

Operation and planning of flexible distribution networks in a smart multi-energy grid context

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The major changes in the so-called “Smart Grid” are taking place in distribution networks, where low carbon technologies such as wind power connected to HV and MV level and photovoltaic generators connected to the LV level are challenging the conventional operation of the distribution network. On the other hand, a number of new energy technologies facilitated by innovative ICT options are emerging to enable more flexible operation of the network, also supporting the integration of demand to provide system services. In this respect, a great deal of responsive demand is based on the flexibility that can be found in other energy vectors and particularly in heat and cooling through various “electro-thermal” technologies, setting out what could be deemed a “smart multi-energy grid”. In this framework, other energy vectors can be optimally integrated in and support the electrical system operation, but can also “compete” with it. For instance, heat network infrastructure supplied by flexible combined heat and power plants that can help balance both the local and the bulk energy systems can compete with reinforcement of the electrical infrastructure to accommodate more electric heat pumps or micro-CHP generators, which can in turn provide demand response services at a more distributed level. If optimal operation of such an evolving distribution network is challenging, optimal planning of the active distribution system of the future in the light of increasing levels of controls as well as uncertainties is even a daunting task.

On these premises, the aim of this talk is to illustrate some of the research activities that are going on at the University of Manchester in the context of operation and planning of future flexible distribution networks in a smart multi-energy grid context. The topics covered will include impact of electric heat pumps and micro-CHP generators on LV networks, optimal electricity and heat distribution network design, multi-energy virtual power plant modeling, demand response from distributed multi-generation plants to support network and system operation, and techno-economic planning of flexible distribution networks with active management options.

Biography

Dr. Pierluigi Mancarella is a Lecturer in Future Energy Networks in the School of Electrical and Electronic Engineering of the University of Manchester (UoM),

UK, where he teaches “Power systems operation and economics” and “Smart Grid and sustainable electricity systems”. He got his MSc and PhD degrees in Electrical Engineering (Power Systems) from the Politecnico di Torino, Italy. Before starting at the UoM, he was a Visiting Researcher at the NTNU of Trondheim, Norway, and a Research Associate at Imperial College London. Dr. Pierluigi Mancarella is currently involved in and leading a number of research projects, funded by the UK Research Council, the European Commission, and various industrial companies, in the area of techno-economics of future networks and smart multi-energy systems. He is the author of two books, five book chapters, and more than 70 research papers.