

Simulation of Grid Integrated with Wind Farm

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Abstract: *This project investigates the integration of a large-scale wind energy farm into an existing power grid and its impact on grid reliability. Using PowerWorld Simulator, the study models the IEEE 9-bus system enhanced with wind and renewable energy resources. Key performance indicators such as voltage stability, frequency response, power flow, and contingency scenarios are analyzed under varying wind generation levels. The research employs the zone branch methodology to segment the power distribution system into protected zones, facilitating a detailed reliability assessment. The role of compensating capacitors is also examined to understand their influence on system reliability indices. Results demonstrate both benefits and operational challenges posed by renewable energy integration, highlighting strategies to improve grid resilience. The findings underscore the importance of reliability analysis in planning and designing modern power distribution systems incorporating renewable energy resources..*

Keywords: Wind turbines, power system dynamics, PowerWorld Simulator, reliability analysis, zone branch methodology, renewable energy resources.

