Mapping the potential of electric vehicles as flexibility asset for solar energy in Europe

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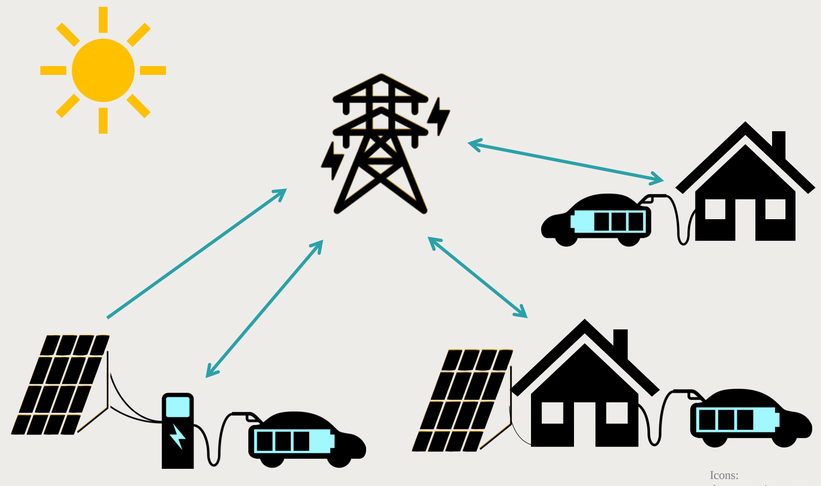
1. Motivation

- ✓ Supply a rising electricity demand for electric vehicle charging with photovoltaic electricity,
- ✓ Absorb the production peaks of solar panels by charging the electric vehicles batteries,
- ✓ Discharge the electric vehicles batteries into the electric grid or a home during demand peaks.

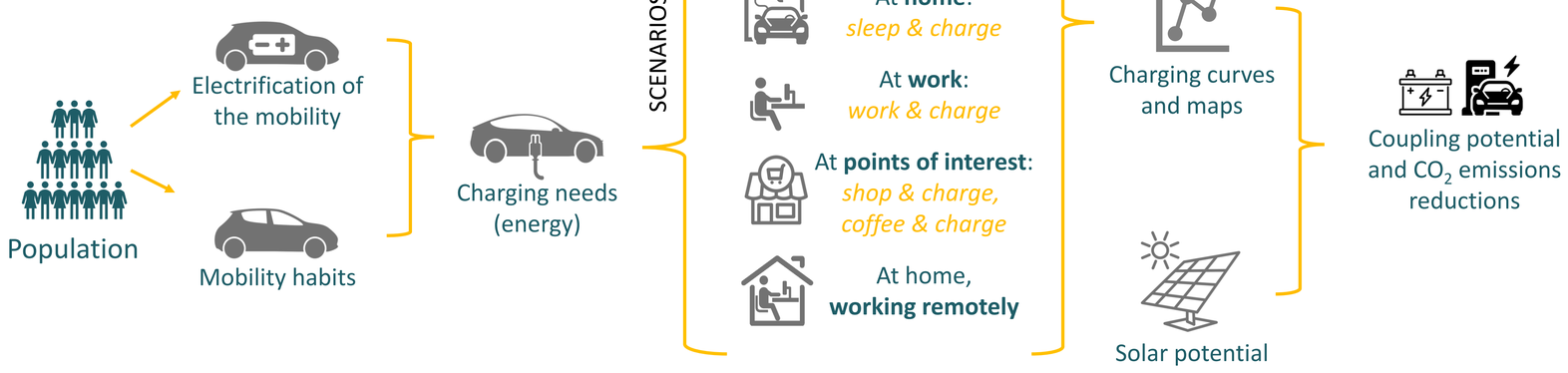


2. Objectives

The objective is to develop a new methodology based on mobility analysis to quantify the potential for coupling electric vehicles and solar electricity generation. The methodology is implemented in the open-source platform citiwatts.eu.

3. Methods

First, the electrification of the mobility and the mobility needs are quantified, to evaluate the charging needs. Then, scenarios are developed to distribute the charging needs between different locations. Finally, the results are compared to solutions in term of coverage of the needs.

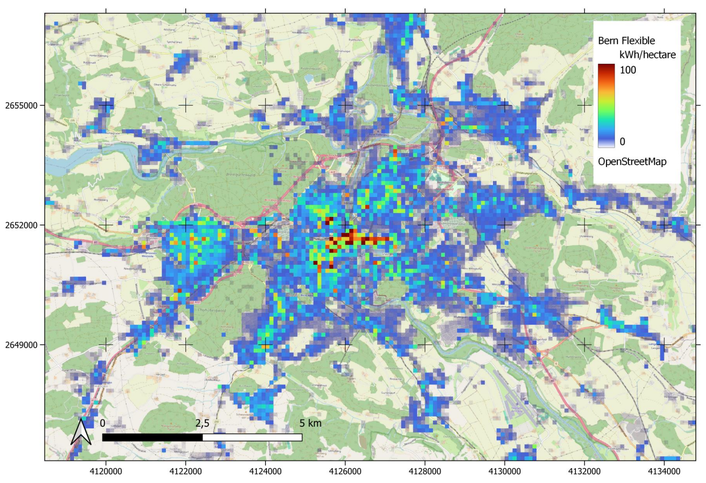


4. Charging scenarios

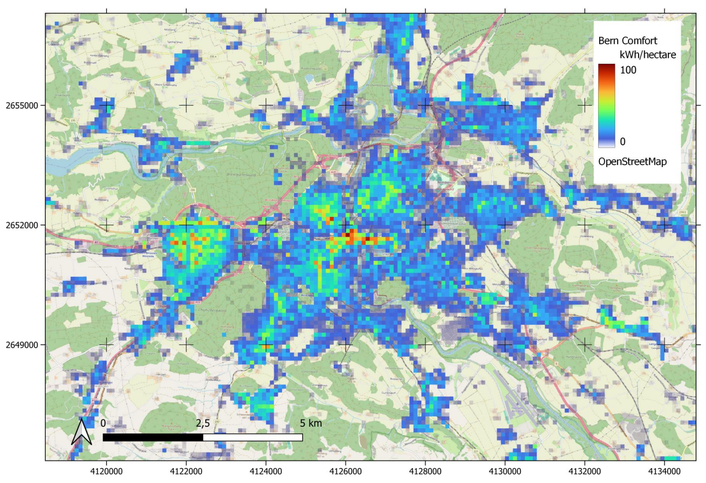
	Comfort	Flexible
At home	52%	32%
At work	14%	29%
Working remotely	5%	8%
At points of interest	27%	31%
Smart charging	no	yes

5. Geographic results in Bern

Compared to the ‘Comfort’ charging scenario, the charging demand in ‘Flexible’ charging scenario, is shifted from peri-urban areas to the city centers.



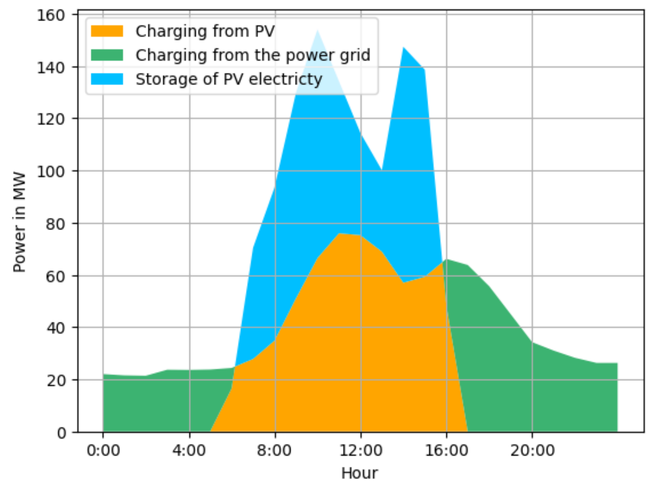
Scenario Flexible



Scenario Comfort

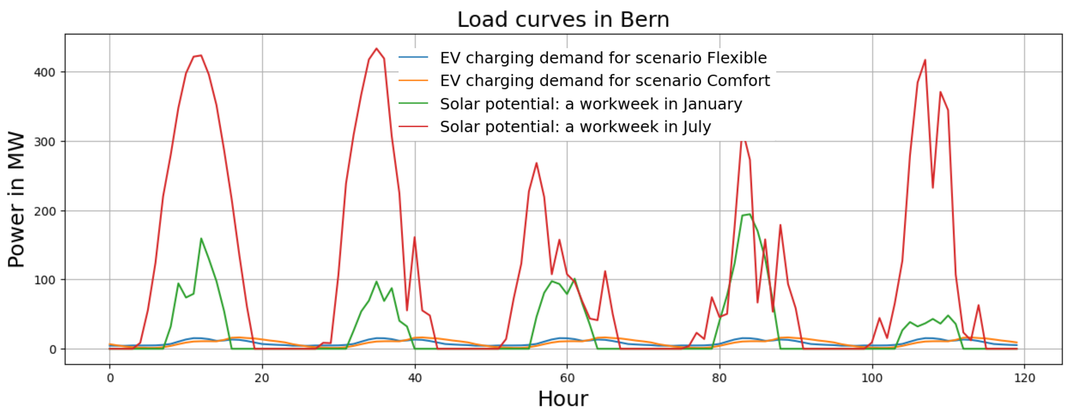
6. Photovoltaic scenario

- 10% of roofs covered by solar panels.
- 20% efficiency of the solar modules.
- 80% as performance ratio.
- Meteorological data are obtained from PVGIS.



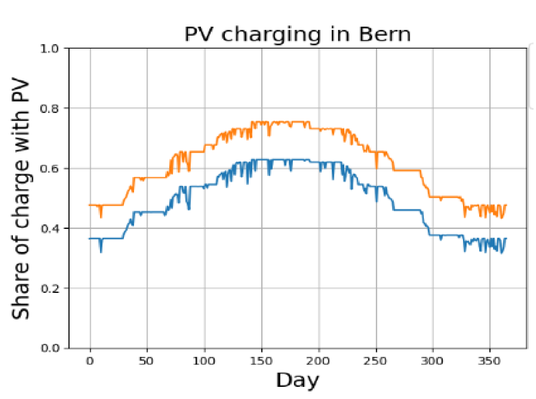
7. Load curves in Bern

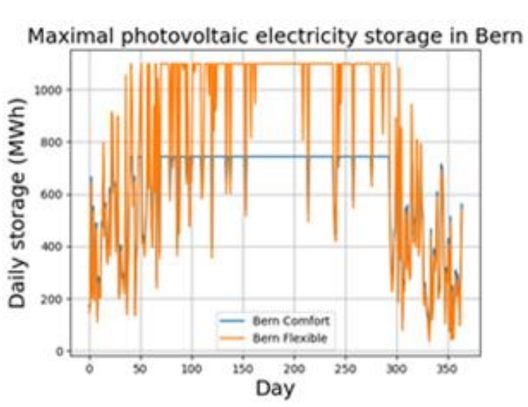
- The total demand is about 208 MWh per day.
- The charging behavior affects the load curves.
- Scenario 'Smart charging at home' reduces the peak by almost 30%, and shift it in time compared to immediate home charging.



8. Flexibility in Bern

- Photovoltaic electricity can supply the additional demand for charging.
- Up to 1.1 GWh/day can be available in the vehicle batteries and can be used for flexibility in Bern in 2050, it is enough to store all the photovoltaic electricity production from September to March.





9. Conclusion

- Significant effect of the charging behaviour on load curves.
- Most of the battery capacity remains available for flexibility.
- In summer, the number of cars available in the day for V2G limits the storage capacity.

10. Uncertainties & future work

- Coarse modelling of leisure and shopping mobility.
- Type and size of POI not taken into account.
- Number of jobs at workplaces not taken into account.

This research is part of the ERA-net OpenGIS4ET project and was funded by the Swiss Federal Office for Energy.