

## Decision support tool for distribution network planning

Long-term planning of interconnected electrical distribution networks involves imagining the evolution of the existing network towards a target network, respecting the objectives and constraints set by the system operator, according to national and local energy evolution scenarios and a time horizon of several decades. At present, there are no tools for automatically and optimally proposing target networks and the intermediate annual networks needed to achieve them. Automatic planning (AI Planning) is an Artificial Intelligence (AI) technique for producing sequences of actions to achieve a goal, based on an initial situation. This technique could therefore be applied to the long-term planning of distribution networks, but first requires definition of the universe in which the AI planner will work. As this technique is local, it is not possible to integrate certain rules requiring a global vision of the problem. To overcome this problem, a simple post-processing algorithm was developed in [1]. Indeed, the intermediate networks obtained through automatic planning may not respect certain technical and/or economic constraints, as these cannot be integrated upstream. Post-processing is required to determine which intermediate networks are feasible. **The aim of the internship is to develop one or more algorithms to optimize this post-processing.** If time permits, a second objective will be to develop clustering methods that can be used to divide a large network into sub-networks, to which the general algorithm developed can be applied.

The stages of the internship are as follows:

- Carry out a bibliography review of existing planning methods and associated resolution algorithms.
- Getting start with the simplified planning tool already developed
- Define and implement the optimization algorithm(s) for post-processing.
- Validation on several power systems
- Brainstorming on future developments of the overall tool (addition of rules, scaling up).
- Depending on progress, a presentation of the results to one or more system operators may be possible.

### Keywords

AI Planning, PDDL language, optimization, distribution system

### Skills required

- Advanced programming skills (design and implementation), particularly in Python and Matlab
- Knowledge of optimization
- A good level of written and spoken professional English
- General knowledge of AI Planning and/or power grids will be appreciate

### Supervision

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Lieu du stage : G2Elab, Grenoble

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## **Bibliography**

[1] Castellanos, S., Alvarez-Herault, M. C., & Lalanda, P. (2023, June). Decision support tool for the development of power distribution networks based on AI planning. In 27th International Conference on Electricity Distribution (CIRED 2023) (Vol. 2023, pp. 1425-1429). IET.