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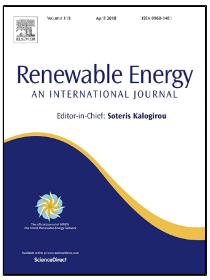

Optimal sizing of energy storage system and its cost-benefit analysis for power grid planning with intermittent wind generation

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Optimal sizing of energy storage system and its cost-benefit analysis for power grid planning with intermittent wind generation

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***Abstract*—**Energy storage system (ESS) is a key technology to accommodate the uncertainties of renewables. However, ESS at an improper size would result in no-reasonable installation, operation and maintenance costs. With concerns on these costs outweighing ESS operating profit, this paper establishes a stochastic model to size ESS for power grid planning with intermittent wind generation. In the model, the hourly-based marginal distributions with covariance is first derived from historical data of wind generation, and a stochastic cost-benefit analysis model with consideration of the generation fuel cost expectation and ESS amortized daily capital cost is formed. Then a hybrid solution approach combining the Point Estimated method and the parallel Branch and Bound algorithm (PE-BB) is designed to solve the model. Finally, the stochastic model and PE-BB approach are thoroughly tested on the 10-unit and 26-unit systems with uncertain wind generation. Simulation results confirmed the proposed model and PE-BB approach are effective to optimize ESS size for power grid planning with intermittent wind generation. The cost-benefit investigations on four typical ESSs also indicated that the ESS capital cost, charging/discharging efficiency and lifetime are important properties for optimizing ESS size, and it is not always economically justifiable to install ESS in power system.