EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

Using Robust Optimization to Incorporate Renewables in Electric Power Generation

ABSTRACT – A current widespread goal in electric power generation, around the world, concerns the economic incorporation of renewable sources. Contrary to what may be the popular perception, a central ingredient in this goal is driven by business, i.e. the business of exporting power to high-demand zones. Renewable power is cheap from a generation expensive, but can be expensive and/or risky when long-distance transport is a goal. The risk arises from the real-time variability of renewable output, which can be substantial. This variability must be counterbalanced in real-time, which can be difficult and expensive.

In this talk we describe techniques from robust and nonconvex optimization that concern the largescale use of batteries (storage) so as to offset the deviations in renewable output from short-term forecasts, the critical step from an operational perspective. Batteries are attractive because they can react very quickly. However, battery technology is in its infancy and batteries exhibit numerous operational constraints, in particular performance curves that are statedependent. When planning the operation of a transmission system over a period of several hours, such battery constraints would have to be taken into account. If batteries are used to offset variance in renewables, we will need forecasts of real-time variability that span several hours, a significant challenge. This brings about the use of robust optimization. We will describe a cutting-plane algorithm, using disjunctive cuts, for combined renewable, storage and normal generator operation. Part of this talk will be spent introducing the above topics to the audience.

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SPEAKER BIO – Professor Daniel Bienstock first joined Columbia University's Industrial Engineering and Operations Research Department in 1989. He received his PhD in Operations Research from MIT. His research focuses on optimization and high-performance computing. A second focus of his research involves the use of computational mathematics in the analysis and control of power grids, especially the study of vulnerabilities and of cascading blackouts. He is also editor-in-chief of Mathematical Programming Computing, an optimization journal that reviews software as well as traditional papers. He became an Informs Fellow in 2014.

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