Minitrack on Distributed, Renewable and Mobile Resources

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The capabilities and characteristics of innovative supply-side and demand-side technologies in the electric power industry, as well as power system operations, implementation of microgrids, planning and markets are evolving rapidly. Electric power supplies (and consumption) is not only becoming more distributed in nature with increased adoption of customer-sited photovoltaics, energy storage and microgrids, but also has the potential to become highly mobile with the electrification of transportation. Effective integration of distributed resources (behind the meter supply and storage), weather dependent renewables, and mobile electric energy supply and storage through electrified transportation requires evolution in planning, operational and control strategies, as well as an appreciation of how people will adopt and use distributed and mobile resources. This mini-track features papers that address modeling, simulation and hardware developments; economic and system analyses; and studies of individual and organizational behavior and decision making as pertaining to distributed, renewable and mobile resources in electric power systems.

This year's mini-track features two groups of papers. The first group includes those that address issues in modeling and understanding the behavior of electricity consumers and how they increasingly interact with the power grid and with one another in increasingly sophisticated ways. The second group of papers in this mini-track addresses system-level problems in the integration of variable renewables and other emerging grid resources, both at the transmission and distribution level.

Consumers of electricity are becoming increasingly participatory on both the supply and demand sides of the electricity industry, and with this increasing participation has come the need for more sophisticated approaches to capturing consumer behavior in power-grid models. Distributed energy resources (DERs) can play an important role in providing services to the power system. Flexible loads can be scheduled to balance variable generation, microgrids and strategic storage can provide reliability and security and distributed sensing can offer unprecedented system visibility. Integration of DERs requires continuing innovation in co-ordinated control, optimization, and modeling, and technology to enable the participation in regulation and balancing services, ancillary service markets and distribution system management. How these customer-suppliers will interact with DERs and the larger power grid is still evolving rapidly. Researchers and the industry are starting to realize the potential of data analytics, as well as the potential for distributed and transactive decision-making. There is also increased recognition of the potential for DERs to improve energy-system resilience in the face of extreme events.

Integration of new resources and technologies into the power grid also creates challenges for system operators and planners. With wind generation currently having the largest share of the new capacity, and solar generation having the highest rate of growth, this trend is expected to continue to produce an increasing amount of variability and uncertainty in system generation portfolios. This technology transition can improve the sustainability of electricity supplies but it also makes the grid as a whole more dependent on the availability of natural resources. Risk-based approaches are needed to assess availability of these resources for adequate grid planning. The need of the power grid for technologies that can provide long-term energy storage, as well as those that can supply needed ancillary services to help grid operators ride through volatile periods of renewable power production, is going to rise. Papers in this mini-track address the ways in which planning and evaluation of environmental performance can be evaluated for power systems moving towards very high penetration of renewables – particularly wind, solar and hydroelectric. Other papers focus on technological innovations needed to give grid operators sufficient tools for reliable grid operations.

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