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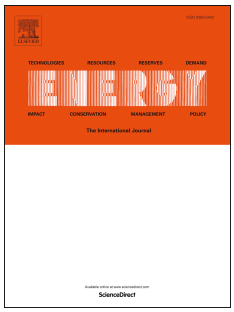

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# Reducing uncertainty accumulation in wind-integrated electrical grid

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**Abstract**

Implementing microgrids has become a major trend in the electric power industry to move toward energy sustainability. One approach for implementing microgrids is to introduce renewable energy. With the inclusion of renewable energy in a microgrid, an appropriate energy storage capacity is needed to cope with uncertainty variation resulting from renewable energy generation fluctuation. This study proposes a probability-based dispatch strategy for determining energy storage capacity with consideration of wind and load fluctuation. The wind and load models are constructed based on their trends and uncertainty variations. The wavelet packet analysis method and the moving average technique are used to extract the trends of wind energy and load. Log-normal and extreme value distributions are used to model the uncertainties from wind speed and load. This research improves an existing method with reduced uncertainty accumulation, resulting in a more suitable battery size. To validate the proposed method, a real-time operating simulation is used to observe the behavior of a wind-integrated electrical grid. Results show that the proposed method can reduce the effects of uncertainty variation caused by wind and load. A smaller energy storage capacity with higher reliability is also obtained through optimization.

**Keywords** : wind energy forecasting, electricity demand forecasting, power dispatch, energy storage sizing, microgrid, design under uncertainty



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