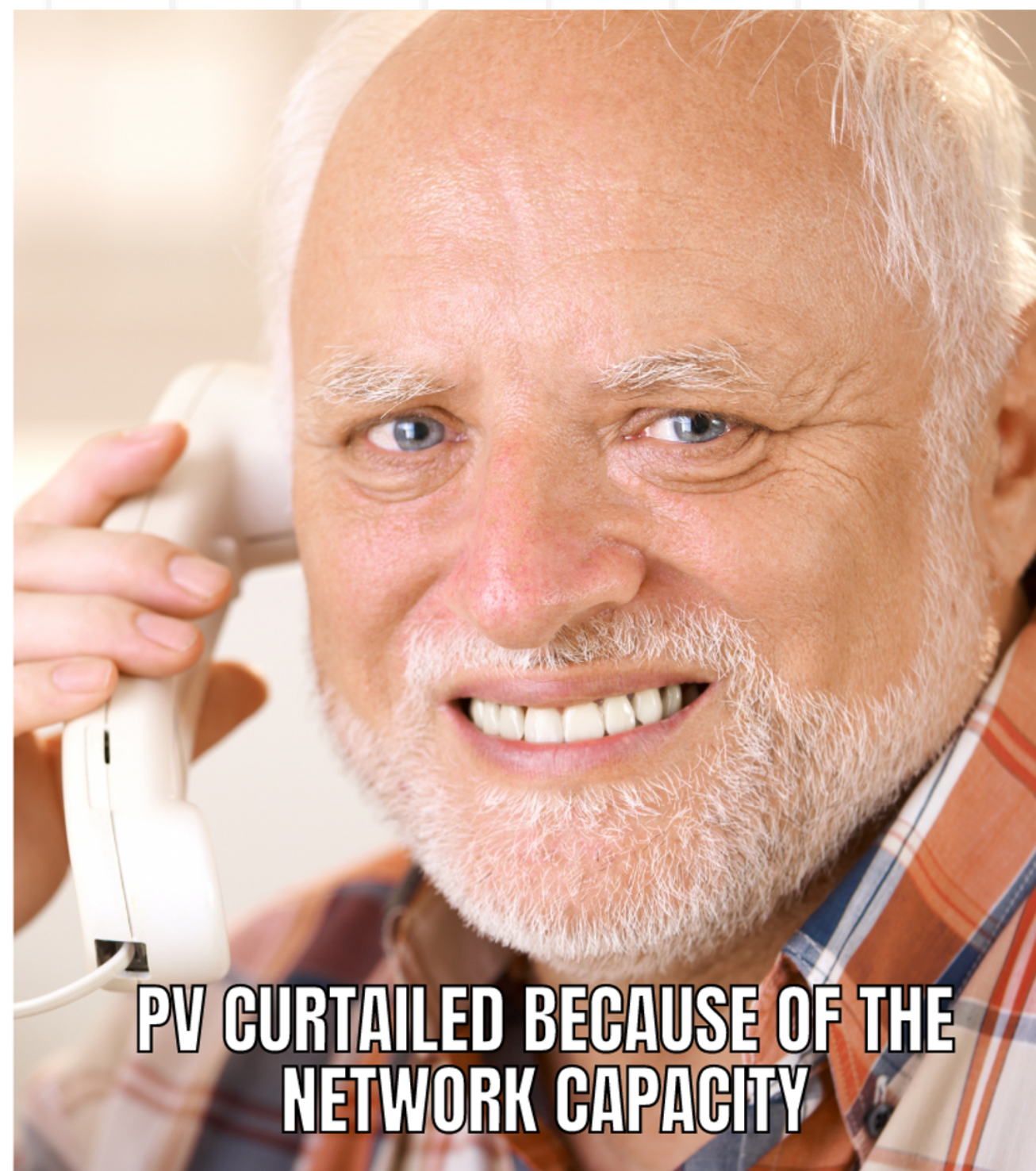


Amina Benzerqa, supervisor: Damien Ernst
abenzerqa@uliege.be

Problem



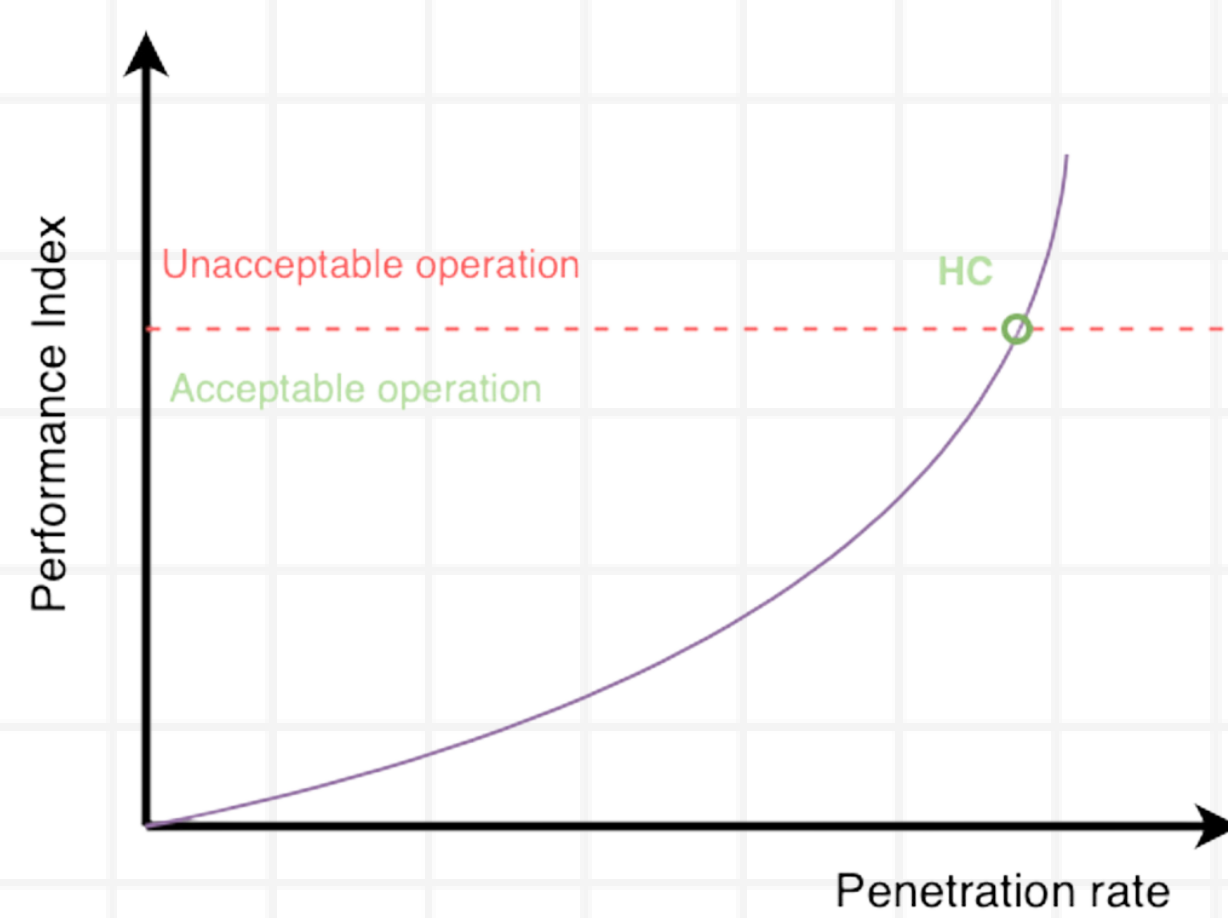
BUYING NEW PV



PV CURTAILED BECAUSE OF THE NETWORK CAPACITY

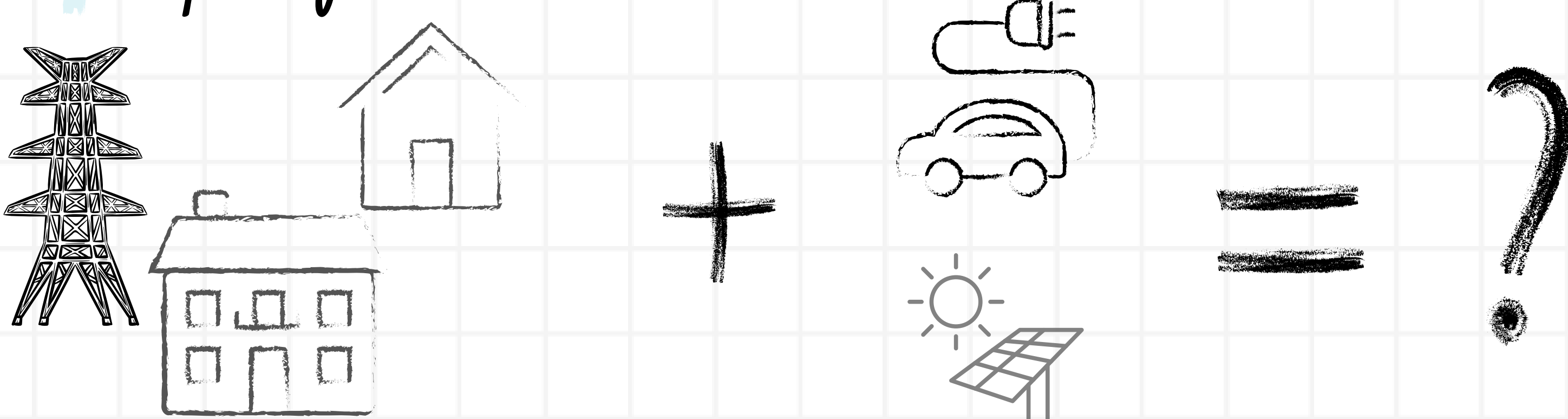
Hosting capacity

The hosting capacity (HC) is defined as the amount of new production or consumption that can be connected to the grid without endangering the reliability or voltage quality for other customers.¹



My work

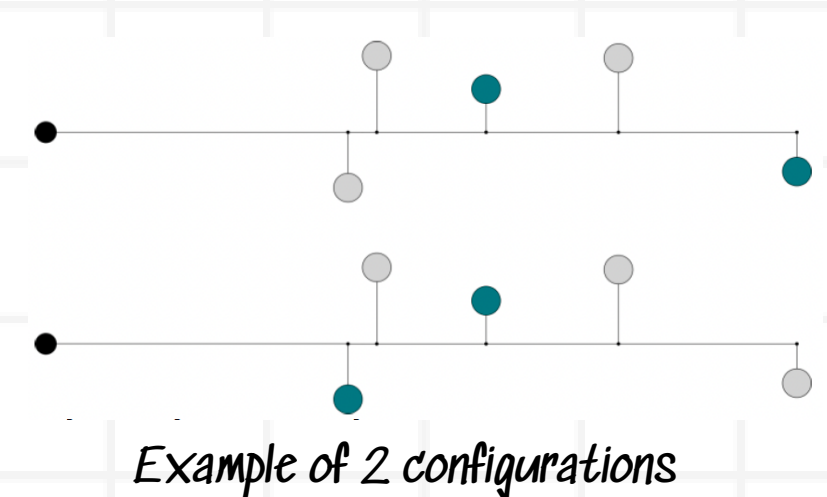
1. Capacity assessment²



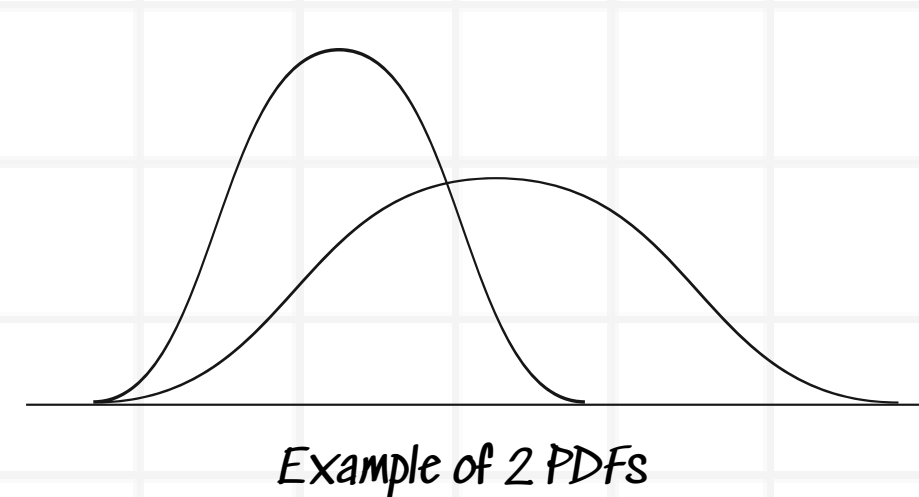
How many new installations (EV, PV) can the network sustain?

Our solution:

Evaluate some KPIs for several configurations for all penetration rates. This allows to create approximations of PDFs. Then DSOs can decide KPIs and their limits.



Example of 2 configurations



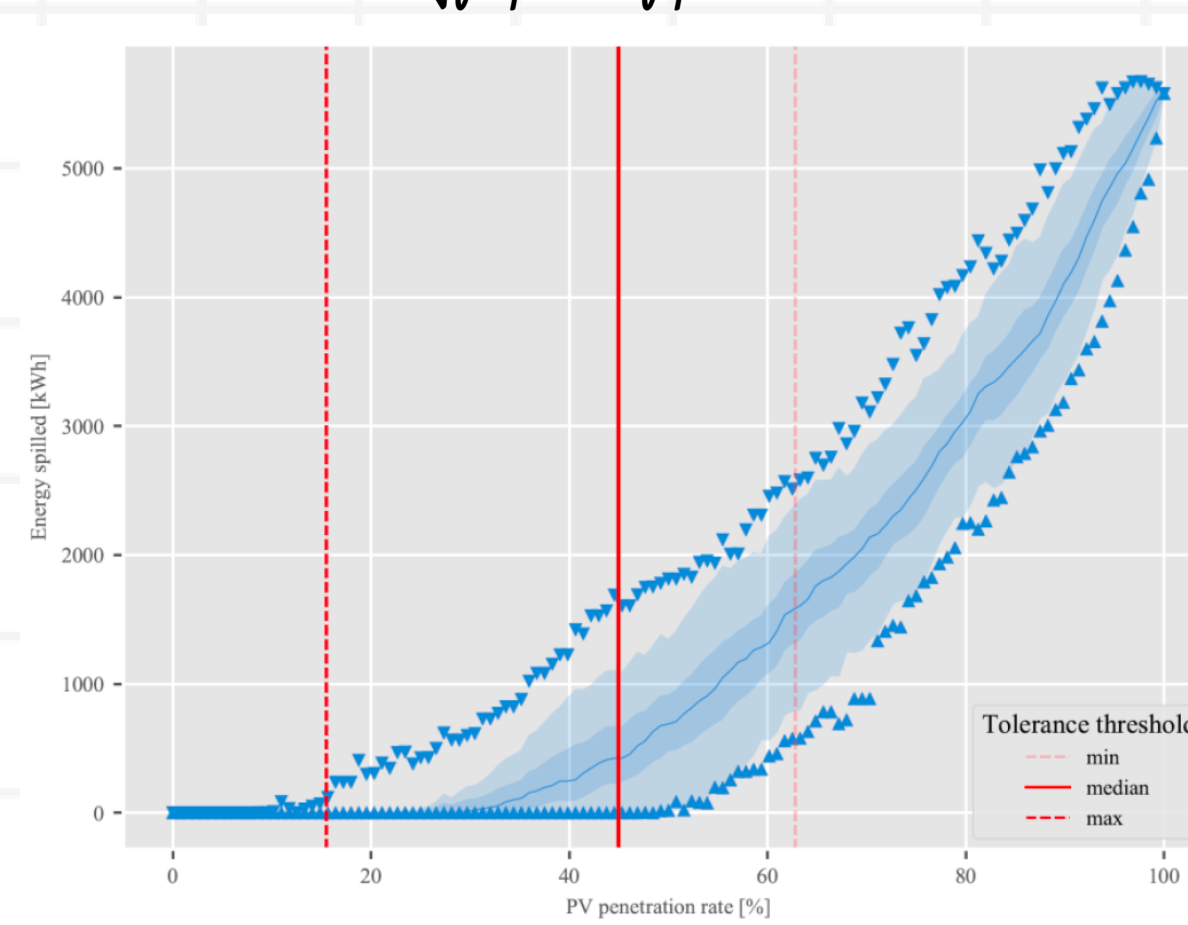
Example of 2 PDFs

Some results:

For PVs, 500 configurations:

- until 30% penetration rate, more than 75% of the configurations lead to no curtailment;
- with 45% penetration rate, 50% of the configurations ensures less than 5% of curtailment.

PV energy spilled by penetration rate.



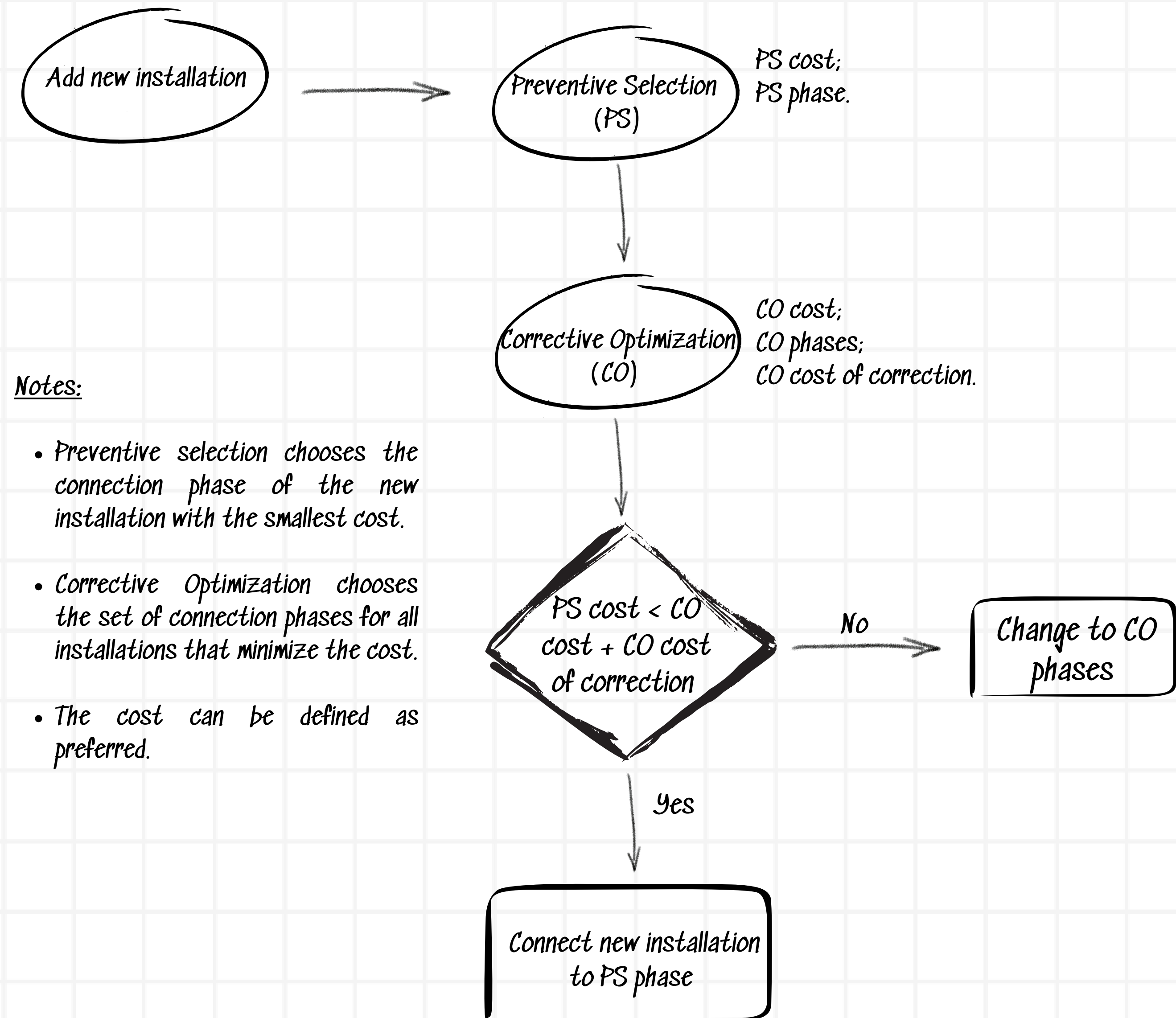
References

1. Bollen, M.H.J.; Häger, M. Power quality: Interactions between distributed energy resources, the grid and other customers. In Proceedings of the 1st International Conference on Renewable Energy Sources and Distributed Energy Resources, Brussels, Belgium, 1-3 December 2004.
2. Benzerqa, A., Mathieu, S., Bahmanyar, A., & Ernst, D. (2021, July). Probabilistic capacity assessment for three-phase low-voltage distribution networks. In 2021 IEEE 15th International Conference on Compatibility, Power Electronics and Power Engineering (CPE-POWERENG) (pp. 1-6). IEEE.
3. Benzerqa, A., Bahmanyar, A., & Ernst, D. (2022). Optimal Connection Phase Selection of Residential Distributed Energy Resources and its Impact on Aggregated Demand. In 11TH BULK POWER SYSTEMS DYNAMICS AND CONTROL SYMPOSIUM (IREP-2022). IREP.
4. Benzerqa, A., Gérard, S., Lachi, S., Garnier, O., Bahmanyar, A., & Ernst, D. (2022). Optimal connection phase selection for single-phase electrical vehicle chargers.

2. Capacity enhancement^{3,4}

Balanced network = HC \uparrow ; Operational costs \downarrow

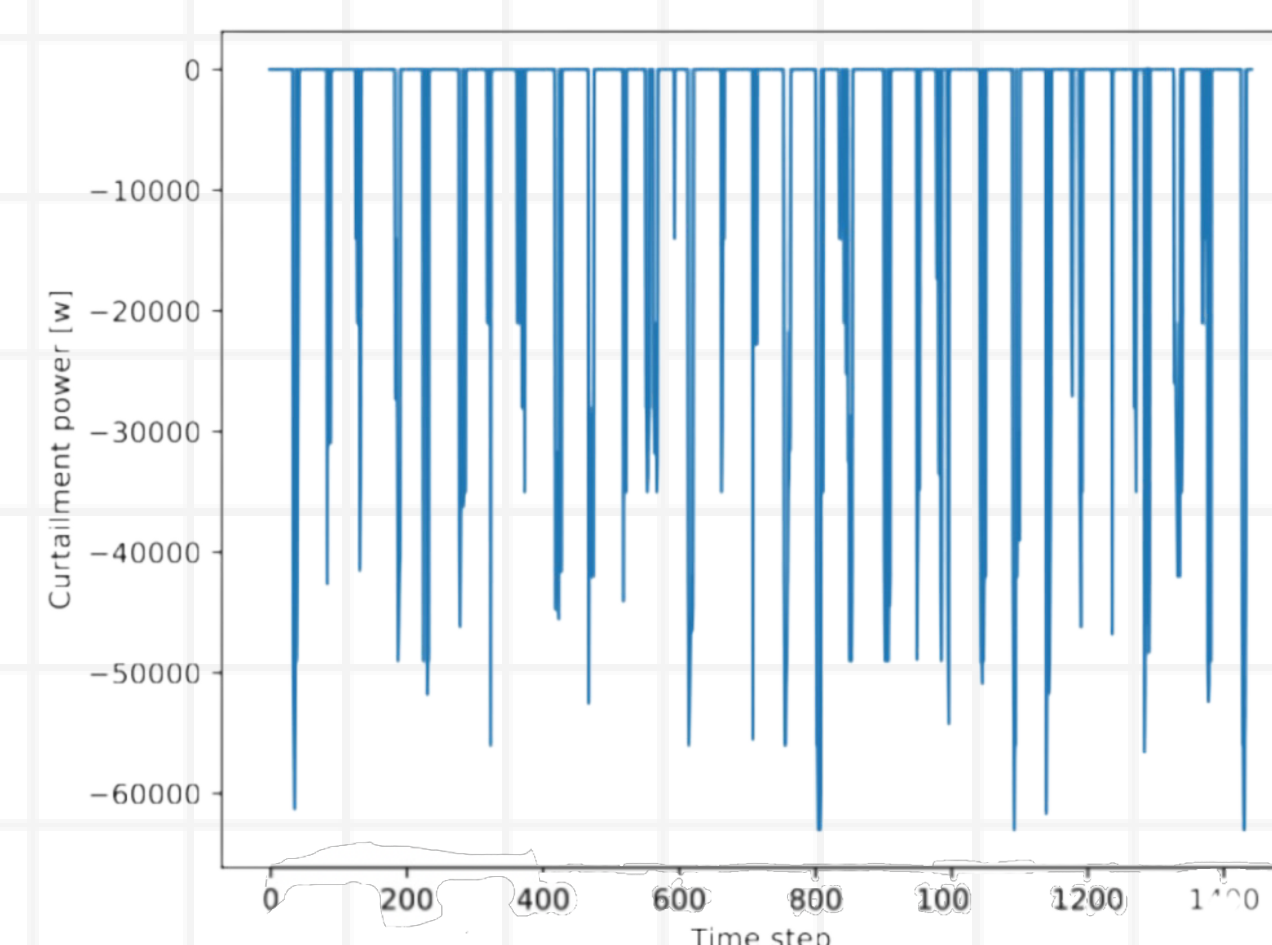
Our solution with nearly no investments is to find the best connection phases for installations



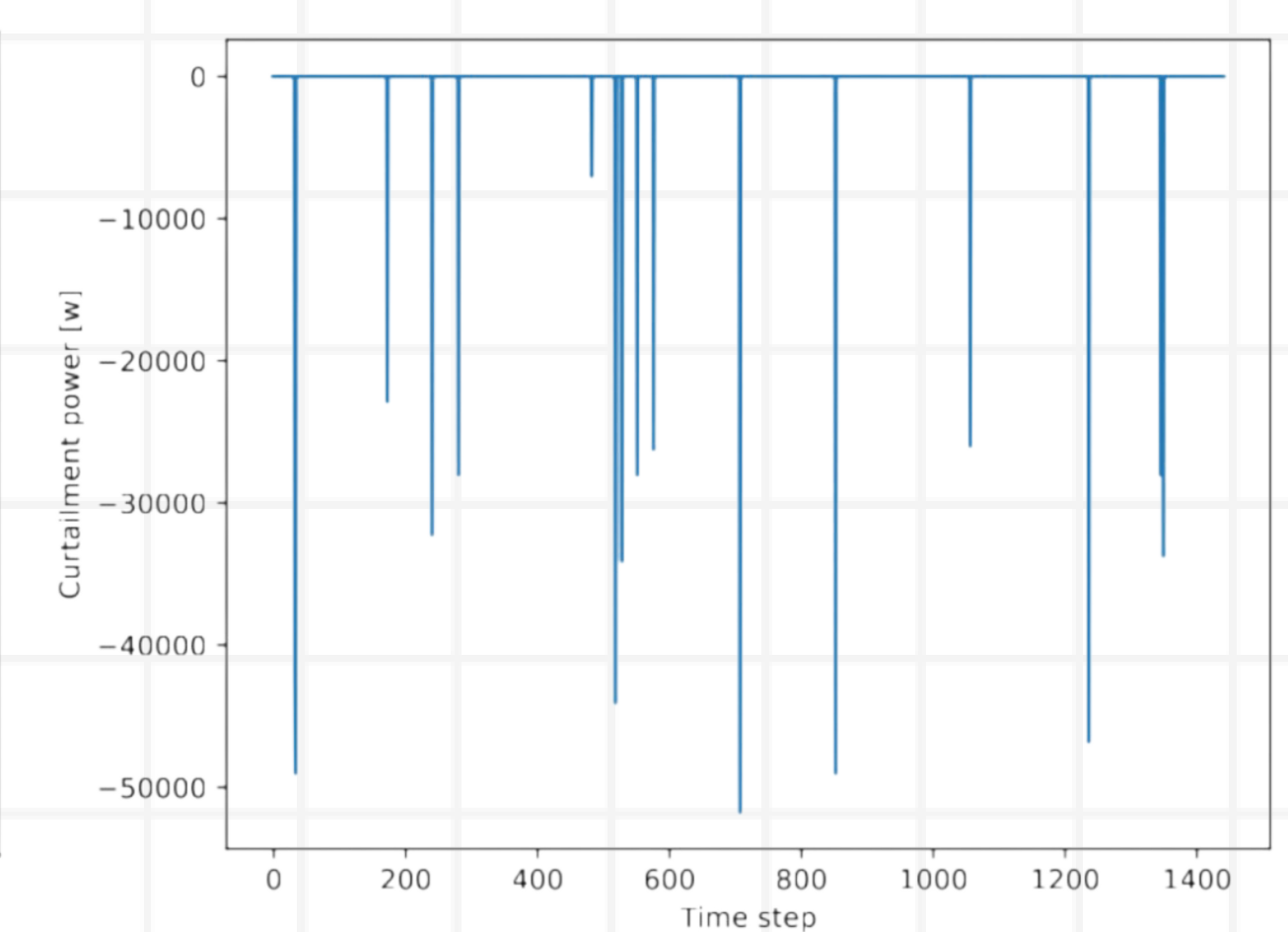
Notes:

- Preventive selection chooses the connection phase of the new installation with the smallest cost.
- Corrective Optimization chooses the set of connection phases for all installations that minimize the cost.
- The cost can be defined as preferred.

Some results:



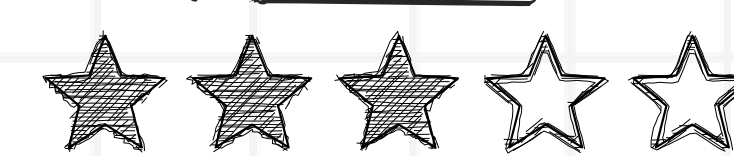
Curtailment powers for 9 new EV chargers without CO.



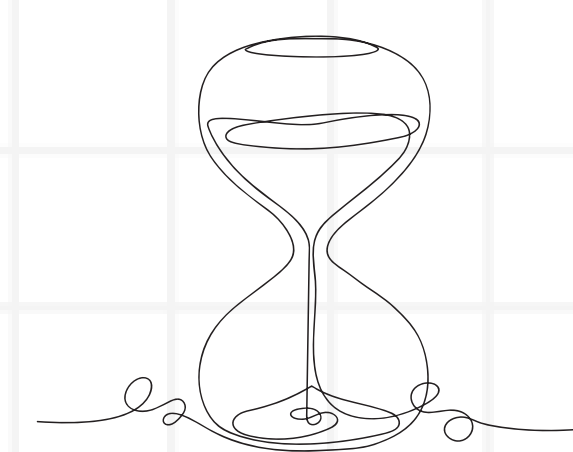
Curtailment powers for 9 new EV chargers with CO.

Future work

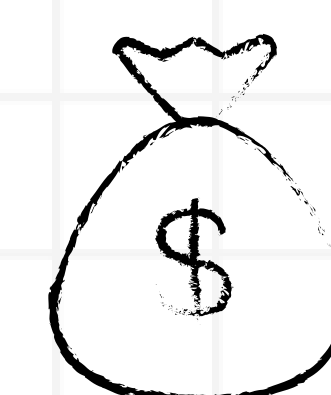
Review



A review paper on the recent works about hosting capacity.



Computing dynamic hosting capacity as it is less conservative than static HC.



Determining network reinforcements policies.