Impact of combined demand-response and wind power plant participation in frequency control for multi-area power systems

An alternative approach for combined frequency control in multi-area power systems with significant wind power plant integration is described and discussed in detail. Demand response is considered as a decentralized and distributed resource by incorporating innovative frequency-sensitive load controllers into certain thermostatically controlled loads. Wind power plants comprising variable speed wind turbines include an auxiliary frequency control loop contributing to increase total system inertia in a combined manner, which further improves the system frequency performance. Results for interconnected power systems show how the proposed control strategy substantially improves frequency stability and decreases peak frequency excursion (nadir) values. The total need for frequency regulation reserves is reduced as well. Moreover, the requirements to exchange power in multi-area scenarios are significantly decreased. Extensive simulations under power imbalance conditions for interconnected power systems are also presented in the paper.

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