# 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.

The first session in this mini-track focuses on issues related to the grid-scale connection of large renewable sources of electricity. Electricity market restructuring, advances in energy generation technology and agreements on the reduction of global greenhouse gas emissions have paved the way for a large increase in the use of renewable generation connected at both the transmission and distribution level. 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. A broad array of issues associated with the incorporation of large shares of variable generation (VG) into power system planning, design, and operation, including market operation, need to be considered.

This session will feature technical papers addressing new approaches, models and methods for the planning, design and operation of power systems with large or increasing shares of VG, including impacts on the bulk system reliability. Some papers will focus on the key issues of managing increased levels of variability and uncertainty on the transmission system with new approaches to increasing co-ordination, system flexibility, and incorporating VG plant output forecasting on all time scales. Also addressed in this session will be the continuous innovation in technology capability required to enable the participation of variable generation in AGC systems and ancillary service markets.

The second session in this mini-track focuses on the "grid's edge" – the increasingly fuzzy boundary between the bulk power transmission grid and the local power distribution network. The grid's edge is where much of the innovation in distributed electricity supply and storage is happening, where electricity and transportation are most likely to merge, and where the challenge of understanding consumer behavior is paramount. 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. Moreover, growth in mobile and stationary DERs vastly increases the number of independent decision-makers providing services to the grid. How these customer-suppliers will interact with DERs and the larger power grid is still evolving rapidly.

This session will feature technical papers presenting new approaches, models and methods for planning, architecting, and operating interconnected transmission and/or distribution systems with significant DER penetration. This session will also explore the interactions between DER owners at the individual or community scale, the technologies that they control and the power distribution and transmission system.

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