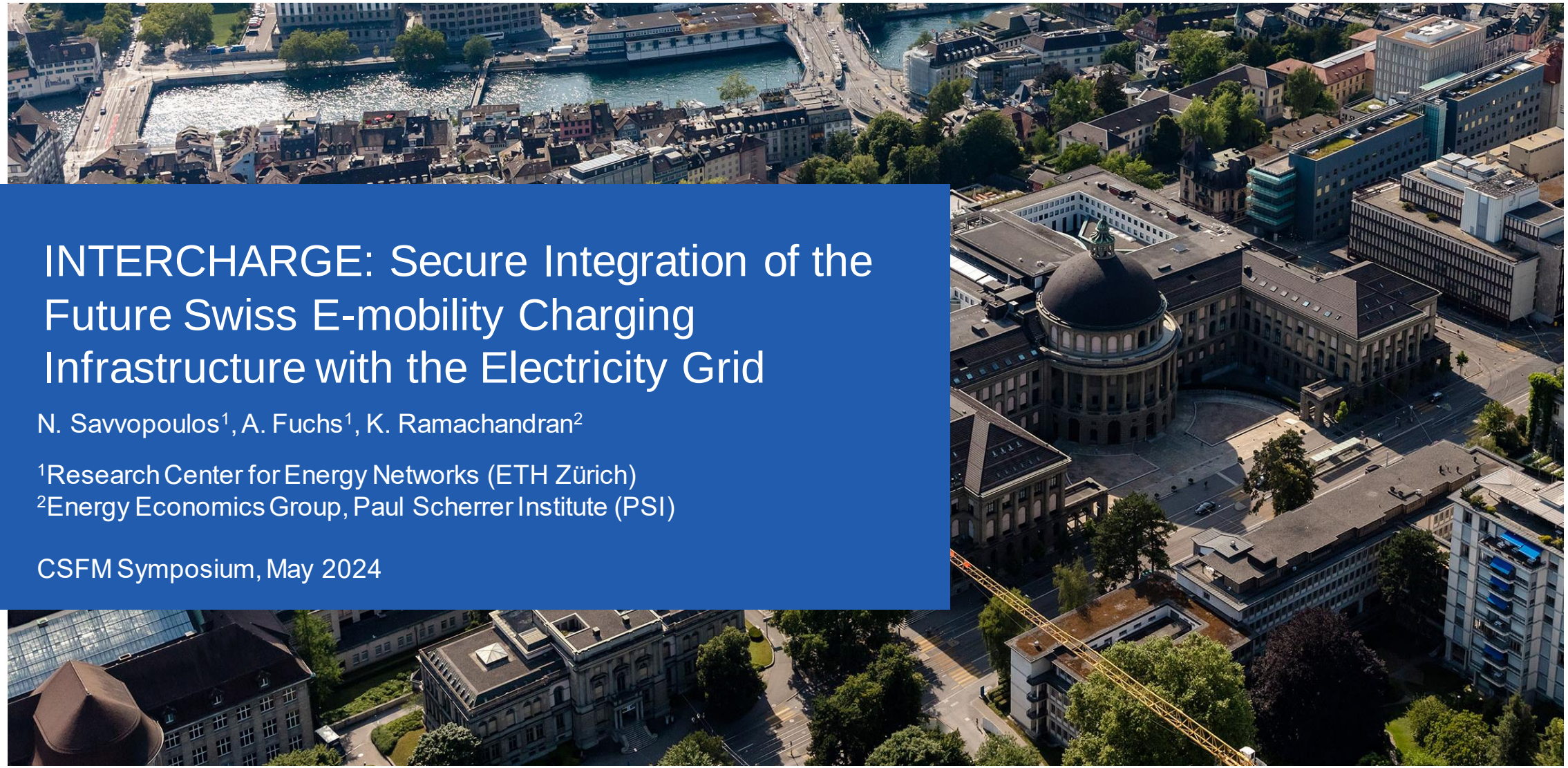

INTERCHARGE: Secure Integration of the Future Swiss E-mobility Charging Infrastructure with the Electricity Grid

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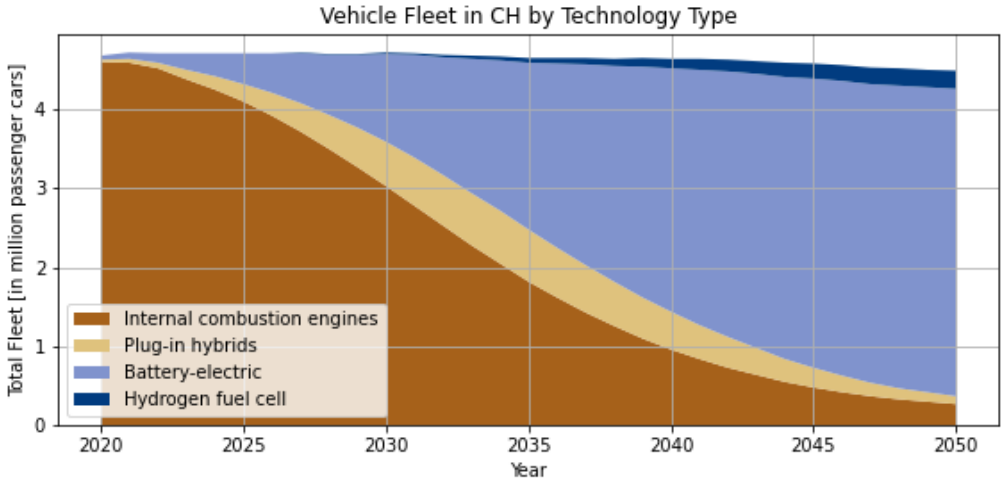
Project background and challenges addressed

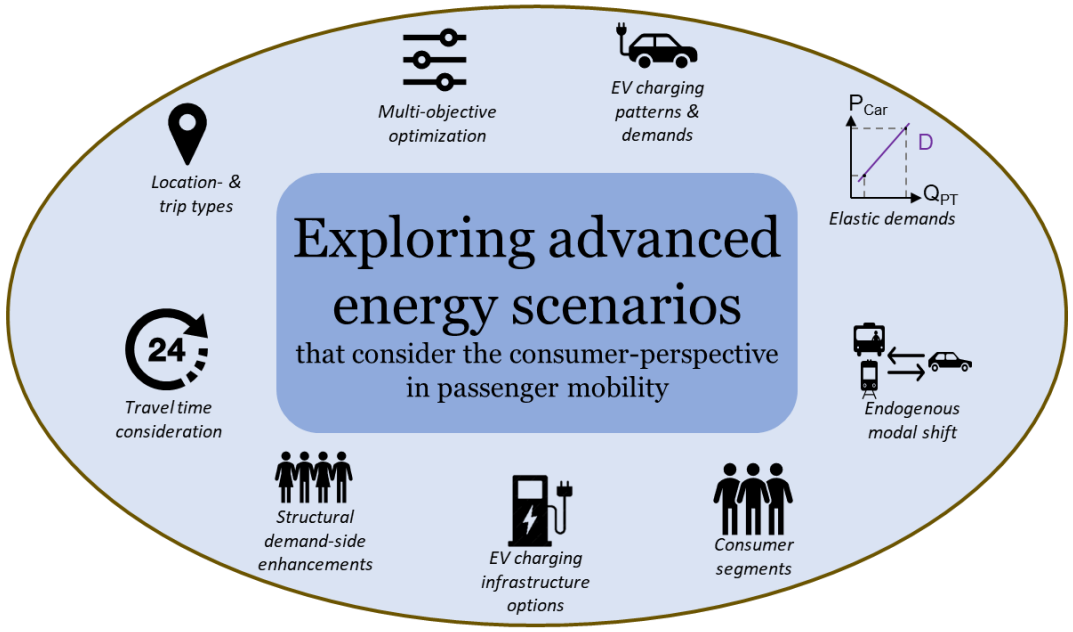
Background:

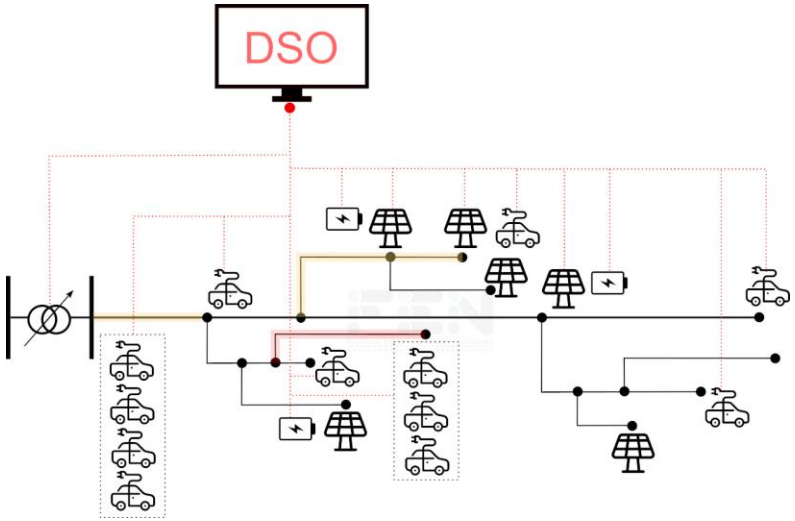
The energy transition leads to a simultaneous and coupled transformation of the **mobility and electricity** sectors.

This requires a comprehensive assessment of **EV-charging impact** on Swiss energy transition and electric power system.



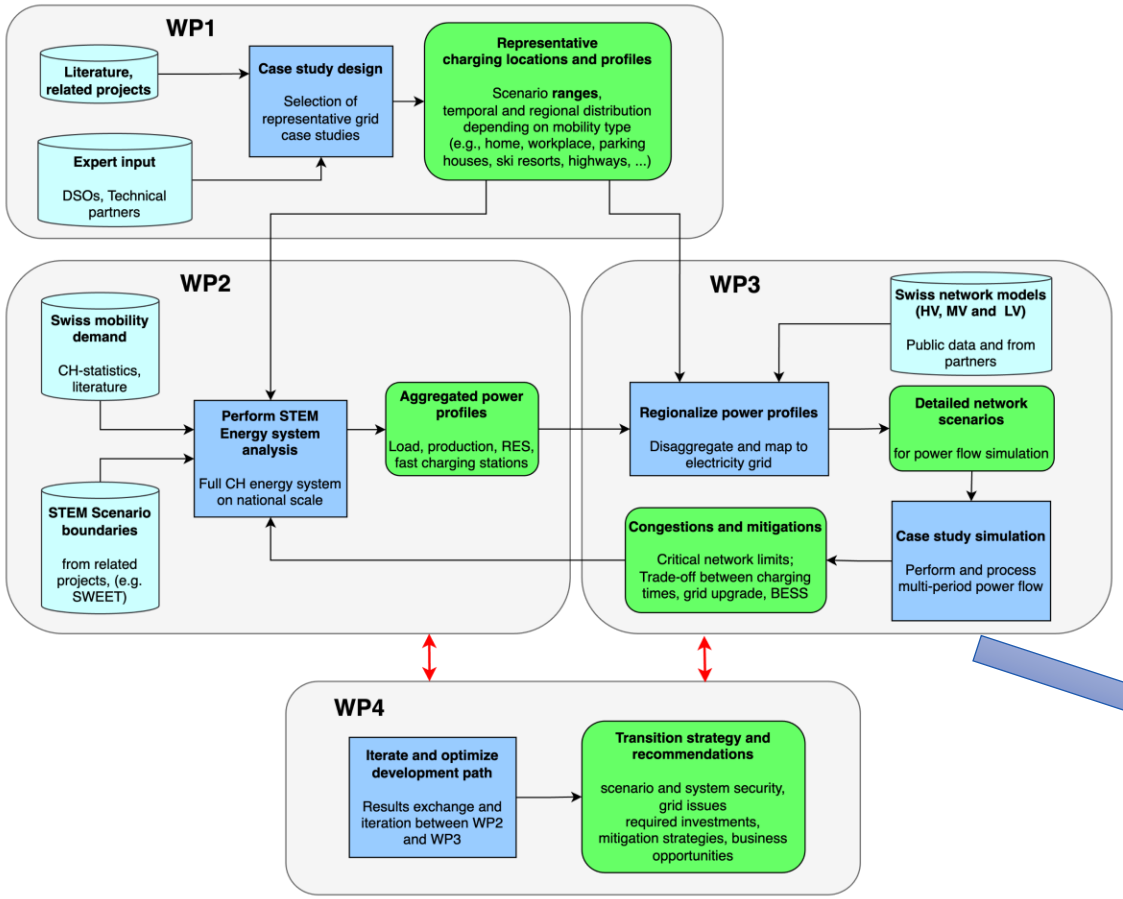
Source: BFE(2023): Understanding Swiss Charging Infrastructure in 2050





Project approach

4 Work packages:
Scenarios / Charging profiles / Grid impact / Recommendations

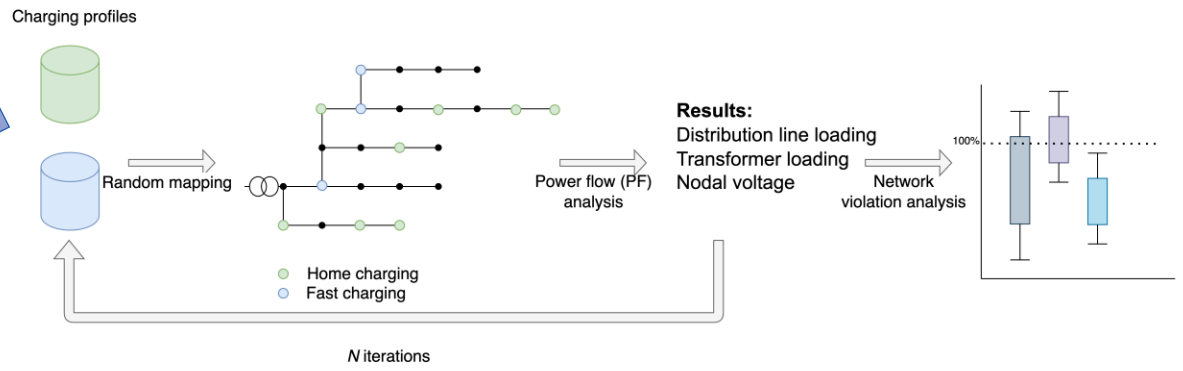


Goals of grid integration study:

- create a **bottom-up** network model with load profiles
- Incorporate temporal and spatial charging **uncertainty**
- investigate different **scenarios of charging infrastructure development**

Stochastic approach to assess BEV charging grid impact:

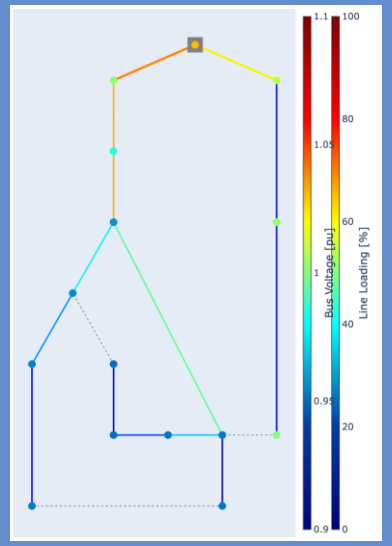
- **random mapping** of charging profiles to every potential charging point
- power flow analysis for daily **network operation**
- **results analysis** of line, transformer loading and bus voltages
- **worst-case / median scenario** based on N charging profile distributions
- evaluation of **grid integration** cost



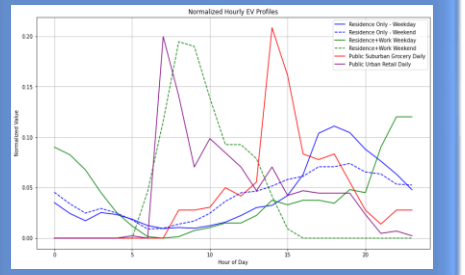
Preliminary results on grid assessment

Input:

CIGRE medium voltage network with simulated **line loading and voltages**



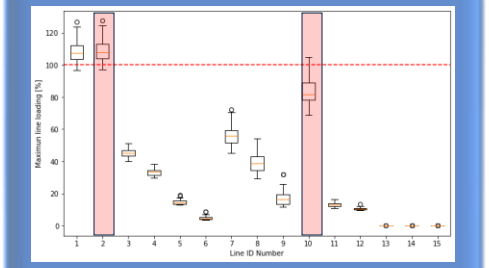
Charging stations added to the network using **normalized EV profiles**



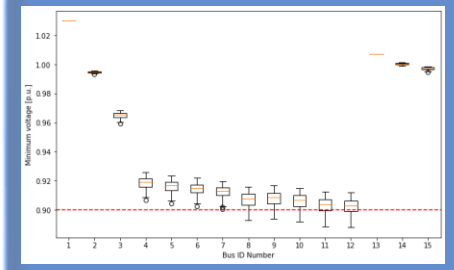
AC PF analysis:

100 Monte-Carlo runs choosing the profile for each charger

Daily **peak line loading:**

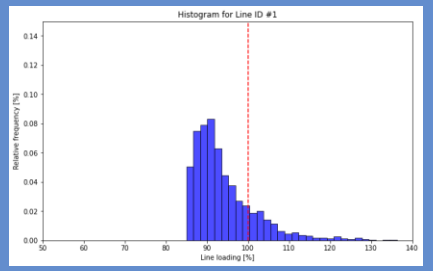


Daily **minimum voltage**:

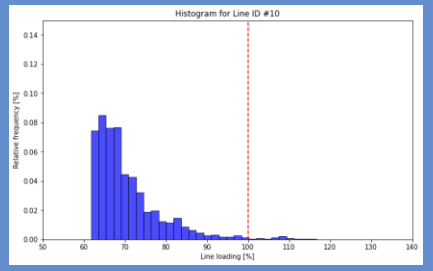


Post-processing to derive grid integration strategies for EV charging:

Frequent line overloading: **recommend line upgrade**



Infrequent line overloading: **explore flexibility options**



Input data:

- Distribution system data
- Non-EV load data (HP, household, PV timeseries)
- Location and type of potential charging points
- EV charging profiles

Processing:

- Stochastic Monte-Carlo / Load flow framework

Outlook/ Next steps:

- Select and analyze representative **Swiss case studies** (urban, rural, industry, tourism, highway ...) at different network levels.
- Explore **uncertain variables** through Monte-Carlo analysis.
- Assess value of different **grid integration strategies**.

ETH zürich

Thank you!