New issues in managing distributed flexibilities in Power systems

Nadia Oudjane (Electricité de France R&D)

With the massive integration of renewable energies (photovoltaic (PV) and wind power) into the power grid, new uncertainties are impacting the power balance. At the same time, advances in « smart » technologies and batteries offer new flexibilities with the possibility of controlling the consumption of a large number of electrical appliances (electric vehicle recharging, heat pumps, etc.). In this framework, a major challenge is to optimize the contribution of this large number of heterogeneous flexibilities distributed across the network to help in balancing the system. Mathematically, this constitutes a large-scale heterogeneous multi-agents control problem under uncertainties. Practically, this new framework induces both technical and economical issues. How to manage those new flexibilities in a privacy preserving and distributed way, from the forecast time horizon to the real time setting ? How to quantify the value of such new flexibilities for the system and build the right incentives for the agents to participate ?