Title: Robust Transmission and Generation Expansion Planning

Speaker:
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Abstract:
A fundamental challenge in power system planning is how to handle the interaction of participants’ behaviors. Recently, several proactive or anticipative transmission and generation expansion planning (TGEP) models have been proposed to jointly model the interactions among deregulated electricity market participants making market-driven investment decisions. They have shown that a transmission network planner can increase social welfare by anticipating line expansion planning to generation expansion equilibrium and market outcomes. However, transmission expansion decisions may lead to suboptimal solutions when the generation expansion equilibrium problem has manifold solutions (i.e., leading to higher total costs and lower social welfare). We present a proactive pessimistic (robust) TGEP model where a transmission planner has a pessimistic attitude towards the outcome of the generation expansion equilibrium. Therefore, the model provides a robust solution to the future worst-case and endogenously-determined generation expansion. Investment decisions on generation expansion are made by generation companies by anticipating electricity market outcomes and having rational expectations of other generation companies’ expansion decisions. This problem states an equilibrium problem with equilibrium constraints (EPEC) which is embedded in the transmission planner problem. The overall resulting problem has three levels. To deal with this three-level model a new method to derive tractable EPEC solutions with global optimality guaranteed based on a column-and-row generation algorithm. Numerical experiments illustrate that the proposed model can be used to analyze the impact of network expansion on generation equilibria and social welfare. Regarding computational results, we show the advantages of using the decomposition technique proposed.
Biography of the speaker:
Dr. David Pozo is Electrical Engineer (2006) and Ph.D. Engineering (2013) both from the University of Castilla-La Mancha, Spain. He has been visiting researcher at Hong Kong University, University of Southampton (UK) and Pontifical Catholic University of Rio de Janeiro (Brazil). He is currently a postdoctoral research fellow at the Pontifical Catholic University of Chile. His interests include the design of efficient market mechanisms and the study of incentive structures that operate these markets, with a special interest in its application to the electricity and the environment. In addition, he is interested in developing new probabilistic and robust optimization methodologies for solving is energy-based problems with large penetration of renewable generation sources.

Organizer:    Dr. Y. Hou