Optimal Development of Wind Farm with Simulation Models and Optimization

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As increasingly viable renewable source, wind energy has often been employed in micro-grid systems where central power plants are replaced with local smaller clean power generators. Simulation optimization models are needed for optimal design of the wind farm because of the uncertainty of wind and the complex interactions between turbines. A two-level optimization framework is developed for seeking the optimal number of turbines and most-productive locations. In our numerical experiments, a wind-storage energy system is considered to supply electricity to a community of several residential households. As a result, the optimized wind farm meets the stochastic electricity demand almost surely.

Keywords: wind farm development, location optimization, wind energy, system uncertainty.