

*Title of the Keynote:*

Recent Research Trends in Designing and Validating Smart Grids

*Abstract:*

A driving force for the realization of a sustainable energy supply is the integration of renewable energy resources. Due to their stochastic generation behaviour, energy utilities are confronted with a more complex operation of the underlying power grids. Additionally, due to technology developments, controllable loads, integration with other energy sources, changing regulatory rules, and the market liberalization, the system's operation needs adaptation. Proper operational concepts and intelligent automation provide the basis to turn the existing power system into an intelligent entity, a cyber-physical energy system. The electric energy system is therefore moving from a single system to a system of systems.

While reaping the benefits with new intelligent behaviours, it is expected that system-level developments, architectural concepts, advanced automation and control as well as the validation and testing will play a significantly larger role in realizing future solutions and technologies. The implementation and deployment of these complex systems of systems are associated with increasing engineering complexity resulting also in increased engineering costs. Proper engineering and validation approaches and tools are partly missing until now.

Therefore, this keynote talk discusses and summarizes the main needs and requirements as well as the status quo in research and development related to the engineering and validation of cyber-physical energy systems. Also, validation examples and short demos are presented. Finally, research trends and necessary future activities are outlined.

*Topics, Keywords:*

Engineering, Research Infrastructure, Smart Grids, Systems of Systems, Testing, Validation