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Optimal Strategy of Energy Storage Aggregators in Ancillary Service Markets: Stochastic Programming Approach

Meysam Khojasteh [(1)], Pedro Faria [(1)], Fernando Lezama [(1)], Zita Vale [(1)]

[1] *Polytechnic of Porto, Porto, Portugal*

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Summary

The uncertain nature of renewable resources can endanger the balance of generation and consumption. Therefore, the system operator shall commit more schedulable and controllable resources to maintain the security of the grid. Among various type of energy resources, battery storages seem to be a reliable alternative to provide the regulation service. In smart grids, consumers can use these household resources to supply their required electricity and sell the surplus energy to the grid. Energy storage aggregators as intermediate between prosumers and the local market can merge the capacity of prosumers' resources and submit their power bids in the market. In this work, a linear model is presented for the participation of energy storage aggregators in the ancillary service market. To model the uncertainty of energy prices in the ancillary service market, the stochastic programming approach is used. The optimization problem is formulated based on the linear programming method. Finally, the performance and efficiency of the proposed model are evaluated via a case study and different scenarios.

Highlights

- A stochastic model is proposed for energy aggregators to merge and manage distributed battery energy storage units in the regulation market.
- The proposed model is formulated as a linear optimization problem that can be solved by common optimization solvers.
- In the proposed model, the stochastic programming approach is used to develop the energy trading strategy for aggregators, based on uncertainties of real-time and regulation prices.