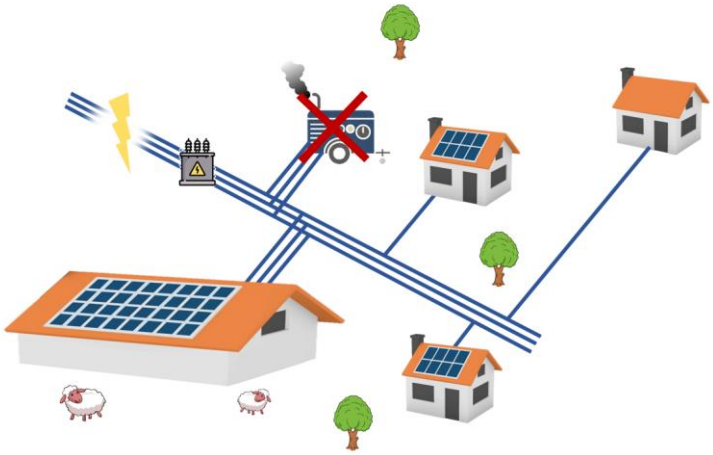
Impacts assessment of a renewable-based re-energization procedure for LV grids

Key-words: Microgrids, re-energisation, PV, Life Cycle Assessment (LCA), Levelized Cost of Energy (LCOE).

Context

In case of fault or maintenance on the MV grid, a portion of the grid (typically a village in a rural area) might not be supplied anymore for a long time. In that case, a diesel generator is traditionally conveyed by the grid operator to temporarily restart the islanded portion. However, a different option can be studied to re-energize the village: use local energy resources as black-start assets to operate the islanded LV grid portion as a microgrid with, if needed, a minimal storage source. This novel option would be beneficial in several aspects compared to a diesel generator or a very large battery. First, fewer CO_2 emissions would be generated locally in emergencies. Second, the blackout duration would be shortened. Third, the ability to operate a portion of an LV grid autonomously results in increased resilience of the distribution grid. Lastly, this solution is cheap as it relies on components that are already in place.



Objectives and tasks

The objective of this internship is to compare the impacts of different temporary re-energization solutions under fault or maintenance scenarios:

- No re-energization
- Re-energization with a diesel generator (traditional option)
- Re-energization using local renewable sources but without a battery
- Re-energization using local renewable sources with a battery.
- The comparison will rely on environmental (Life Cycle Analysis, LCA), economic (cost and benefit evaluation, LCOE), and more social (SAIDI, SAIFI) criteria.

The main tasks will be:

- Perform a comparative LCA of the solutions, and analyze the sensitivity of the results against a relevant selection of parameters (e.g. size of the battery, size of the islanded grid portion, geographical location, etc.);
- Compare the solutions in terms of costs, and analyze the sensitivity of the results against a few parameters (e.g. size of the islanded grid portion, duration of the outage, etc.);
- Investigate the social impacts that the new methods would have;
- Conclude on the impacts of the new methods from different points of view.

Location of the internship

The internship will take place mainly in the SYREL team (Electrical Systems and Networks) of the G2Elab (Grenoble electrical engineering laboratory) with some interactions with Enedis.

Framework of the internship

This internship is linked to a Ph.D. project of the Chair of Excellence on SmartGrids with Enedis. This chair allows the co-construction of prospective research programs and pedagogical innovations on emerging and strategic topics based on innovation. It aims to meet the challenges related to:

- The integration of renewable energies through the development of smartgrid solutions
- The development of new electrical uses
- Advanced data processing
- Training in SmartGrids professions

It focuses on two main areas: the operation and optimization of electrical distribution networks and innovative solutions based on new information and communication technologies, data processing and artificial intelligence.

Supervisors

- Encadrants G2Elab : Jérôme Buire, Jane Marchand, Vincent Debusschere
- Correspondants Enedis : Nabil El Jarrai, Jean Pompée
- Correspondante chaire SmartGrids : Marie-Cécile Alvarez-Hérault

Applications: Until the end of November 2022

Dates: Start between February and April. Duration: around 6 months.

Level: Master 2

Merci d'envoyer un CV, une lettre de motivation et votre relevé de notes de M1 (ou deuxième année d'école d'ingénieur) à vincent.debusschere@g2elab.grenoble-inp.fr