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Distributed Electrical Systems Laboratory
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DESL-EPFL

Student project proposal

Project title

Optimal planning of distributed energy resources in a distribution network.

Project type: MSc thesis, MSc semester project

Project responsible and e-mail
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Project description

The increased displacement of conventional electricity generation in favour of renewable energy resources (RES) has increased the stochasticity in the generation mix, which is causing multiple new challenges such as in voltage regulation or lines and transformer congestion. At distribution level, the renewable-generation trend has increased the number of Distributed Energy Resources close to consumers, making these challenges even more difficult to handle since distribution networks are weaker. This problem can be tackled by installing flexible energy resources, which can be controlled to mitigate the grid problems [1].
In this work, we aim at developing and algorithm for optimal sizing and sitting of generic flexible distributed energy resources to provide grid flexibility while satisfying its technical constraints. The problem accounts for the power flow constraints [2]. The planning algorithm can consider three different resources which are photovoltaic plants, demand response from building space-heating and -cooling systems and battery energy storage systems. The algorithm will be validated on a real distribution test case.

Tasks of the student

- Literature review of existing methods [1-2] and familiarity with developed tool in the lab.
- Adapt the method to include planning of generic distributed resources.
- Validate the algorithm by simulating for a benchmark distribution network.

Requirements

- Linear algebra, electrical circuits,
- Having attended optimization course,
- Familiarity with MATLAB, python (optional) programming environment.

References

[1]. Nick, M., Cherkaoui, R. and Paolone, M., 2014. Optimal allocation of dispersed energy storage systems in active distribution networks for energy balance and grid support. IEEE Transactions on Power Systems, 29(5), pp.2300-2310.
[2]. Gupta, R., Sossan, F. and Paolone, M., 2019, June. Performance Assessment of Linearized OPF-based Distributed Real-time Predictive Control. In 2019 IEEE Milan PowerTech (pp. 1-6). IEEE.