# Global
# SMART ENERGY
# ELITES

# 2019

Published by:

SMART ENERGY INTERNATIONAL

# SWISS MODEL EMBRACES THE DIGITAL REVOLUTION

Achieving a fully operational smart grid is a journey whereby new discoveries are being made through R&D and pilot projects. There is no 'plug and play' procedure, as every part of the grid is complex with its own frame of reference and parameters that need to be taken into careful consideration during the planning and design of a project rollout.

Azienda Elettrica di Massagno (AEM), a small Swiss utility, is exploring the sector's digital revolution by implementing a smart grid that will balance its load profile (smart grid), monitor sensitive parameters from the end users (smart meter) and implement new business models (smart market). The core of this business model is based on an algorithm connecting data gathered from different sources (consumption, power flow at the interconnection gate with the high tension grid, weather conditions, AEM's power production and in the future, AEM's power storage) to maintain a predetermined load profile. This also allows for voltage control (at end users' site) by increasing user production or decreasing consumption as needed. This

> *"To realise the data collection opportunities, a high-performance communication network is essential."*

step by step rollout project, which is planned to launch in summer 2019, will include a broadband bi-directional communication network.

Currently, the Centre for Studying Artificial Intelligence (www.idsia.ch) is developing the algorithm for balancing the distribution grid. The first prototype will be available for validation tests in winter 2018, ready for the summer launch. Based on high-frequency data flow provided by the meters, the broadband communication system is able to collect data (capacity and energy consumption/production and on-demand voltage levels) at 1-minute intervals, integrating it with voltage data collected at the distribution level.

This consumption/production high-frequency data will eventually enable the utility to split its main grid into many mini-grid entities, which will be based on self-consumption and supported by district batteries and managed by blockchain procedure. Should this be achieved, it will increase the value of local and decentralised production, reducing strain on the low-voltage grid, increasing grid efficiency and reliability and cost reduction. Already the Swiss utility is looking to pilot a mini-grid installation to test the technical, economic and social viability of a small self-consumption district. The pilot will power 15 houses, fitted with 4 photovoltaic installations (roughly 50kW installed capacity) and a 25kWh battery.

## HIGH-PERFORMANCE COMMUNICATION NETWORK

To realise the data collection opportunities, a high-performance communication network is essential. The high-frequency data flow is generated on the consumption site by Landis+Gyr E450 smart meters. The data is then transferred to a central unit using a hybrid system which utilises G3-PLC broadband radio frequencies and optic fibres. The data grid is able to download and upload data orders to any consumption and production location. With no definitive determination of the future market's design, the ability to collect data at the sources in 'high-frequency', to build up performance data networks and to include intelligence (algorithm) for managing captured data is leading to increased system flexibility. This is one of the premises for introducing new business models that can address present and future challenges. The parameters of the installed smart meter will be programmed by Optimatik, a Swiss-based service provider.

The level of cooperation among the team's partners is very high and the workflow is efficient. Developing this new concept was not without teething problems and bottlenecks in the supply chain, mainly caused by product upgrades needed to align with the project's specifications. However, these hurdles increased the team's unity and determination to ensure thorough checks of all details, an exercise that is useful for all partners to enhance their skills in providing further 'smart grid' installations.

## PROJECT CHALLENGES

The core project challenges thus far have been in:

- projecting the broadband channels (to reach economic project viability, AEM chose a hybrid system based on PLC, radio frequencies and optic fibres)
- proving the interfaces between the system and the different consumption/production devices of each single customers, because of the lack (at this stage of the projects) of internationally valid protocol standards.

The team charged with developing the algorithm is still investigating the most efficient use of data together with the German company Kister, which is providing the software.

## PROJECT GOALS

Upon completion, AEM is aiming to achieve three goals:

- Aligning the distribution grid's load profile consistently with TSO requirements (in a first step this will mean reducing peak load) to optimise costs and technical efficiency at the national high voltage point of connection
- Managing power flow on the low voltage grid to utilise available capacity, limiting redundant investments, controlling voltage levels and avoiding over/under voltage situations (particularly on low voltage sections where there is a density of photovoltaic plants)
- Developing new business models (in particular, new tariff schemes) a grid split into small units based mainly on self-consumption and a basket of services to be provided to its customers.

In order to achieve a fully operational smart grid continued investment in R&D is essential. As there is no one size fits all model, it is important to understand that every part of the grid is complex with its own set of parameters and should be modified within its suited framework. ■

> *"Achieving a fully operational smart grid is a journey; one where new discoveries are being made through R&D and trial and error."*