Simulation of Power Systems with Time-Dependent Resources

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Integration challenges are daunting

Utility-scale storage: critical tool in the effective harnessing of the renewable resources

Active Demand Response Resources: demand side participation that provides additional flexibility in managing the supply-demand balance

Proposed Simulation Approach

Captures various sources of uncertainty by using Monte Carlo simulation that effectively exploits the power system structure and characteristics

Probabilistic models: represent the intermittency and variability of renewable resources

Identification of wind regimes: clustering algorithm allows the identification of daily patterns

Identification of solar pattern clusters: patterns differentiate between daily climatic conditions

Research Objective

Development of a computationally tractable approach that can quantify, over longer-term periods, the variable effects of:
- economics
- reliability
- environmental impacts

of power systems with integrated time-dependent resources

Proposed Simulation Approach

The simulation captures the time-dependent resource utilization in the day-ahead transmission-constrained markets with the explicit representation of uncertainty and evaluates all the variable effect metrics of interest

Critical metrics evaluated by the simulation:
- LMPs
- LOLP, EUE
- Greenhouse gas emissions

Potential uses of this research

- Resource planning
- Investment analysis to assess the feasibility of investment opportunities and to develop appropriate strategies and schedules
- Transmission planning studies to determine the timing/benefits of changes in the grid
- Policy analysis to determine the impacts of different policy formulations
- Responses to various what if questions