






ChaProEV: Generating Charging Profiles for Electric Vehicles

Omar Usmani ^{1*} and Germán Morales-España ^{1,2*}

¹ TNO Energy and Materials Transition, Radarweg 60, Amsterdam, 1043 NT, The Netherlands  ² Faculty of Electrical Engineering, Mathematics and Computer Science, Delft University of Technology, Delft, The Netherlands  * These authors contributed equally.

DOI: [10.xxxxxx/draft](https://doi.org/10.xxxxxx/draft)

Software

- [Review](#) 
- [Repository](#) 
- [Archive](#) 

Editor: [Open Journals](#) 

Reviewers:

- [@openjournals](#)

Submitted: 01 January 1970

Published: unpublished

License

Authors of papers retain copyright and release the work under a Creative Commons Attribution 4.0 International License ([CC BY 4.0](#)).

Summary

ChaProEV is

Statement of need

- Profiles are good and useful, but optimisation modes might also need soem underlying parameters to do optimisation computations as well
- Provide optimisation models with the boundary conditions they need
- ChaProEV provides the necessary parameters (as explemplified in COMPETES, Mopo/Ines, etc.) in a clear and accessible way, with the also allowing a clear way to modify them without touching code ([Sijm et al., 2022](#))

Conceptual innovations: Supporting optimisation models

Basic elements

A commonly used aggregated EV formulation is ([Morales-España et al., 2022](#)):

$$e_t = e_{t-1} + \eta^{G2V} p_t^{G2V} \Delta$$

Further modelling

Software innovations

No code parameters and profiles modification (explain what kind of modifications are possible)
Scenarios

1. Demand for next leg (kWh) (from network): The charge that the vehicles leaving in the next time step need to pull from the network for the leg they are about to undertake, corrected by the charger efficiency.
2. Demand for next leg (kWh) (to vehicles): The part of the above that vehicles get. ($\{E_t^{\text{drive}}\}$ in Equation)
3. Connected vehicles: The share of vehicles that are connected to a charger ($\{N_t^{\text{plugged}}\}$ in Equation (??))
4. *Charging Power from Network (kW)*: Maximum power that connected vehicles can potentially draw from the network. ($\{\bar{P}_t^{G2V}\}$ in Equation)

- 32 5. Charging Power to Vehicles (kW): Maximum power that can potentially go to vehicles
33 go to vehicles (i.e. the same as above with a charger efficiency correction).
- 34 6. *Vehicle Discharge Power (kW)*: The amount of power connected vehicles can discharge
35 to the network.
- 36 7. Discharge Power to Network (kW): How much of that discharged power can go to the
37 network. ($\{\bar{P}_t^{V2G}\}$ in Equation)
- 38 8. Effective charging efficiency: Ratio between charging power going to the vehicle and
39 power coming from the network. This can vary in time, as the location of the charging
40 vehicles (and thus the efficiency of the involved chargers) changes as they move around.
41 (η^{G2V} in Equation)
- 42 9. Effective discharging efficiency: Same as above, but for discharging (it is the power going
43 out of the vehicles divided by the power going into the network). (η^{V2G} in Equation)

44 Acknowledgements

- 45 ChaProEV was partly developed under funding from the European Climate, Infrastructure
46 and Environment Executive Agency under the European Union's HORIZON Research and
47 Innovation Actions under grant agreement no. 101095998.
- 48 Morales-España, G., Martínez-Gordón, R., & Sijm, J. (2022). Classifying and modelling demand
49 response in power systems. *Energy*, 242, 122544. [https://doi.org/10.1016/j.energy.2021.](https://doi.org/10.1016/j.energy.2021.122544)
50 [122544](https://doi.org/10.1016/j.energy.2021.122544)
- 51 Sijm, J., Morales-España, G., & Hernández-Serna, R. (2022). *The role of demand response*
52 *in the power system of the netherlands, 2030-2050* (Report No. P10131). TNO. [https:](https://publications.tno.nl/publication/34639481/emVYyq/TNO-2022-P10131.pdf)
53 [/publications.tno.nl/publication/34639481/emVYyq/TNO-2022-P10131.pdf](https://publications.tno.nl/publication/34639481/emVYyq/TNO-2022-P10131.pdf)