

Power Grid Reliability: Implications of Environmental Regulation and Coal Plant Retirement in Systems with Large Scale Penetration of Wind Power

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Abstract: The Environmental Protection Agency's (EPA) regulations and the Renewable Portfolio Standards (RPS) have provoked a prolonged debate on the electricity system reliability. EPA will likely result in the retirement of coal power plants while the state RPSs will continue drive large-scale deployment of the renewable energy sources, primarily wind. Combined, these changes in the generation fleet may affect the reliable operations of the power system, as coal plants are well-suited to balance the low frequency variability of wind. In order to understand the real implications of these alterations, we extensively analyze the operations of the PJM electricity system under different wind penetration and coal plant retirement scenarios. For this purpose, we use a security constrained unit commitment (SCUC) to model the grid's ability in providing and transferring least cost energy to the consumers. We evaluate several metrics including electricity prices, unserved energy, transmission congestion levels, wind curtailment level, coal and wind share in the total generation for each study scenario.

Keywords: Coal power plant retirements, Security constraint unit commitment, Power system reliability, Wind integration, EPA's regulations, Renewable Portfolio Standards.