Micro Storage Intelligent and Distributed (MSID)

Prof. D. Wannier[1], J.Vianin[1], J.-M. Alder[1], H. Pereira[1], J. Ferreira Da Silva[1]
[1] University of Applied Sciences Western Switzerland (HES-SO), Switzerland

Summary

The Swiss Federal Office of Energy (SFOE) MSID is a three-year 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, hot water), prediction with machine learning (ML) and demonstrate flexibility services.

Use case – Voltage stabilisation

Result of the voltage management with the algorithm

The VPP platform contains an algorithm creation system. With this system we can control everything that is connected to the system (Shelly relay, inverter, etc). In the case of our two use-cases with network issues (FMA and OIKEN), we control the charging and discharging of the batteries according to the network voltage level. In case of higher consumption like in the figure 2, our algorithm can increase the voltage with the batteries discharge. In case of PV production, like in the figure 4, we reduce the voltage with batteries charge. Finally, all the data is stored and analysed on a TimeSeries InfluxDB database. This storage also allows us to create rules informing us directly by email in case of problems with the data (missing, values too high or low).

Figure 1 : The VPP platform with two batteries

Figure 2 : Voltage increases during discharge controlled by the Studer Innotec NEXT3 inverter

Figure 3 : Studer-Innotec Next3 inverter (FMA)

Figure 4 : Voltage reduction during charging controlled by the Studer Innotec NEXT3 inverter

With the VPP system developed with our partners in the project for grid voltage stabilisation, we are now able to support the grid with the help of batteries in an automated mode. At the FMA site, 15kWh of Weco batteries were installed in combination with a Studer-Innotec NEXT3 inverter (Figure 3). At our second partner OIKEN, 6kWh batteries from Leclanché was installed with 3 Xtender inverters from Studer Innotec (figure 3). The DSO can remotely manage the algorithm

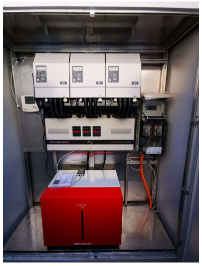


Figure 5 : Studer-Innotec Xtender (OIKEN)

Use case – combinatorial algorithm that integrates self-consumption

In order to collect data for both voltage stabilisation and self-consumption optimisation, we have installed a control box at six pilot sites. The control box (figure 5) is designed to interface with several systems such as the Enphase API for solar production or with Shelly devices for hot water. With the data collected, the control box is then able, with the help of ML algorithm to predict the PV production, to control inverters or Shelly relays (allowing the heating or not of the hot water). In figure 6, we can see that the hot water relay has been activated because the Weco battery connected to the Studer-Innotec Xtender inverter has reached 90% SOC.

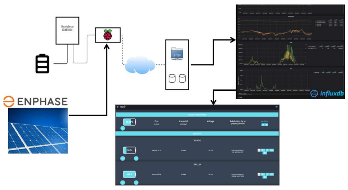


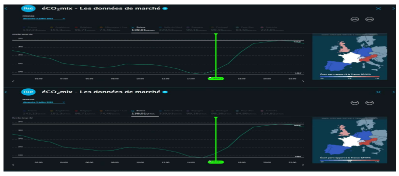
Figure 5 : Architecture schema

Figure 6 : Activation of the hot water relay

SMS notification for charging an electric vehicle at a reduce price as soon as dynamic tariff will be allowed

With the ML algorithm prediction of the PV power for the next hour and the forecast of electricity prices we can detect a possible low tariff time for charging an electric vehicle. In case of overproduction of renewable energies (wind, photovoltaic, etc.) as well as low expected consumption, we send an SMS to a user group. This message informs a set group of people about the availability of electricity at a reduced price for a defined period of time. In the example below, the DSO has defined a maximum price of CHF 0.16 per kWh and the user group was informed the day before that the price would be reduced the next day between 1pm and 4pm for charging electric vehicles.

Figure 7 : SMS notification system of a reduced price for the next day



Planned 4-hour shortage at the Swiss Digital Center: a new use case for the MSID Virtual Power Plant platform

The VPP platform of the SFOE MSID project has been integrated into the Swiss Digital Center to manage and upgrade the Leclanché battery connected to a Fecon inverter. The objective on this new site is to demonstrate the feasibility of managing the potential planned shortages with the VPP platform. We will add two Studer-Innotec NEXT3 inverters connected with Vehicle to Grid (V2G) charging station. With these V2G charging stations, we can use two additional batteries as a flexible load.

Figure 2 : Diagram of the Swiss Digital Center with the different network components

Partners

Hes·so Valais Wallis, EnAlpin, Forces Motrices de l'Avançon, Genedis, Electrinfo, icare, Studer, OIKEN

Conclusions

The VPP platform developed as part of the SFOE MSID project allows remote automated control of the flexible loads of the different sites according to their specific problem (network or self-consumption). The next step will be to demonstrate a planned shortage management in the combinatorial algorithm.

Contact and more information: david.wannier@hevs.ch, https://www.hevs.ch/en/minisites/projects-products/easilab/