Optimal Sizing of Hybrid Renewable Energy System Based on the Operational Value Function

신주현, 이재형†
한국과학기술원
(jayhlee@kaist.ac.kr†)

In this research, design of wind/battery integrated hybrid energy system is studied, which is the yearly investment problem for sizing wind generation and energy storage is typically performed to minimize future operating costs as well as capital cost. For estimating the yearly operating cost, a day to day Markov decision process (MDP) is integrated with two-stage stochastic programming for one-day operation. At the same time, a general wind model for timescales from seasonal to hourly is developed for consistent connection of the decision making across the scales. Value function capturing all future operating costs is approximated in the MDP, and polynomial surrogate model for the value function is constructed based on a set of sample data obtained by uniformly probing a feasible design space. Appropriate model structure is determined by model quality metrics considering both model accuracy and complexity, and the regression parameter of the model is estimated by least square. The size optimization of the studied energy system is thus solved, and the optimal balance curve of battery and wind capacity is obtained by varying the unit investment cost.