

Student project proposal

Market-aware optimal energy storage allocation in active distribution networks

Project type MSc thesis BA semester project MSc semester project

Project responsible and e-mail

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Project description

As renewable energy sources become increasingly prevalent in today's distribution grids, the traditional centralized electricity network is transitioning into a distributed system. However, the integration of distributed renewable resources into the local grid presents control and operational challenges, such as line congestion and grid imbalances. Among the potential solutions, the allocation of energy storage with market-aware optimization emerges as a promising method to alleviate these issues. The objective of the proposed project is to enhance an already-existing approach and apply it to a real-scale grid, utilizing field data obtained from a local Distribution System Operator (DSO).

Tasks of the student

- Collection of a consistent dataset associated with a specific real grid (power system model and boundary conditions).
- Define and execute optimal power flow algorithms for the optimal allocation of distributed energy storage systems with different operational and planning objectives.

Requirements

- Familiarity with fundamentals of electrical distribution systems (distributed generation, and storage), energy market, and power flow.
- Familiarity with the basics of optimization, such as convex optimization problems and duality theory.
- Proficiency in programming language. (MATLAB or Python)

Literature

[1] J. H. Yi, R. Cherkaoui and M. Paolone, "Optimal allocation of ESSs in active distribution networks to achieve their dispatchability," *IEEE Transactions on Power Systems*, vol. 36, no. 3, pp. 2068-2081, May 2021.

[2] M. Nick, R. Cherkaoui, J. -Y. L. Boudec and M. Paolone, "An exact convex formulation of the optimal power flow in radial distribution networks including transverse components," *IEEE Transactions on Automatic Control*, vol. 63, no. 3, pp. 682-697, March 2018.

[3] X. Wang, F. Li, L. Bai and X. Fang, "DLMP of competitive markets in active distribution networks: models, solutions, applications, and visions," *Proceedings of the IEEE*, vol. 111, no. 7, pp. 725-743, July 2023.