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## **Utility Restructuring and Electricity Markets**

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This presentation intends to create a framework for the topics presented in the “Market Functions” session and to motivate discussions.

The restructuring of the electric utility industry is at different stages of its evolution around the globe. The trends in North America and Europe highlight the two major approaches to restructuring and energy market design. In North America, the restructuring evolved from the implementation of Open Transmission Access in the mid 90’s to creation of ISO’s and RTOs, in the early 2000’s and beyond, based on the principles of the “Standard Market Design” including centralized unit commitment and dispatch. An inherent characteristic of this trend has been the ever increasing role of security constrained based unit commitment and dispatch and locational marginal pricing model, to improve market efficiency and to better manage transmission congestion and integration of renewables. Restructuring Europe began in the 80’s. In most cases, this has included organized national or regional counter-trade markets with aggregate “zonal” transmission systems that support sometimes separate trading platforms and scheduling procedures that are only partially integrated with system operations. The balancing counter-trades are performed by the system operator to offset transactions that undo the schedules of market participants to bring the net schedules in line with the capabilities of the transmission system. Under the European Union directives, more coordinated advancement of the restructuring continues at national, regional and continental levels. The recent European Third Energy Package intends to improve market efficiency and system reliability through unbundling of all national systems and implementation of a single European market. It also aims to facilitate integration of renewable resources.

The proliferation of renewable energy and other “smart grid” resources such as demand response and storage has globally been on the rise. Demand response and storage can be considered as controllable resources. However, the inherent intermittency and uncertainty of renewable resources and their ever increasing share of generation make resource scheduling an ever more challenging problem. Renewable resources, centralized or distributed, often aggravate transmission problems and present challenging generation ramping requirements. Various market based solutions are deployed to address these problems. These include faster intra-day markets, real-time/intra-hour security constrained unit commitment, demand response and storage. Considering the characteristics of the restructuring trends and market designs one can speculate with reasonable certainty that the common nature of the problems will eventually result convergence of market design fundamentals. Meanwhile, larger footprints, virtual bidding, more complex resource models and network details, potential stochastic models and other factors will continue to present new challenges.