Master Thesis Proposal: Contribution to the development of solar hybrid micro-grids for rural electrification in developing countries

Advisor: Prof. Sylvain Quoilin

Academic Year 2025-26

Traineeship opportunities

This master thesis can be combined with a traineeship within the "Universidad Mayor de San Simmons" in Bolivia, or within the 1PwrAfrica company in Benin. Travel grants opportunities are available for developing countries, and should be requested a few months before departure.

Highlights of the work

1. Analysis of the monitoring data relative to existing micro-grids.
2. Modeling the different components (both thermal and electrical) of a micro-grid
3. Optimization of the system architecture: component selection and sizing
4. Proposal of control strategies

Figure 1: PV-Battery-Genset microgrid, installed in El Espino, Bolivia

Context

The University of Liège has been collaborating for multiple years with the Universidad Mayor de San Simón and 1pwrafrica to support rural electrification in remote areas of developing countries. In particular, systems such as solar home systems or hybrid microgrids involving PV and batteries have been considered, modeled and monitored.

Prof. Sylvain Quoilin (squoilin@uliege.be)
Allée de la Découverte 17 (B49) B–4000 Liège (Belgium)
Tel: +32 (0)4 366.48.22
url: http://ises.uliege.be/

In order to optimize the deployment of such systems, it is important to consider their integration into the national energy system: they must be optimized at the same time as the centralized systems and proper modeling tools need to be further developed for that purpose.

Objectives

The goal of this master thesis is to analyse field monitoring data relative to these systems, and improve a library a models (RAMP, MicroGridsPy, OnSSET) for the simulation and the planning of micro-grids. The main modelling language will be python and will involve the use of large datasets such as historical time series for the solar irradiation, electrical load and thermal load.

Requirements

The candidate should have a Bachelor in engineering and a background in Electrical/Electromechanical/Energy/Computer engineering. Knowledge or experience in linear programming/python is a plus.

Location

This final thesis will be performed within the University of Liège (B49), in Cochabamba (Bolivia), or in Cotonou (Benin).

NB: all traineeships are evaluated by the local partner based on the CV of the candidate.

Informations

Further information can be obtained by directly contacting S. Quoilin by e-mail.

Prof. Sylvain Quoilin (`squoilin@uliege.be`)
Allée de la Découverte 17 (B49) B–4000 Liège (Belgium)
Tel: `+32 (0)4 366.48.22`
url: `http://ises.uliege.be/`