Power Systems Engineering Research Center

What Investments Should Be Made Now? Long-Run Transmission Expansion Under Uncertainty

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PSERC Public Webinar
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Description

Aggressive development of renewable electricity sources will require significant expansions in transmission infrastructure. But how many new circuits, and where and when? These decisions must be made in the face of profound economic, technological, and political uncertainties.

I present a stochastic two-stage optimization model that captures the multistage nature of transmission planning under uncertainty and use it to evaluate interregional grid reinforcements in Great Britain and the U.S. Western Electricity Coordinating Council (WECC). In the model, a proactive transmission planner makes investment decisions in two time periods, each time followed by the investment and operations response of generators. Uncertainty is represented by economic, technology, and regulatory scenarios, and first-stage investments must be made before it is known which scenario will occur. The model identifies expected cost-minimizing first-stage transmission investments, and yields estimates of the value of information, the cost of ignoring uncertainty, and the value of flexibility. Our results show that ignoring risk in planning transmission for renewables has quantifiable economic consequences, and that considering uncertainty can yield decisions that have lower expected costs than traditional deterministic planning methods. Traditional sensitivity analysis-based robustness analysis yields different (and less optimal) results than the stochastic model. In the WECC study, some near-term transmission investments are recommended because of the flexibility they impart, even though they would not be optimal under any individual scenario.

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Biography: Ben Hobbs is the Theodore M. and Kay W. Schad Professor in Environmental Management in the Department of Geography and Environmental Engineering, Whiting School of Engineering at Johns Hopkins University (JHU). He also has an appointment in Applied Mathematics & Statistics, and is the Founding Director of the Environment, Energy, Sustainability & Health Institute. He chairs the CAISO Market Surveillance Committee, and serves as Scientific Advisor to the Energieonderzoek Centrum Nederrlands. He is a Fellow of IEEE and INFORMS. After earning a BS at South Dakota State University and and a MS at SUNY-Syracuse, he obtained his PhD from Cornell University. Prior to joining JHU, he was on the Systems Engineering faculty at Case Western Reserve University and the scientific staff of Brookhaven and Oak Ridge National Laboratories.

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PSERC's Webinar Coordinator: Venkataramana Ajjarapu, Iowa State University, vajjarap@iastate.edu.

Professor Ajjarapu welcomes feedback on the webinars and suggestions for future ones.