Introduction to Integrating and Modeling of Load and Renewable Generation Minitrack

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The electric power system is adding increasing amounts of both non-dispatchable, renewable energy technologies and dynamic demand response. Many state policies require up to 30% penetration of renewable energy technologies within the coming decades. Wind power already represents a significant percentage of new generation, while photovoltaics continue to improve in both efficiency and cost. Benefits of these technologies, in terms of enhanced reliability, reduced transmission and distribution costs and reduced emissions can be realized only by considering multiple factors, including the need for spinning reserves, system-wide loss reduction, security limits and cost/benefit analysis.

The first session in this minitrack addresses these challenges and influential factors in current thinking about how to integrate these technologies. Papers in this session focus specifically on the integration of wind power and photovoltaics into the power system, with topics ranging from optimal placement, conventional generator dispatch and emissions patterns, and the statistical properties of the intermittent resources. A fourth paper addresses the distribution system control and management more generally, proposing a three-tiered hierarchical control scheme.

On the demand side, the number of customers able to respond, individually or in aggregate is increasing, pushing the power system to embrace a new paradigm of active and controllable load. Load behavior is a growing challenge as demand response is increasingly expected to address system-level issues, particularly when intermittent generation resources are a significant consideration. As novel concepts such as the development of load as a resource are explored, the need for new methods to analyze demand is moving well beyond our current capabilities.

A common theme of the papers in this session is the development of proposals to control thermostatically controlled loads (TCL). One paper examines the aggregation of a large population of TCLs to be used for direct load control and demand response. The use of demand side management as spinning reserve is also examined, along with a proposed method for developing a baseline demand level from which demand reduction can be measured. A fourth paper examines building-level issues, introducing the question of examining the role of community engagement in determining the supply of electricity for residential buildings. This paper examines the coordination of electrical supply and demand within a single building that supports a communal electricity market for the building residents.