Advanced power system uncertainty representation in wind power generation planning

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Speaker:

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Abstract:

This presentation introduces a distributionally robust planning model to determine the optimal allocation of wind farms in a multi-area power system, so that the expected energy not served (EENS) is minimized under uncertain wind power and generator forced outages. Unlike conventional stochastic programming approaches that rely on detailed information of the exact probability distribution, the proposed method attempts to minimize the expectation term over a collection of distributions characterized by accessible statistical measures, so it is more practical in cases where the detailed distribution data is unavailable. This planning model is formulated as a two-stage problem, where the wind power capacity allocation decisions are determined in the first stage, before the observation of uncertainty outcomes, and operation decisions are made in the second stage under specific uncertainty realizations. In this presentation, the second-stage decisions are approximated by linear decision rule functions, so that the distributionally robust model can be reformulated into a tractable second-order cone programming problem. Case studies based on IEEE-RTS system are conducted to demonstrate the effectiveness of the proposed method.

Bio:

Fahad Al-Ismail, received the Bachelor's and Master's degrees in electrical engineering from King Fahd University of Petroleum and Minerals (KFUPM), Dhahran, Saudi Arabia, in 2009 and 2012, respectively. Since December 2016, he has been working toward the Ph.D. degree in electrical engineering at Texas A&M University, College Station, TX, USA. He is currently an Assistant Professor in the Department of Electrical Engineering, KFUPM. His research interests are power system planning, power system reliability, renewable energy integration, and uncertainties representation.