María Ruiz
SCHNEIDER ELECTRIC

María Garrido Lupiáñez
SCHNEIDER ELECTRIC

The importance of monitoring electrical grids: impact on smart interoperable buildings

Background

In recent years, the EU strategy aims to be climate-neutral by 2050 – an economy with net-zero greenhouse gas emissions. This objective is at the heart of the European Green Deal, and is a legally binding target thanks to the European Climate Law.

The transition to a climate-neutral society is an opportunity to build a better future for all, while leaving no one behind. For that purpose, society is moving towards sustainable energy transition, a transformative shift in how energy is produced, distributed and consumed, aiming to move away from fossil fuels towards a system centred on renewable energy sources such as solar, wind, hydropower and geothermal.

Motivation for energy monitorisation in Electrical grids

In the context of power system operation, the objective is to meet the demand at every location within a power network as economically and reliably as possible.
In the traditional power systems, energy was produced in bulk (carbon, fuels…) and transmitted to the distribution grid, from where it was distributed to the consumers.
However, in recent years' distribution generation became a considerable part of the overall power production. New technologies allow the electricity to be generated in small sized distribution generators (solar panels…), that produce energy at the point of the connection, on the primary or secondary distribution network.

In case of decentralized generation, while demand is low, the voltages might be higher than the tolerated maximum limits. On the other hand, during periods of high demand, the voltage at the locations of the consumers may drop to levels below acceptable. Also, connecting a new customer can impact the load imbalance of a feeder, which can consequently cause imbalanced voltages and increase energy losses.

As a matter of fact, this transition from traditional power systems towards renewable sources has introduced uncertainty and unpredictability factors in the electrical grid that need to be managed from both the generation and consumption perspectives.
Extensive use of distributed generation in power grids cause the necessity to adapt the network to new conditions of generation and consumption. Also, after new customers are placed, it is particularly important to have an insight into the updated network state (e.g. voltage violations, current overloads, etc.).

A good example of the criticality on the necessity to handle unpredictable situations in the electrical grid, is the power blackout occurred across the Iberian Peninsula on 28th April this year. Electric power was interrupted for about ten hours in most of the Peninsula and longer in some areas. As a consequence, it caused severe difficulties in telecommunications, transportation systems, and essential sectors such as emergency services.

Although there is not a concluding reason for the blackout, according to the report by the European Network of Transmission System Operators for Electricity (ENTSO-e), "Voltage in southern Spain increased drastically, and consequently also in Portugal. The overvoltage triggered a cascade of generation losses that caused a drop in the frequency of the Iberian Peninsula's electrical system".

Real-Time Data monitorisation needs

Nowadays, in a global environment where energy efficiency is a necessity, the smart buildings that will compose our energy communities are becoming the key elements in the transition to a more sustainable model. However, what makes a building really smart? The answer is not just in sensors or algorithms, but in the ability to monitor, measure, analyse, and operate in real time. This is where real-time energy monitoring becomes essential.

A smart energy management system cannot operate alone. It needs continuously updated data to adapt to changing environmental conditions. This is because energy demand is not static: it varies according to the time of day, space occupancy, weather conditions or user behaviour. Only with constant monitoring is it possible to detect these changes and respond automatically and efficiently. In addition, real-time monitoring makes it possible to detect anomalies, anticipate failures and apply predictive maintenance, which reduces costs and improves system reliability.

This approach becomes even more relevant when used to compare energy performance between two communities with different monitoring systems. By applying RTUs in both environments, it is possible to collect homogeneous data on key parameters - such as consumption, generation, efficiency or demand response - and to analyse how technological differences influence the overall performance. This comparison can not only identify best practices but also justify investments in more advanced and adapted technologies in each context.

Both use cases are being actively explored in the project WeForming. This is an initiative that is focused on energy transformation through distributed intelligence. Implementing advanced RTUs and comparative monitoring strategies, WeForming is not only trying to optimize energy consumption in real communities, but also to generate knowledge applicable to future smart cities. Its approach demonstrates that technology, when combined with a strategic vision, can be the key to transforming energy in a measurable, replicable, and sustainable way.

WeForming

Follow us for more articles

[María Ruiz]

European Commision Funded Projects - Project Manager
SCHNEIDER ELECTRIC

Telecommunications Engineer (University of Seville) and PMP certified (Project Management Institute). 18 years experience on IT international projects including Accenture and BMW Financial Services. Currently working for Schneider Electrics in R&D Department managing European Funded project

[María Garrido Lupiáñez]

Testing Engineer
SCHNEIDER ELECTRIC

Industrial Technologies Engineer (University of Seville). Currently working as Software Testing Engineer for Schneider Electrics, focused on embedded systems and testing process automation. Previous experience in aerospace and automotive sectors, contributing to process optimization and data analysis.

POWERED BY

Funded by the European Union

The WeForming project has received funding from the European Union's Horizon Europe Programme under the Grant Agreement No. 101123556.

UK Research and Innovation

The UK participant is co-funded by UKRI.