Micro Stockage Intelligent Distribué (OFEN MSID)

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Summary

The OFEN MSID is a 3 years project that brings together the interests of 4 distribution service operators (DSO). Their objectives include remote network stabilization (use cases 1 and 2), optimization of self-consumption and co-creation of new business models to make photovoltaic storage profitable (use cases 3 and 4). This project aims to aggregate micro-storage systems (electric vehicles, batteries, heat-pumps) and develop associated business models. The FMA (Gryon/Vaud) and OIKEN (Sierre/Valais) pilot sites both have grid voltage challenges. The FMA site is located at an altitude of 1’114 meters. The micro-grid include a farm equipped with 30 kW photovoltaic panels (PV) as well as a mountain cafe. The OIKEN site is a tennis hall with 120kWp PV and a small consumption.

Introduction

One of the work package dedicated to FMA and OIKEN aims to optimally size and control an energy storage system taking into consideration voltage constraints.

Both use cases are encountering network overvoltage problems due to high PV feed-in coupled with their spatiotemporal characteristics (PV location in the grid topology and low consumption at specific date and time). To achieve our goal an inverse problem methodology has been developed and will be published at the 26th International Conference & Exhibition on Electricity Distribution (CIRED 2021).

Partners

SEIC-TELEDIS GROUPE, OIKEN, ELECTRINFO, icare, EnAlpin, FORCES MOTRICES DE L'AVANÇON, STUDER

Methods

There are two requirements for the methodology; First, one must provide network topology and elements characteristic. Secondly, one must collect data of voltages and power (at least two measurements on specific location on the studied network). Then the procedure is described as follow:

- Synthetic data generation
- Data-driven modelling
- Power flow boundaries estimation
- Optimal energy storage sizing and control

The details about the implementation will be revealed in the paper “Physic-guided machine learning for distribution network modelling: Application on optimal storage sizing and control” related to CIRED2021 event.

Results

We will present the result obtained for the OIKEN use case. After successfully training the data-driven power grid model, we applied a linear optimization algorithm to obtain the optimal energy storage sizing solutions. We studied power feed-in limitations also known as peak shaving by directly restricting/limiting the power injected by the inverters. The figure 1 demonstrated that the higher the desired voltage stability, the more storage is required. We analyse that peak shaving allows to optimise the storage size.

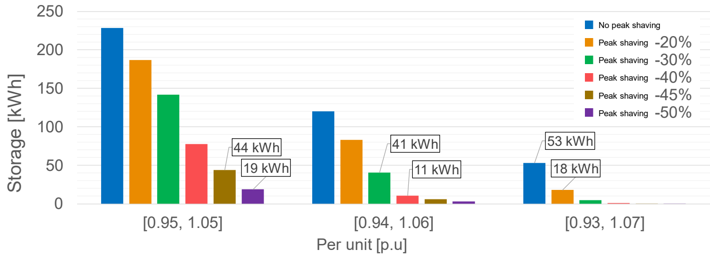

*Figure 1 : Results of **optimal sizing** using data-driven model*

The figure 2 illustrated the performance of using the data-driven based optimal control for voltage regulation.

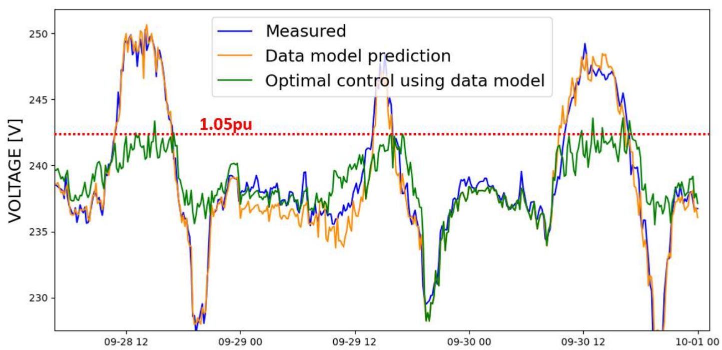

*Figure 2 : Results of **smart optimal control** using data-driven model*

Conclusions

In this applied research project, we successfully demonstrated the performance of combining physic modelling and data in order to achieve more accurate and computationally efficient result of energy storage sizing and control.

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