Smartgrids for Energy Transition: from DER integration to system flexibility

Nouredine Hadjsaid

Univ. Grenoble Alpes, CNRS, Grenoble INP*, G2Elab
38000 Grenoble, France

Email : Nouredine.Hadjsaid@g2elab.grenoble-inp.fr

Abstract:
Most countries worldwide have embraced the path towards an energy transition for more sustainability, efficiency, security of supply and energy accessibility. This process is being accelerated by the climate change urgencies and the sensitivity of modern societies to ecological issues. Thus, renewable energy sources, clean mobility, energy efficiency programs and the active involvement of the end user consumer in the energy chain are on the rise at an unprecedented rate.

In this context, the power grid is a vital infrastructure for facilitating energy transition with the electric vector being enforced. Thus, Distribution grids are the most affected by this transition as they are at the interface of most grid connected renewable energy sources, Plug-in Hybrid and Electric Vehicles (PHEV), and end user consumers including their flexibility. In addition, all these energy resources are distributed in nature (DER-Distributed Energy Resources), mostly not observable neither controllable with heterogeneous features and power rating. However, it has to be noted that power grids are significantly affected by the decrease of the overall inertia linked to the development of power electronic interfaced renewable energy sources, the increasing interaction with distribution grids being more active, and the changing nature of loads being more controllable including self-consumption. This issue is critical for the overall system stability.

As such, this transition requires an even smarter grid at all levels able to achieving the assigned goals without overinvesting on existing assets while considering technical, economical and regulation constraints. The key issues are clearly adaptability and flexibility at all levels of power grids and dynamics.

The extent of technologies to be developed for allowing the grid integration of large scale DER (including PHEV) in the best security/safety and economic conditions encompasses several areas that include flexible generating, load control and storage technologies, advanced forecasting tools, new monitoring and imbedded control devices, smart equipment for fault management, and related information and communication technologies for example.

The presentation will address energy transition challenges, DER development and power grid evolution, the role of flexibility and other solutions being developed in the framework of Smargrids to meet the increasing complexity of the whole electrical system. It will cover both up to date research and development in this field as well as industrial applications including some examples on large-scale pilot projects for smarter grids.