TradeRES
New Markets Design & Models for 100% Renewable Power Systems

TradeRES Research Bulletin

Bidding in Local Energy Markets Considering Uncertainty from Renewables and Demand

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Summary

The penetration of distributed energy resources in distribution networks is currently enabling the emergence of local energy markets (LEM). However, considering renewable generation and load demand variability is crucial to realize such transactive energy systems. In this work, we propose a bi-level optimization model for bidding in LEM, considering the uncertainty of renewables and demand. At the upper-level, consumers, prosumers, and producers submit bids in a double-auction LEM to minimize the cost of consumers and maximize the profits of producers considering PV generation and demand variability. The lower-level corresponds to a pool-based LEM that maximizes the energy transactions of players. Due to the complexity of the problem, metaheuristics are used to find near-optimal solutions to the problem. Results suggest that the model can account for the uncertainty that may be realized in the day-ahead for load demand and PV generation but at the expense of a higher overall cost.

Highlights

- A mathematical model for optimization of energy bids in local markets is proposed and formulated. The model include the consideration of the uncertainty of demand and PV generation.
- We model the uncertainty of demand and PV generation considering a large number of possible scenarios, and apply a reduction technique avoiding losing relevant information of possible outcomes
- We provide a framework to solve the problem using evolutionary computation, and provide illustrative examples on how to apply such techniques
- We apply the proposed approach under a case study considering players of different types participating in the LEM. Offers based on bidding curves are considered to incorporate consumers' flexibility.
- To the best of our knowledge, this attempt has not been made before for this specific bidding model.

Info

The TradeRES project will develop and test innovative electricity market designs that can meet society's needs of a (near) 100% renewable power system. The market design will be tested in a sophisticated simulation environment in which real-world characteristics such as actors' limited foresight into the future and risk aversion are included.

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