Modelling and optimisation-based control of flexible energy systems for more sustainable and efficient networks

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Monday 8 November 2021
2pm

via Microsoft Teams

Abstract:

The growing deployment of distributed energy resources, as well as of utility-level renewable energy sources in transmission networks, and the consequent decreasing use of synchronous generators, can result in significant environmental and economic benefits but, at the same time, in reduced total system inertia and controllability, hence in new challenges to the operation, optimization and control of power grids. Within this context, flexibility (i.e., the ability to adjust to the time-varying grid conditions) plays a crucial role for the transition towards power systems that can efficiently accommodate high shares of renewable energy sources. Managing the flexibility in urban districts and in distribution networks, requires control and optimisation tools not yet available. Furthermore, there are several multi-energy systems within a district (i.e., systems with integrated electricity/heating/gas systems), which currently lack coordination, and which can be regarded as excellent flexibility providers. Unutilized and available flexibility in distribution networks has the enormous potential to support safe and stable operation of the whole energy grid. There is still a very limited understanding of the true impacts of the flexibility on the power system as well as of how to devise effective frameworks for optimally and dynamically coordinating an arbitrarily large number of flexibility sources. Filling this knowledge gap is essential for the transition to a more sustainable energy grid. In this talk, promising optimisation-based approaches to manage the operation of storage devices as flexibility providers and multi-energy systems will be discussed.