A Decision Support System for Smart Grid Energy Management

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Abstract

With a renewed interest in energy and climate issues, policymakers and industry leaders are recognizing the significant potential that the Smart Grid (SG) can play in the future. The SG enables widespread penetration of new technologies that include smart distribution networks, demand response, increased penetration of large-scale renewable distributed generation, plug-in electric vehicles and electricity storage technologies and provides new information and flexibility to both consumers and providers of electricity. The SG provides reliability, reduced peak demand, more efficient utilization of the available infrastructure and reduced energy losses. Environmental benefits associated with smart grid include a significant reduction in power sector carbon emissions.The SG poses many challenges as we migrate from the current grid, toward a new grid with two-way power flows, two-way and peer to peer customer interactions, and distributed generation. Centralized decision making and hierarchical SCADA systems have to be replaced by more flexible energy management systems (EMS). In addition, the models to be used must be capable of accounting for uncertainty present in the power system due to the intrinsic uncertainty of the renewable sources and also due to the use of imprecise and vague terms or even the lack of information while stating incorporating criteria like environmental impacts, operation condition history and alternative supply availability. The work presented in this paper identifies the requirements that lay out the functions and applications of the SG and provides a framework of knowledge management mechanisms used by the EMS in order to support it.

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