Integrating MATSim into a Comprehensive Multi-Model Platform for Analysis and Planning of Sustainable Electromobility Scenarios

MATSim User Meeting 2023

05/09/2023, Zurich, Switzerland

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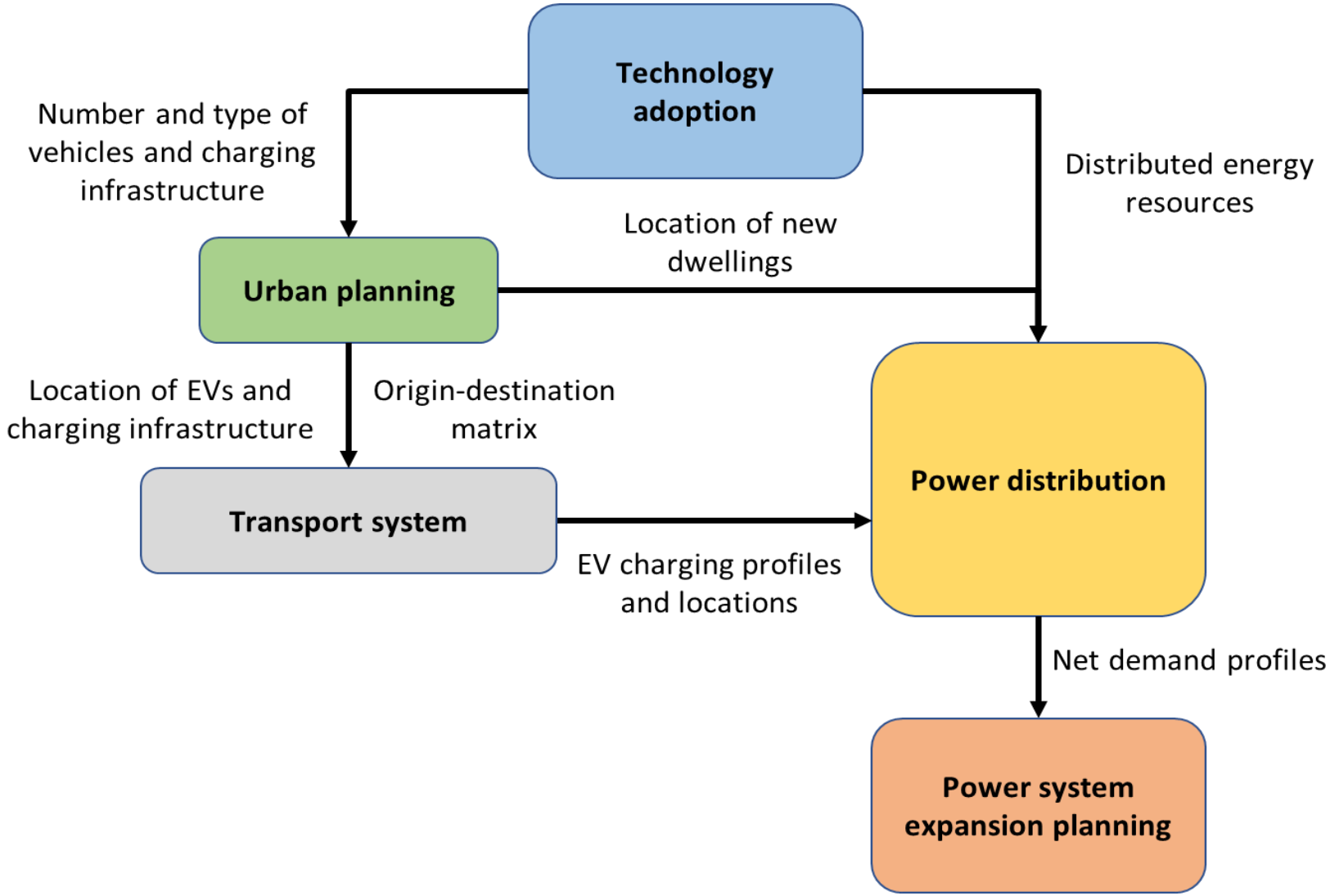
Introduction

2021

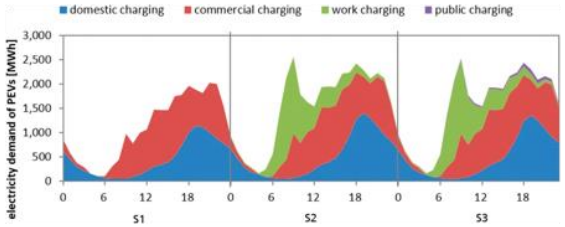
2021

2023

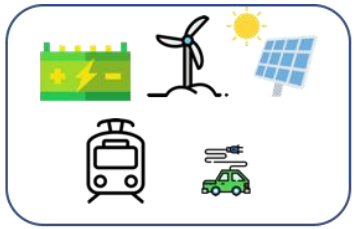
Methodology: General integration



Methodology: power distribution system

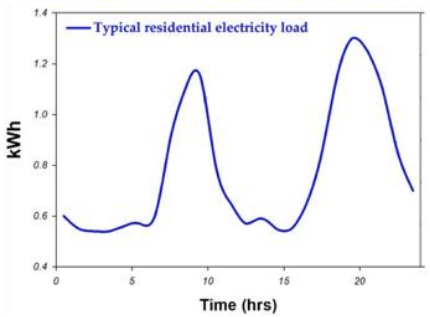


MATSim
Multi-Agent Transport Simulation

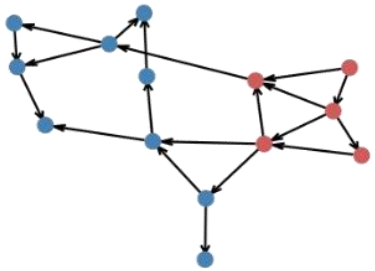


Distribution Network Operator

grupo saesa

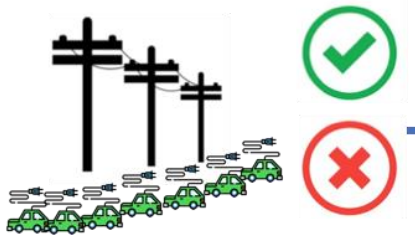


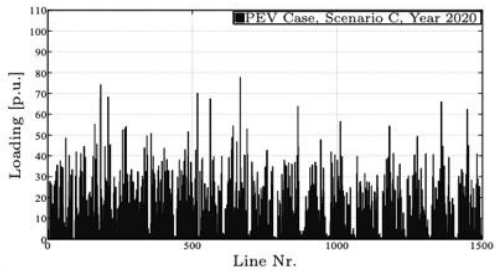
pandapower



Three-phase power flow

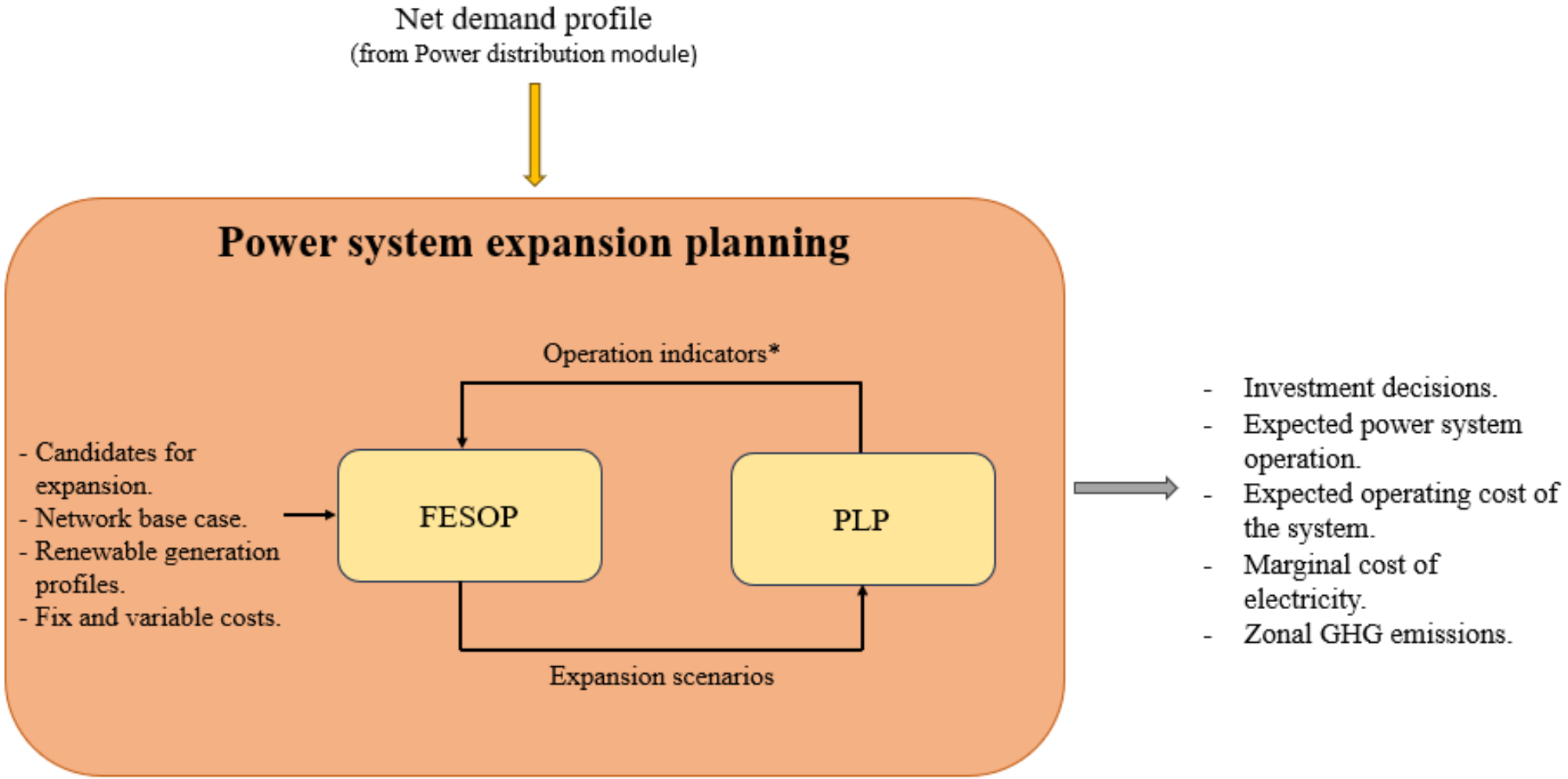
Quality of service
Grid expansion
Grid-reinforcement investment
EV-user satisfaction





Power System Expansion Planning

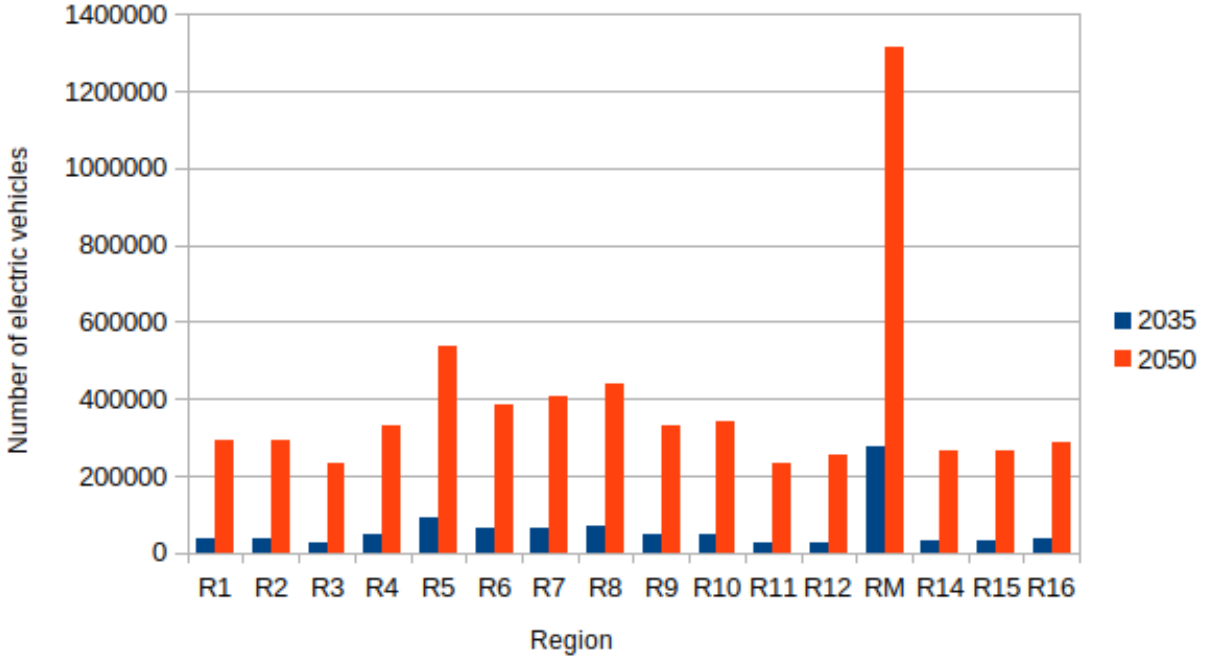
Methodology: power system expansion



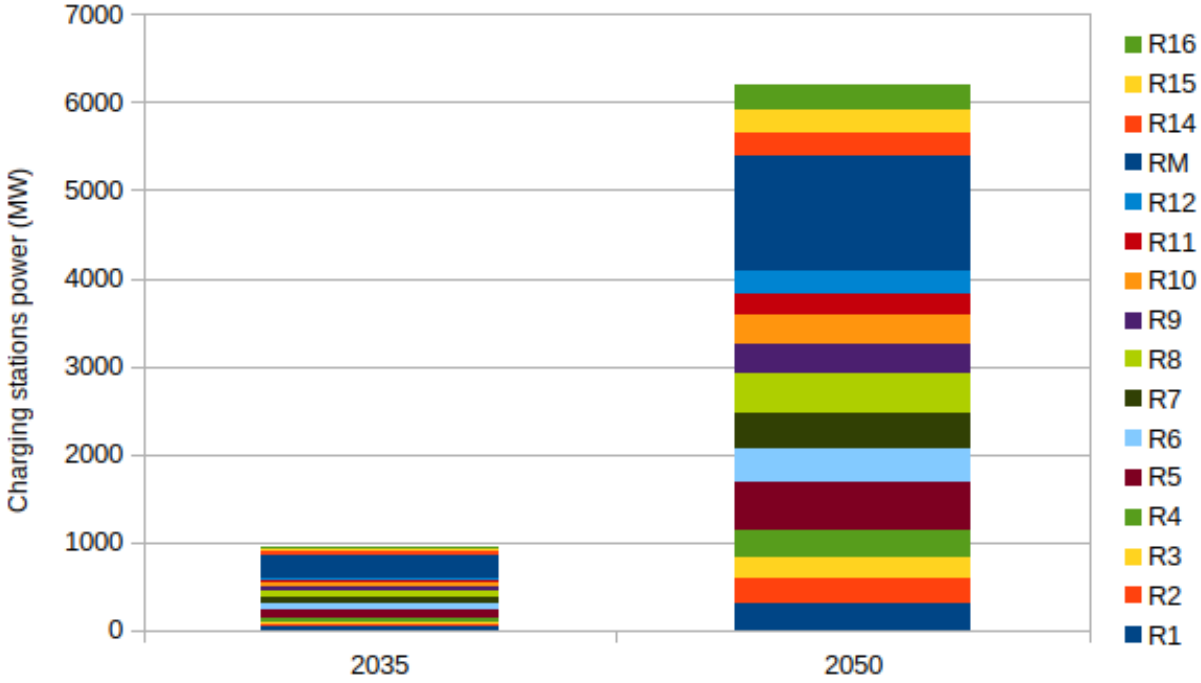
*Operation indicators: generation by unit, lines losses, marginal costs, electrical faults, etc.

Results: Technology adoption - Electromobility

Projected number of electric vehicles and charging stations



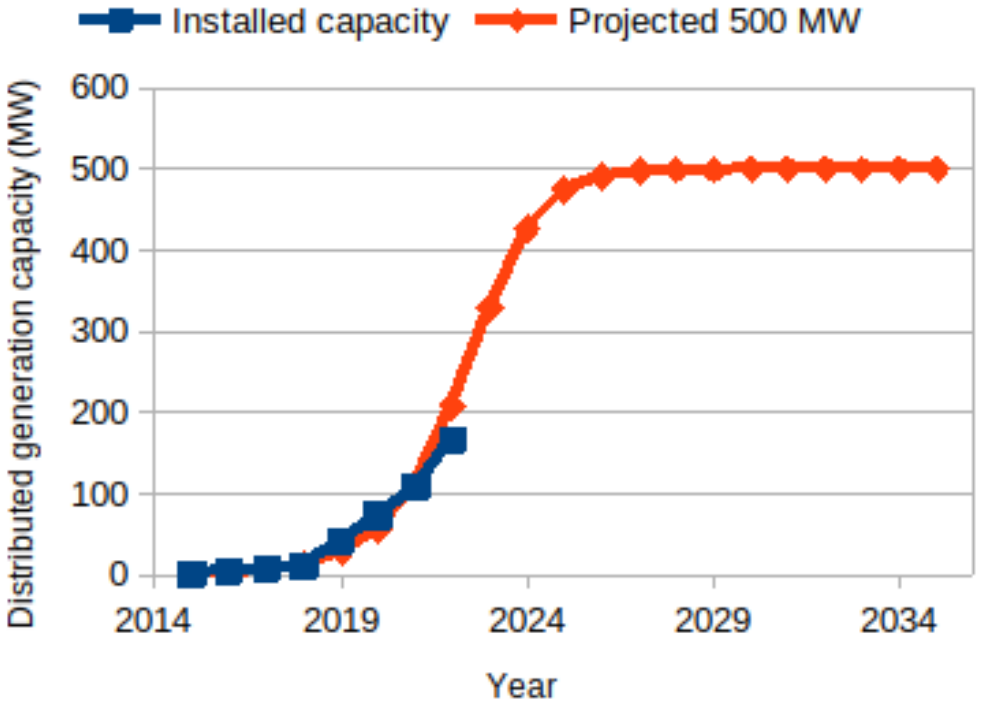
Projected number of electric light duty vehicles for years 2035 and 2050



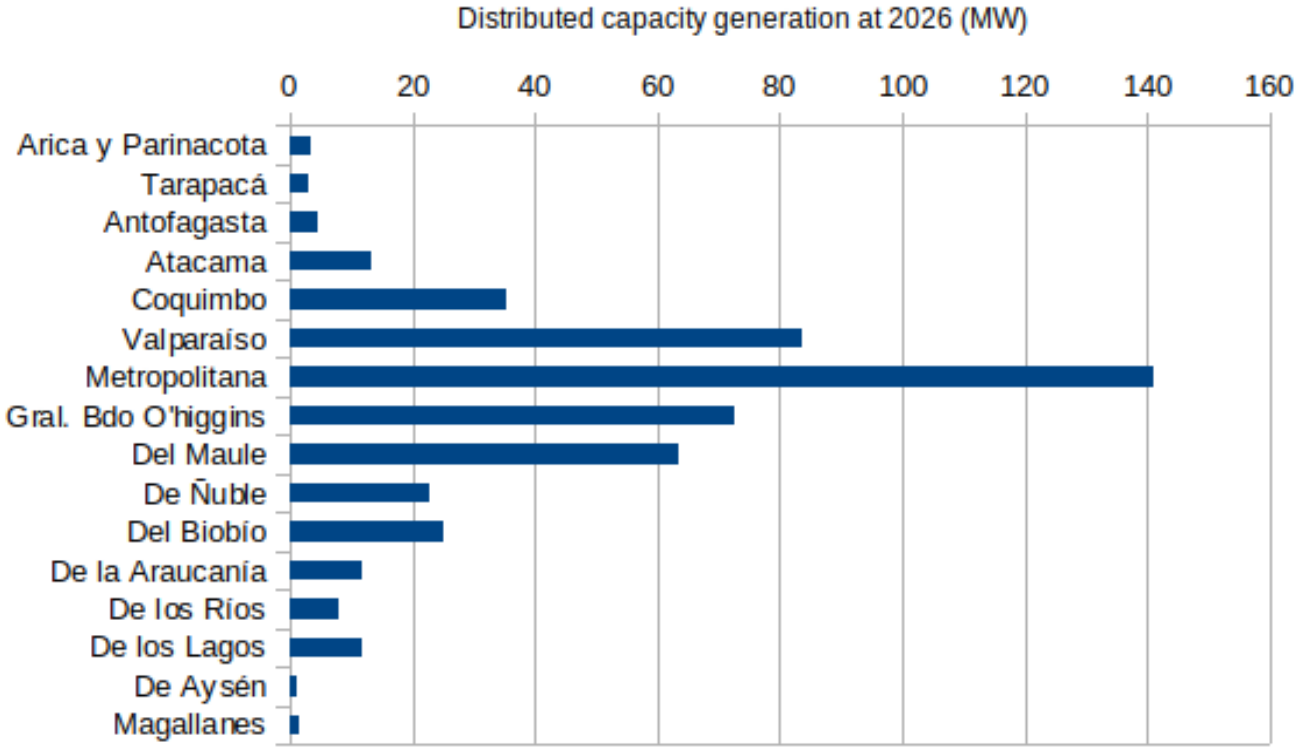
Total capacity of public charging power for years 2035 and 2050 per region

Results: Technology adoption – Distributed energy

Projected installed capacity for distributed generation based on a baseline setpoint of 500 MW for 2026



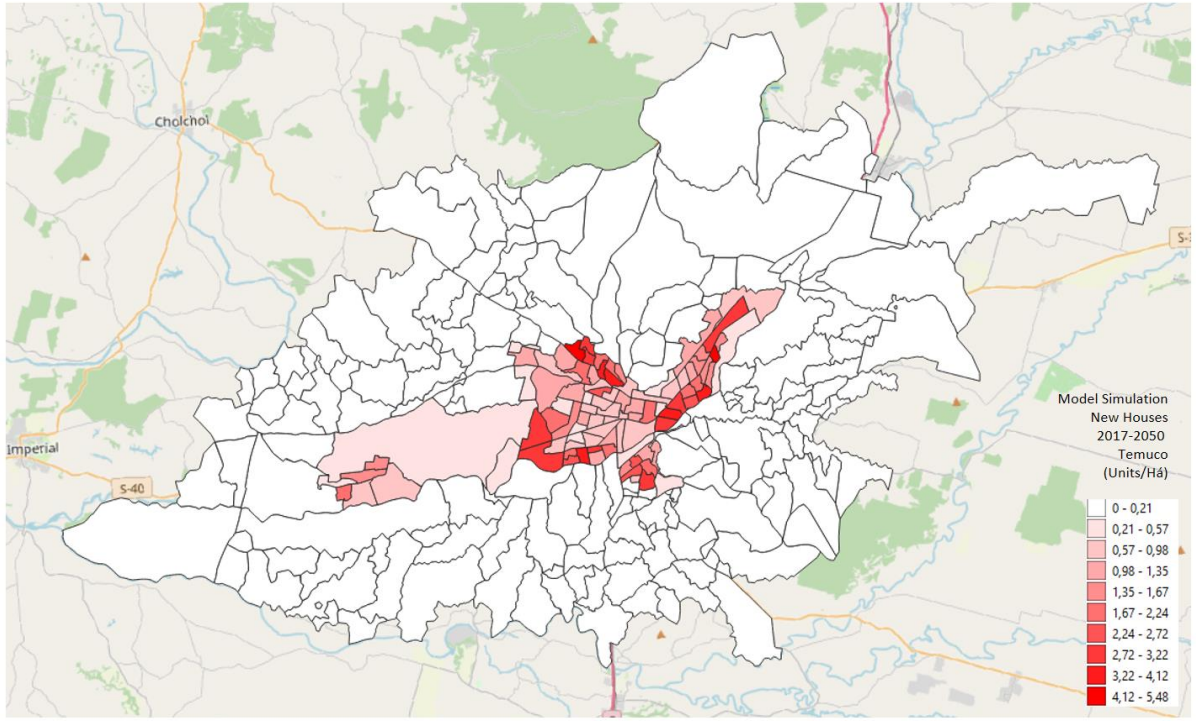
Total installed capacity per year



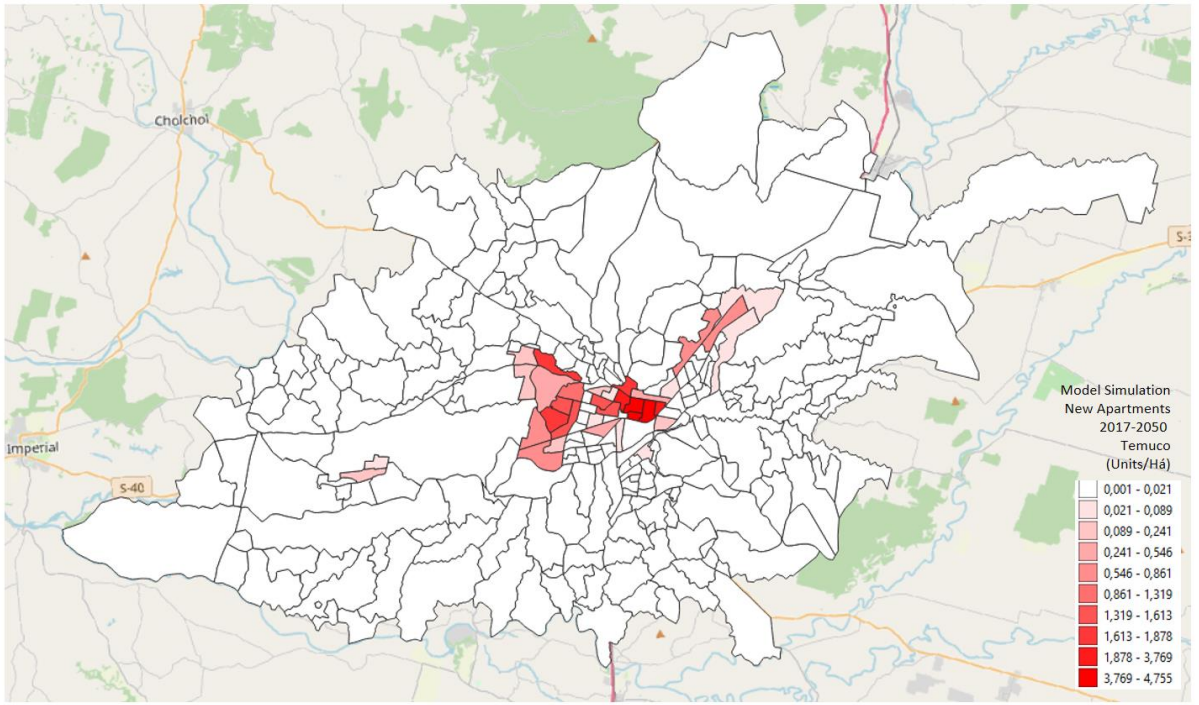
Distribution of the installed capacity for each country region for the year 2026

Results: Urban planning

Future 2050 scenario



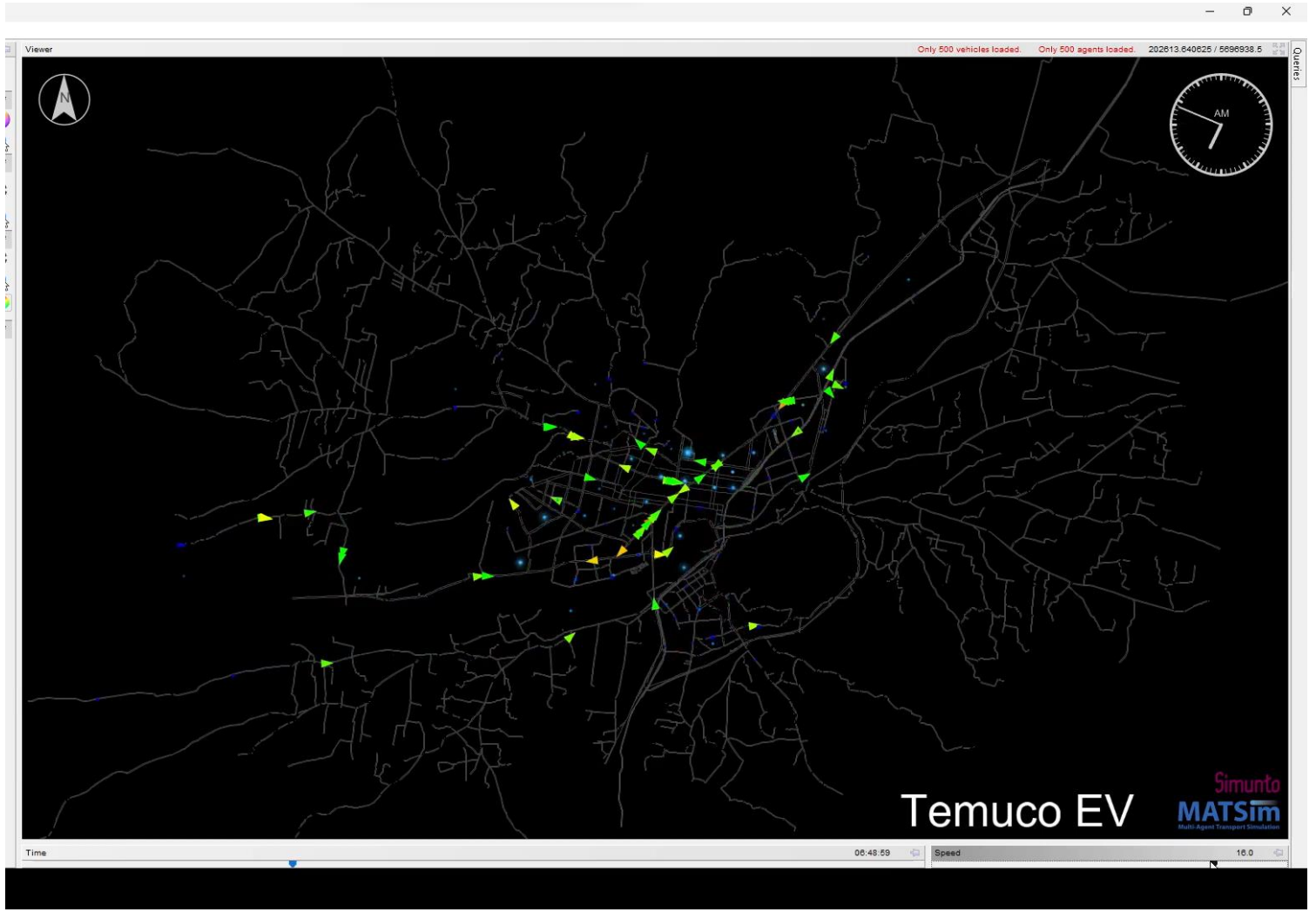
Houses growth heatmap



Apartment growth heatmap

Results: Transport system (MATSim)

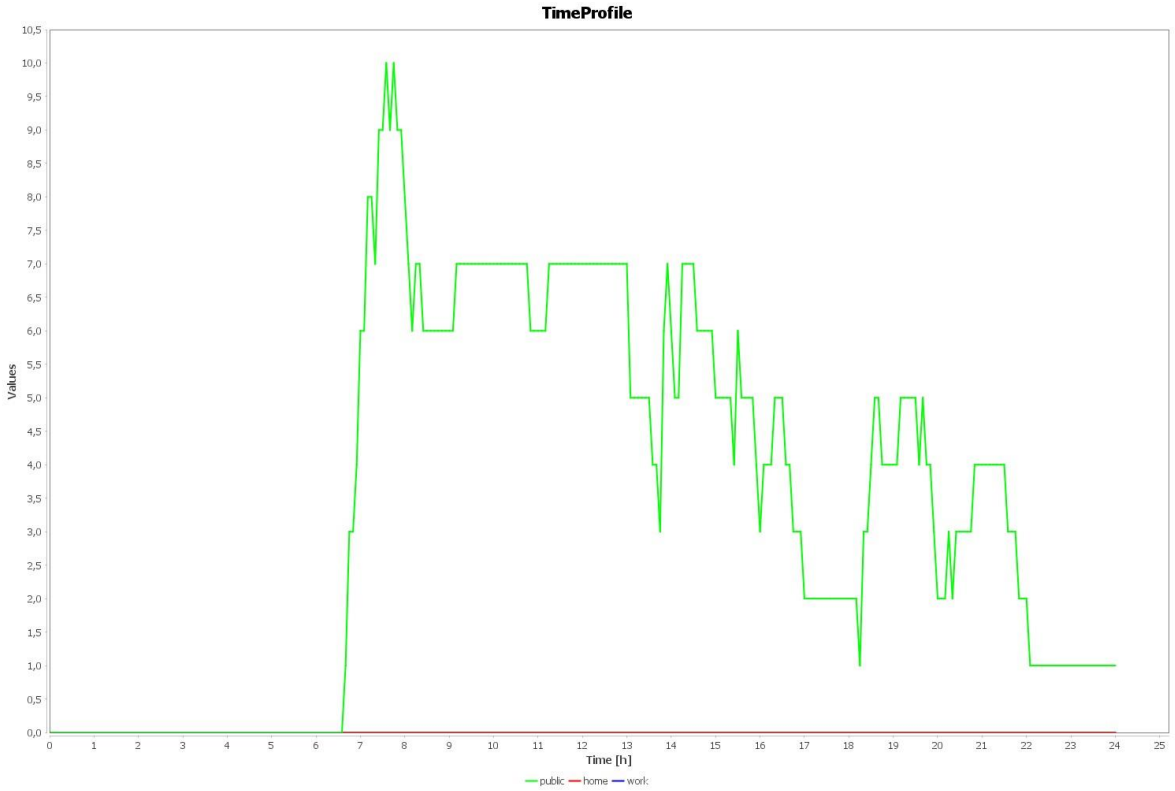
24 hours simulation
6,600 EVs
4 public charging locations
Home v/s public charging
“UrbanEV” contrib
https://github.com/TUMFTM/urbanev



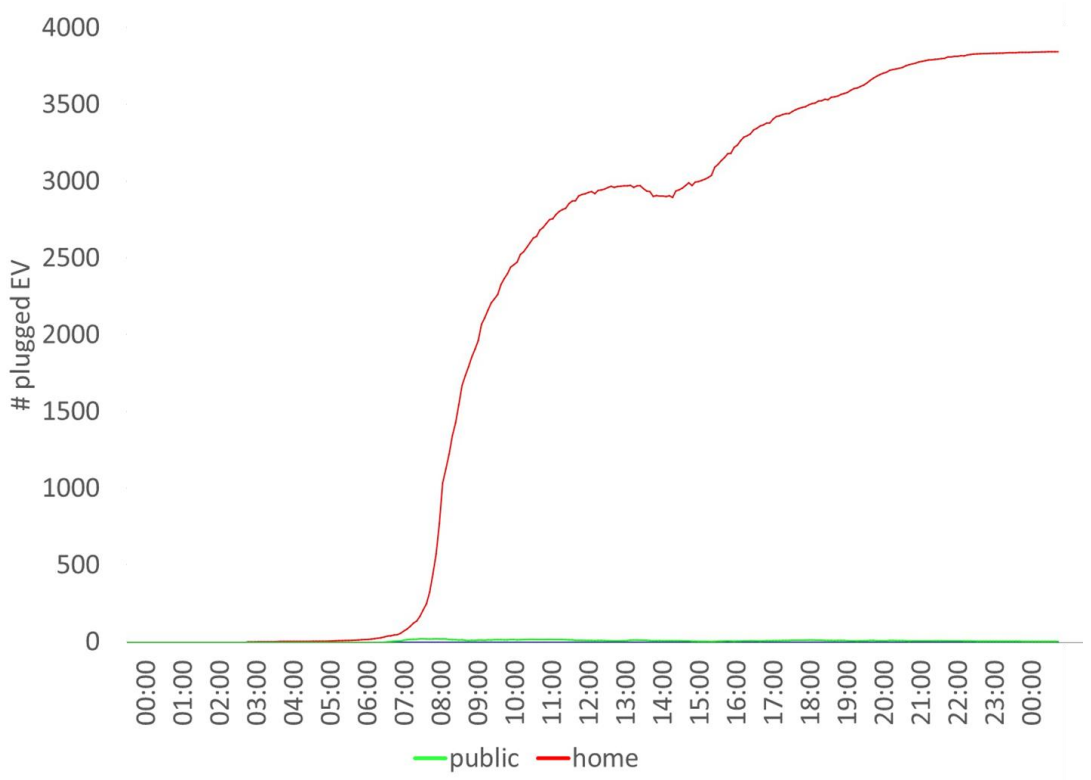
https://www.youtube.com/watch?v=J9bL1Kjscw0

Results: Transport system

Number of plugged vehicles within a day of simulation



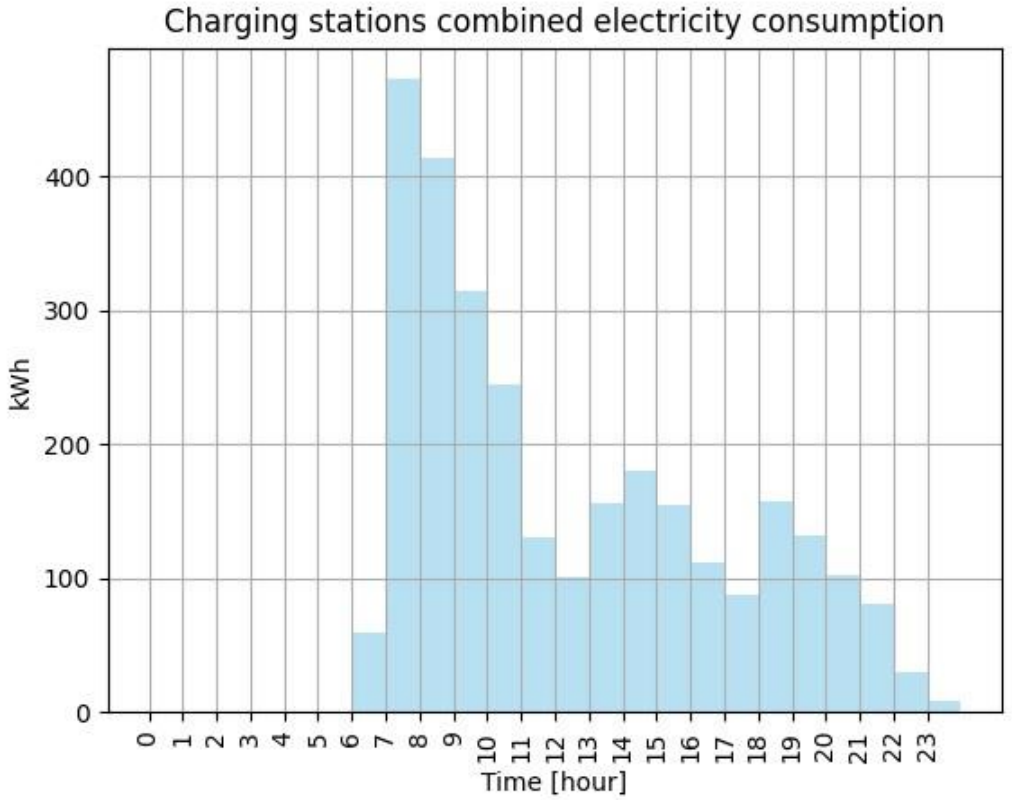
Public charging (No home charging)



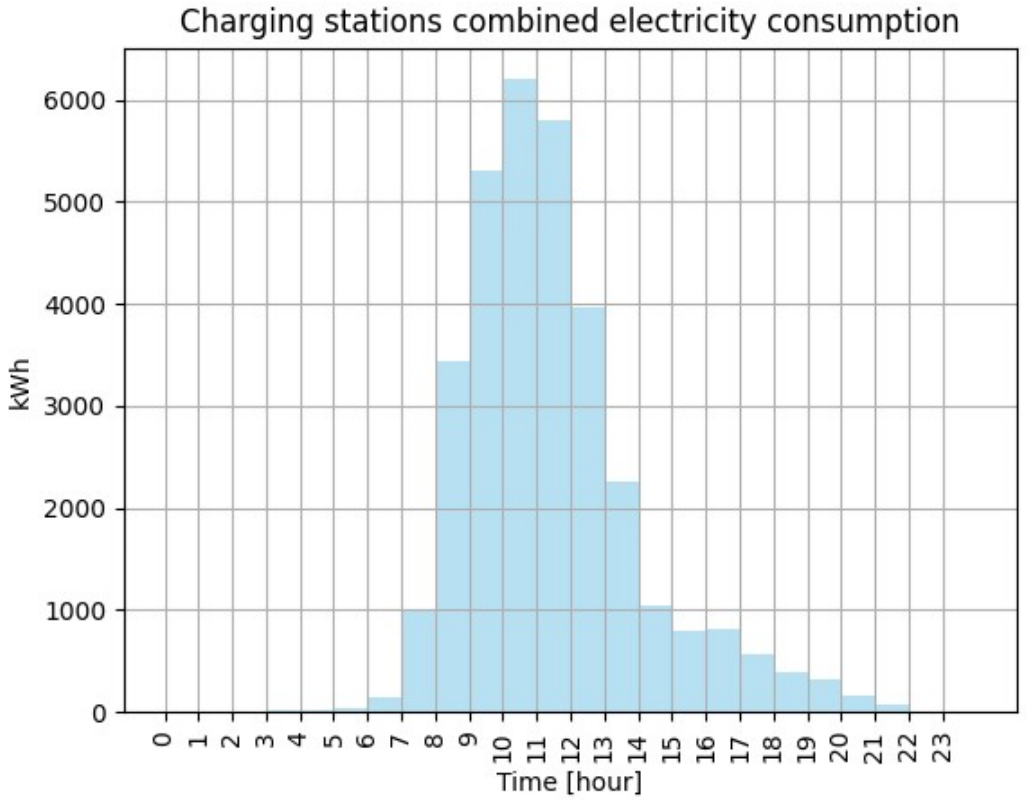
80% home charging

Results: Transport system

Charging energy demand profiles

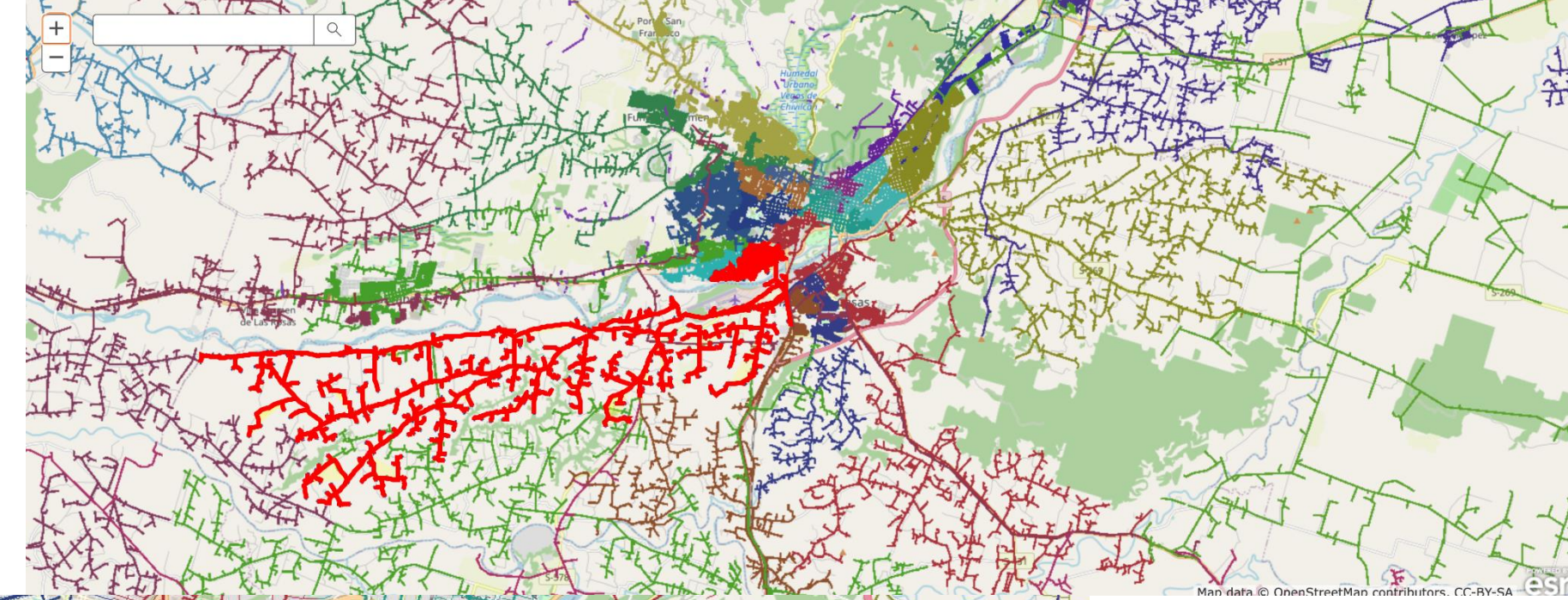


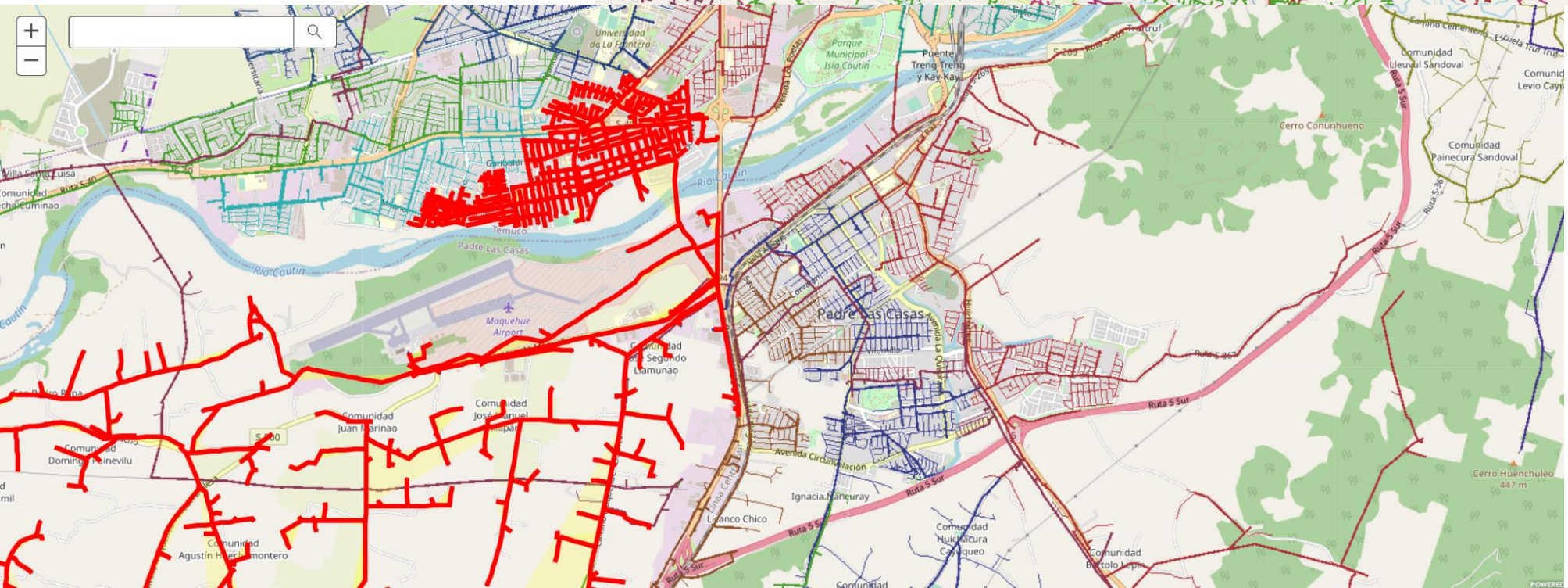
No home charger



80% home charger

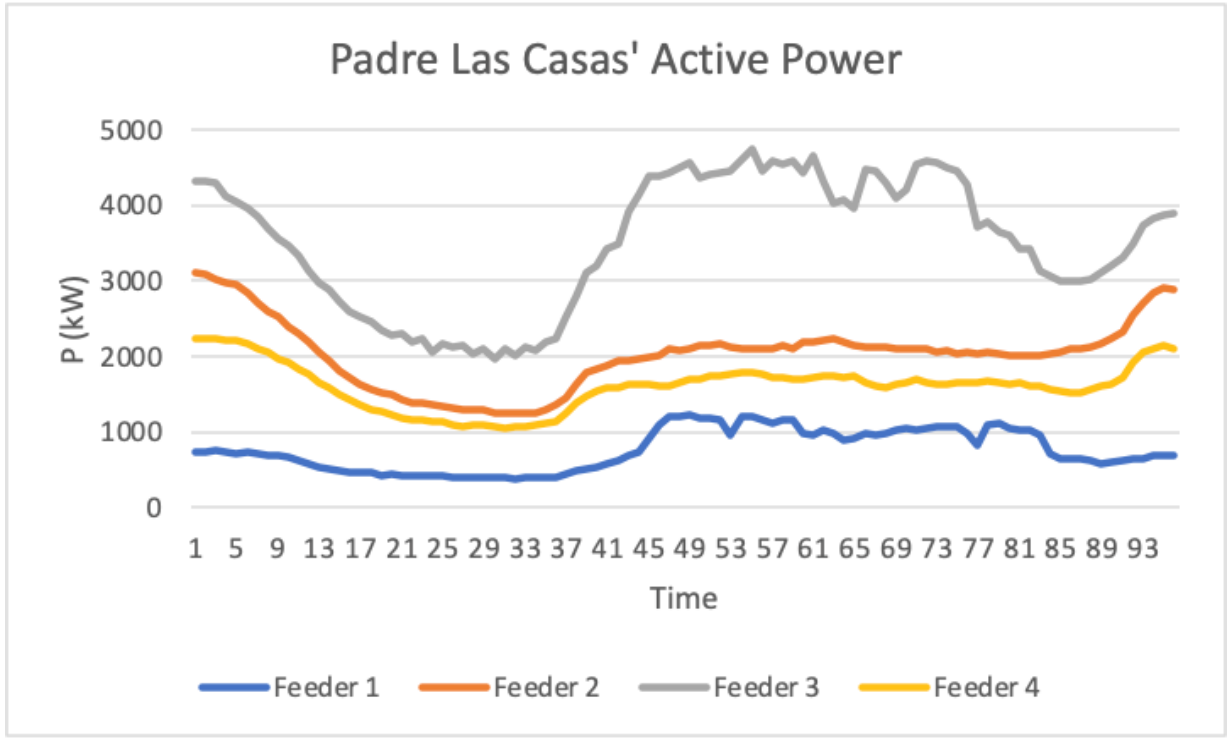
Results: Power distribution system

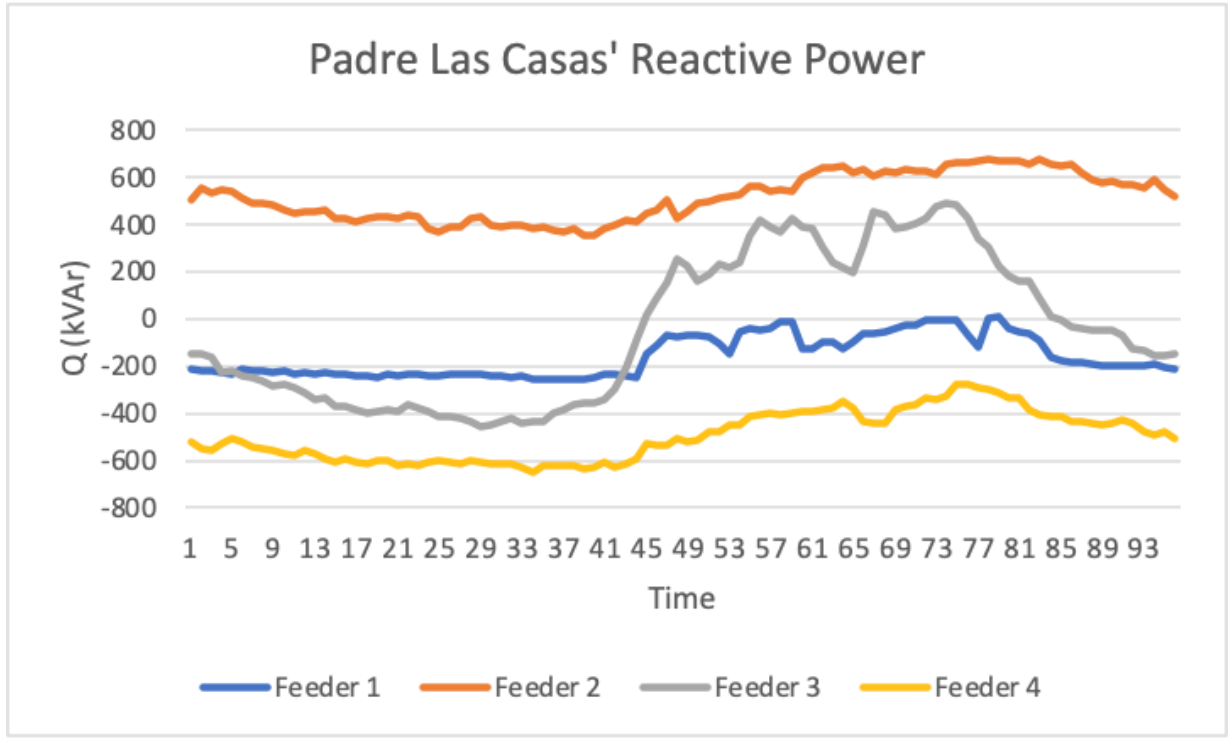




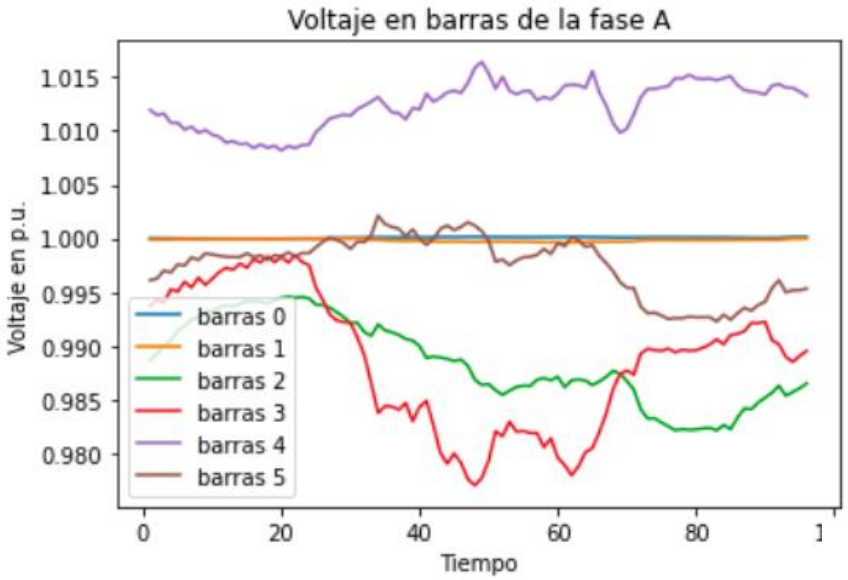
Results: Power distribution system

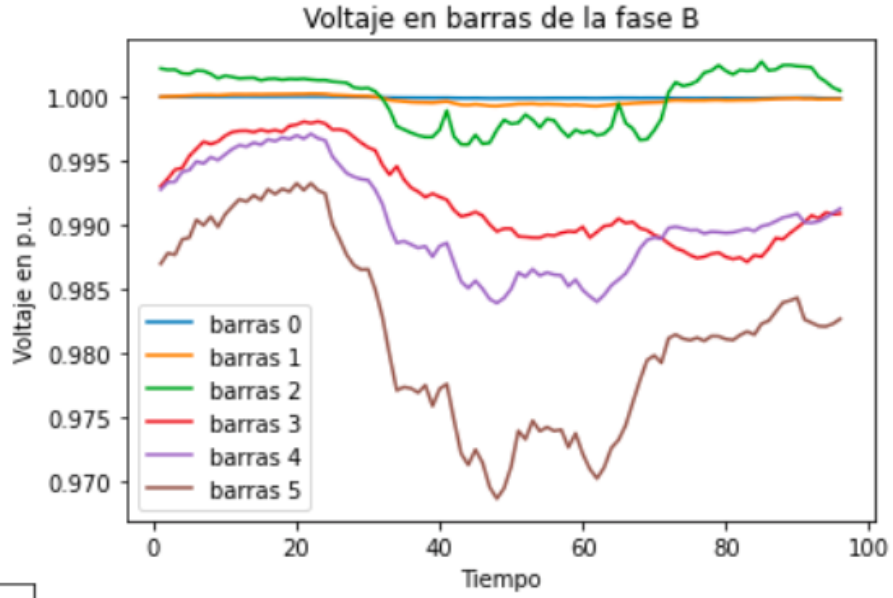
Daily power profile in Padre Las Casas

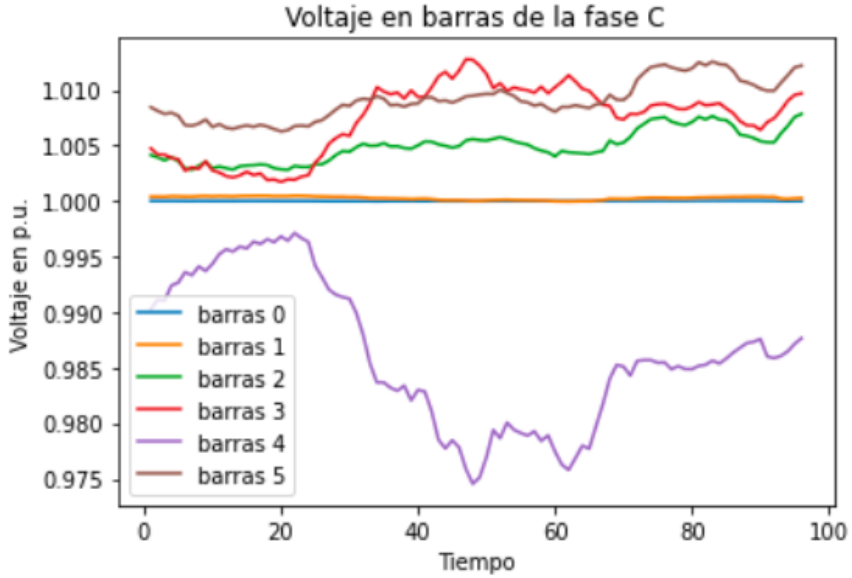




Results: Power distribution system







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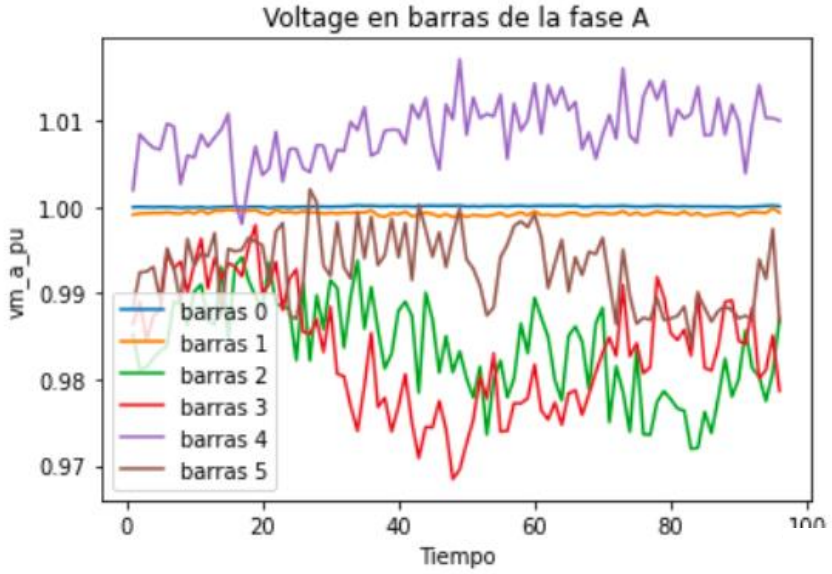
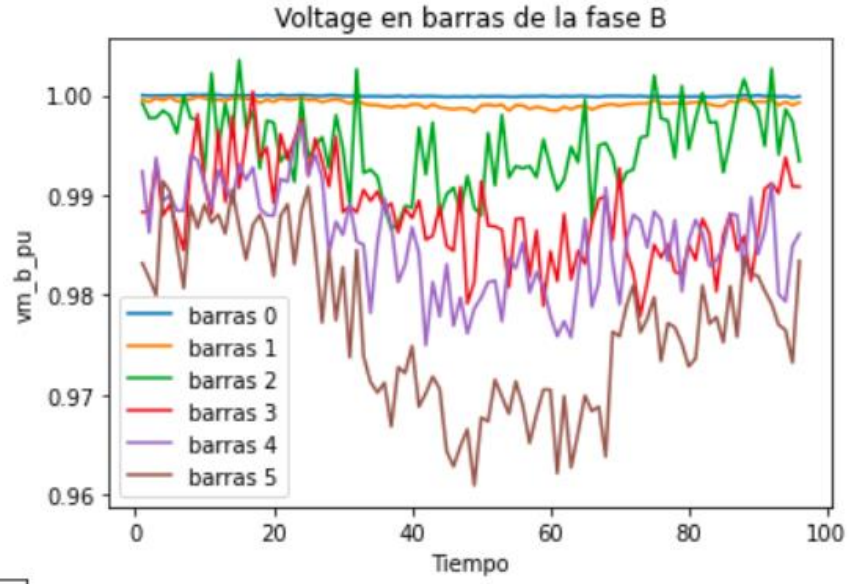
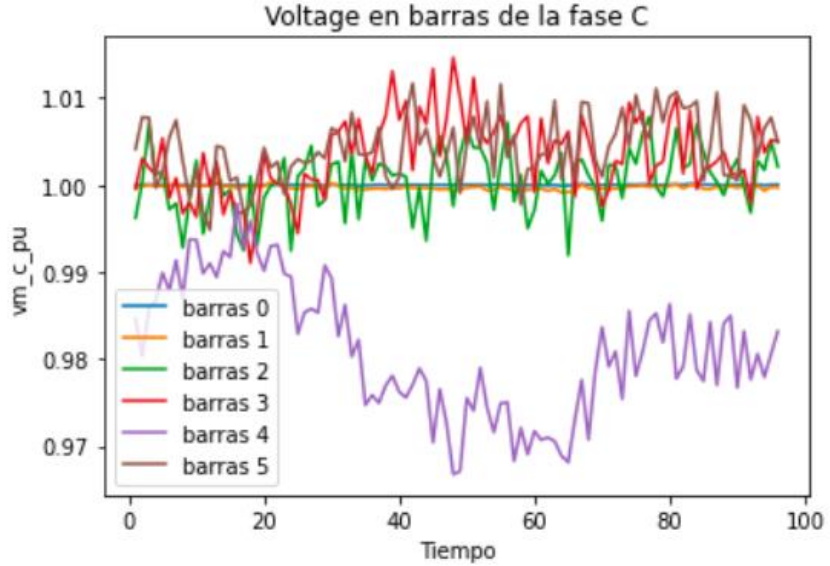
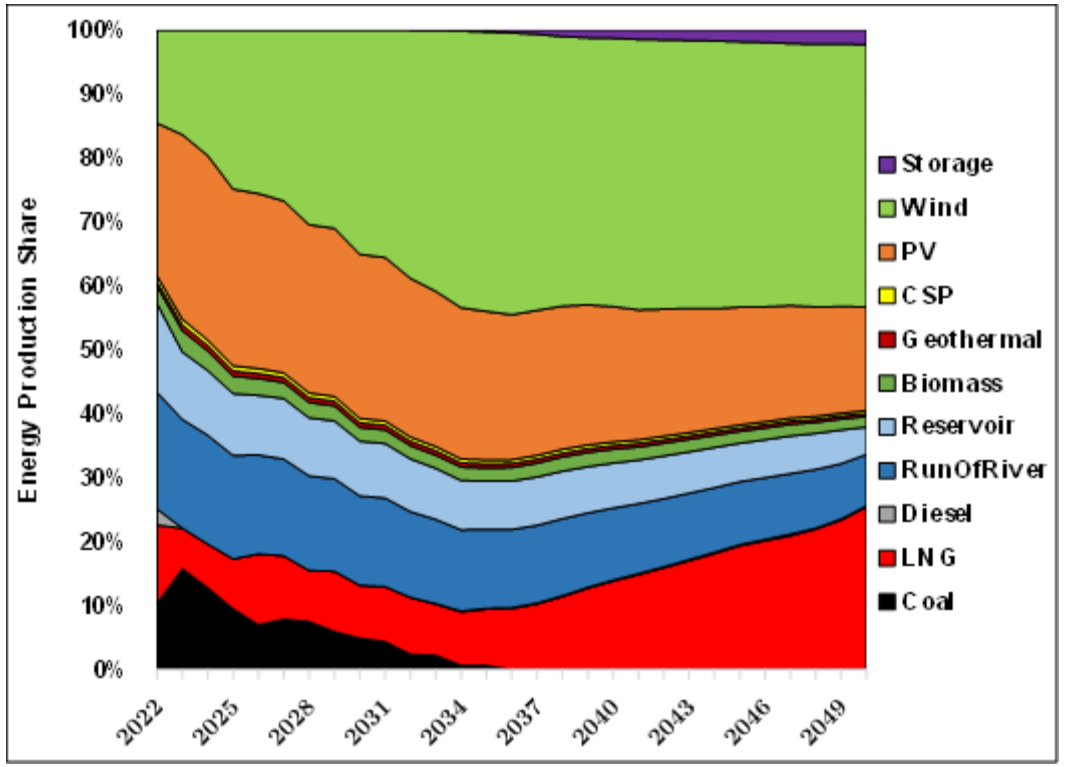


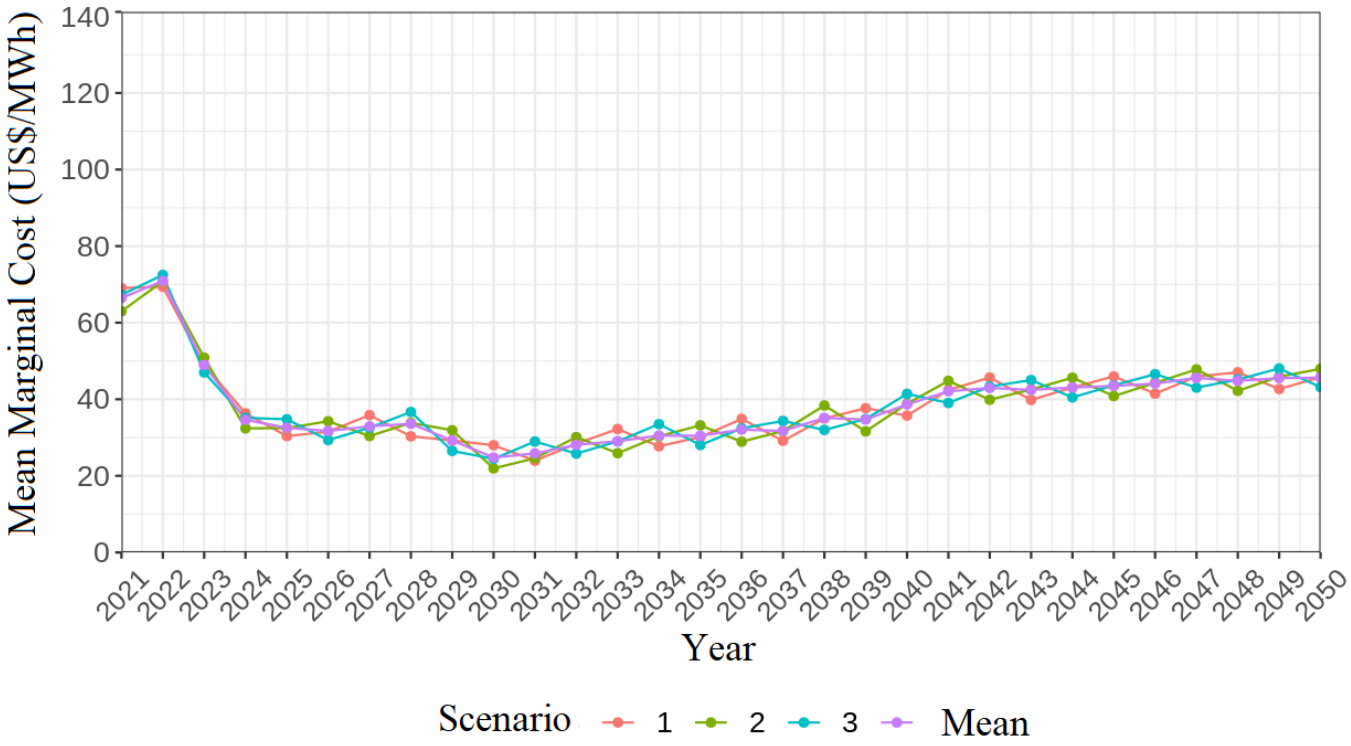




Results: Power system expansion



Energy production share



Mean marginal costs

Conclusions

- Integrated simulation framework assesses electromobility's impact on grids and energy systems.
- Integration of diverse modules presents calibration and validation challenges.
- Future research includes policy design and urban planning integration.
- Open access to code and data fosters collaboration and transparency.
- Framework serves as a versatile tool for sustainability planning and policy.

Thanks to the whole team and institutions

Team:

Marcelo Matus Acuña, Gonzalo Bustos-Turu, Tomás Cox, Mónica Zamora Zapata, Williams Calderon-Muñoz, Ignacio Ceballos, Bárbara Silva, Lorenzo Reyes-Chamorro, Chariel Chávez Mancilla, María Del Pilar Buitrago-Villada, Fernando Peña Cortés, Eduardo Fernández Soto, Alejandro Tirachini, Leonardo Camus, Carlos García Bujanda, Gianluca Falcone Araya, Luis Di Stefano

Institutions:

Centro de Aceleración Sostenible de Electromovilidad, Universidad de Chile, Chile; Centro Nacional de Inteligencia Artificial, Chile; Innovative Energy Technologies Center, Universidad Austral de Chile, Chile; Universidad Católica de Temuco, Chile; Pontificia Universidad Católica de Chile, Chile; Universidad de Carabobo, Venezuela.

Funders:

ANID grant FONDEF IT210050, and partially from **ANID grant FONDECYT N° 3210460**.