

From centralized to decentralized power systems: Some stochastic optimization problems in energy management

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Abstract:

Historically, the management of electrical systems aimed at finding the best (minimal cost) generation schedule satisfying the supply-demand balance while respecting the operating constraints of thermal and hydro power plants. In a context of deregulation and energy transition, this traditional management, called “centralized” (because the integrated actor only decides), is deeply changing to adapt to new ways of generating and consuming electricity in a market and competitive setting. On one hand, new means of generating decarbonized electricity, based on the use of renewable sources of energy are integrated to the classical mix made up of thermal and hydro plants and/or come in substitution to a growing part of it. On the other hand, new uses of electricity (electric vehicles, clean urban transport) emerge. This induces new ways to optimize both generation and electricity consumption, based on information and communication technologies and mathematical optimization techniques, for integrating intermittent sources of production, smoothing the load curve and reducing the energy bill.

We present some stochastic optimizations problems in energy management issued from both historical and present contexts of energy.