Comparison of Wind Speed Forecasting Models for Power Reserve Scheduling in the Congested Transmission Network

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Abstract

Due to its stochastic nature, wind energy imposes unprecedented challenges on the power grid, and a properly scheduled reserve is essential to accommodate wind power's intermittency and volatility. Many power reserve scheduling studies have considered the uncertainties of the renewable energy integration but few address how different wind speed forecast techniques influence the scheduling of reserves in the congested transmission networks. In this paper, three forecasting techniques: artificial neural network, autoregressive integrated moving average, and probability distribution function-based model are adopted to forecast one day of wind speed at Taylor, TX in 2012. To evaluate the impacts of the forecast techniques on power reserve scheduling, a stochastic reserve optimization model was developed to ensure the delivery of reserve in the event of transmission congestion and ramping constraints. A modified RTS-96 test system was employed and the results claim that different forecast models significantly affect the amount of scheduled up and down reserves in a stochastic reserve optimization problem. The level of operating reserve that is induced by wind is not constant during all hours of the day. Dynamic up and down reserves will be needed with a large scale of wind farm integration.

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