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Optimal Strategy of Energy Aggregators in the Energy and Regulation markets: Chance-Constrained Approach

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Summary

Multiple energy systems have become increasingly interdependent in recent years. In the smart grids, energy aggregators (EAs) as intermediaries between consumers and energy markets are responsible to supply the required energy of consumers. However, fluctuations in consumption could endanger the expected cost of EAs. Therefore, EAs shall use flexible resources to diminish the unexpected variation of demand. Among various types of energy resources, battery energy storages (BESs) and combined heat and power (CHP) units are flexible alternatives to provide the required electricity and heat demand of consumers. In this work, a linear model is presented for the participation of EAs in the energy and regulation markets based on the electrical and thermal requirements of consumers. To model the impacts of stochastic consumption, the chance-constrained programming approach is used. Moreover, the McCormick relaxation is addressed to linearize the cost function of the CHP unit. The performance is evaluated via a case study and various confidence levels. Simulation results indicate that increasing the confidence level from 0.75 to 0.85 results in a 5.4% increase in EA's costs.

Highlights

- EAs use flexible resources to manage demand fluctuations in smart grids.
- Linear model optimizes EA participation in energy and regulation markets.
- Higher confidence levels raise EA costs, with a 5.4% increase from 0.75 to 0.85.

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