DOE/OE TRANSMISSION RELIABILITY, RELIABILITY & MARKETS PROGRAM PEER REVIEW MEETING

June 5, 2018 | Kimpton Hotel Palomar

List of Presentations

SESSION I

1. A Probability-based Model for Cost-effective Integration of Renewables into the Electricity Grid
Rajendra Adhikari, Virginia Polytechnic Institute and State University

The goal of this project is to address two issues for variable generation (1) Effective Load Carrying Capability (ELCC) numbers for resource adequacy (RA) calculations; and (2) production costing analysis based on uncertain renewable energy generation. To address these issues, Virginia Tech is developing a production costing tool that use probabilistic data for renewable energy sources (both solar PV and wind farms), and treat these as generation candidates in a power system expansion plan.

2. Multistage Stochastic Transmission Expansion Algorithm for Wide-area Planning under Uncertainty
Mort Webster, The Pennsylvania State University

The overall objective of this project is to develop and demonstrate a computational method for solving the optimal transmission plan under uncertainty in future generation in multiple steps for a large network. The algorithm will be parallelizable to take advantage of high-performance computing networks, and will consist of a linear-programming-based approximate dynamic programming algorithm.

SESSION II

3. Stochastic Continuous-time Flexibility Scheduling and Pricing in Wholesale Electricity Markets
Masood Parvania, University of Utah

In this project, the University of Utah aims to develop a novel stochastic continuous-time unit commitment (UC) model that offers a different approach to sampling the information and decision variables in the wholesale market operation. The proposed UC formulation schedules the optimal continuous-time power trajectories of dispatchable generation resources and electric energy storage (EES) devices to balance the continuous-time variations of load and renewable energy sources (RES), respecting the transmission network constraints. The proposed UC model reduces the approximation error in describing the continuous-time ramping phenomena in the day-ahead operation, capturing more accurately the essential information available about the load and RES evolution in time, while revealing the potential operational flexibility of resources that have significant impact on the day-ahead market solution, but is not captured by current UC formulation.

4. Models and Strategies for Optimal Demand Side Management in the Chemical Industries
Michael Baldea, University of Texas at Austin

University of Texas (UT) aims to exploit the Demand Response (DR) potential of industry, focusing on Dispatchable Demand Response (DDR) and Non-Dispatchable Demand Response of chemical, petrochemical, and refining processes—collectively referred to as "chemical processes." Chemical processes account for about 30% of industrial electricity consumption, and have significant DR capabilities. Yet, estimates put the actual exploited DR potential at about 20-50% of the available capacity, leaving an enormous portion untapped. UT's project will remedy this situation by addressing the following specific objectives: (1) Characterize the DR-relevant dynamics of chemical and petrochemical processes; (2) Develop models and DR scheduling optimization problem formulations that are amenable to real-time solution; and (3) Create representations of the DR behavior of chemical process that can be embedded in power system models.

SESSION III

5. Economical and Engineering Aspects of Proactive Demand Participation: Centralized versus Bilateral Control Structure

Nanpeng Yu, University of California at Riverside

The goal of this project is to perform critically needed research related to the retail market development and impact assessment of demand-side participation and its integration into the wholesale market. The proposed control frameworks and algorithms consider both engineering and economical aspects of proactive demand-side participation. Moreover, the proposed demand-side participation markets will be validated using small-scale campus demonstrations and large-scale computer simulations. Using rigorous mathematical analysis and real-world demonstrations, this proposal is aimed at providing a comprehensive framework for formulating, validating, and comparing demand-side participation markets.

6. Multi-Stage and Multi-Timescale Robust Co-Optimization Planning for Reliable and Sustainable Power Systems

Lei Wu, Clarkson University

The objective of this project is to develop a sophisticated decision tool called Multi-stage and Multi-timescale robust Co-Optimization Planning (MMCOP). This tool will help planner's facilitate generation and transmission co-optimization planning of emerging power systems. MMCOP will represent an efficient decision tool for augmenting the existing power utility capabilities to support collaborative planning, analysis, and implementation of emerging power systems and to effectively mitigate risks and uncertainties in both short-term operation dynamics and long-term policy/technology changes.

SESSION IV

7. Management of Risk and Uncertainty through Optimized Cooperation of Transmission System and Microgrids with Responsive Loads

Lindsay Anderson, Cornell University

Cornell University's overarching objective of this project is the development of a scalable co-optimization solution for transmission and microgrids that includes demand response, storage, and renewable resources. This solution will incorporate realistic modeling and integration of responsive demand in the low-voltage system, to assist in management of uncertainty in the transmission system induced by renewable generation sources and contingencies.

8. Flexible Service Contracting for Risk Management within Integrated Transmission and Distribution Systems

Zhaoyu Wang, Iowa State University Science & Tech

Iowa State University's project aims to investigate the ability of "distribution resource aggregators" making use of innovative types of "swing contracts" to ensure the availability and real-time provision of flexible services from distribution resources (DRs) in order to facilitate the robust efficient management of risks and uncertainties for integrated transmission and distribution (T&D) systems. A Distribution Resource Aggregator (DRA) is any entity capable of providing dispatchable real-time services from DRs. A swing contract is a contract whose terms permit a diverse spectrum of services to be offered as ranges of values rather than as point values, thus permitting greater flexibility in their real-time implementation.