LABORATOIRE D'ELECTROTECHNIQUE ET D'ELECTRONIQUE DE PUISSANCE DE LILLE

Master Thesis Project, 2022-2023

— Impact of climate change on low voltage network operation and planning —

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Context

For several years, Western Europe has been experiencing increasingly hot summers. This is a direct consequence of climate change induced by human activities. This change has and will have an impact on the operation and planning of electricity networks, especially low voltage (LV) networks.

Objective

This master thesis will determine the impact of future climate conditions (higher temperature, drought) on the operation of electrical networks. These new climatic conditions will modify the use of network equipment (ampacity) and lead to the development of new uses (PV panels, heat pump). These two aspects will force distribution system operators to adapt the operation and planning of LV networks.
This thesis project will focus on the first aspect (impact on the equipment). The second aspect will be studied in a future master or doctoral thesis.

Work steps

1. Conduct the state of the art on the impact of climate change on the equipment of electrical networks
2. Estimate the temperature of a typical meteorological year of 2050 in the Hauts de France based on the IPCC reports [1].
3. Study the behaviour of the network equipment (cables) for this typical year of 2050 compared to a reference year (2020 for example). The method studied will be analytical and/or by finite elements [2].
4. Determine the impact on the operation of a typical LV network (voltage profile, overcurrent) [3].
5. Conduct a sensitivity study on the results obtained.
6. To extend this study, add new uses to this network, identify future network constraints and propose adaptations to be made via network planning or operation.

Key word

Climate change, Low voltage grids, network operation, load flow, finite element method, sensitivity analysis

References

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[2] F. Binot, T. D. Le, and M. Petit, "Characterization and Modeling of LV Cables Considering External Parameters for Distribution Networks," *Energies*, vol. 14, no. 23, p. 7849, Nov. 2021. http://dx.doi.org/10.3390/en14237849

[3] E. L. Codjo, "Data-based investigations of Low Voltage Distribution Systems: Machine Learning Applications for the monitoring of the network under ageing and variable atmospheric conditions," *PhD Thesis*, 2022, in press