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Editorial Market-based distributed energy resources operation for future power systems

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Editorial on the Research Topic
Market-based distributed energy resources operation for future power systems

1 Introduction

One of the biggest challenges in the current power system operation is caused by the large scale integration of distributed energy resources (DERs) that have high volatility generations (Uzum et al., 2021). Communication and control technologies are significantly improved to provide direct interaction between agents and customers, such as in peer-to-peer frameworks. In addition, the recent developments in monitoring, sensor networks, and advanced metering infrastructure (AMI) greatly enhance the variety, volume, and speed of measurement data in electricity transmission and distribution networks. By harnessing these technologies, the application of big data, artificial intelligence, and machine learning methods can be implemented to overcome the challenges from massive DERs integration in power systems. However, these technologies require a large amount of capital to operate, which can lead to financial loss if used without an appropriate strategy.

In this context, the topics of interest of this Research Topic address market-based DER operations, regulation, and decision-making, and analyze the impact of market-based DER operation on power systems.

2 Research Topic papers summary

In this section, we have summarized the manuscripts published in this Research Topic.

Xu et al. in addressed the issue of EV *via* a price-based demand response for economic operation in distribution systems. Existing price-based demand response algorithms fail on spatial-temporal distribution of large-scale EVs connected to the distribution network. In this study, a price-based demand response was proposed for a day-ahead economic dispatch strategy. Simulation cases were implemented in IEEEE 33-bus systems to demonstrate the effectiveness of this strategy.

Kocer et al. addressed the different characteristics of charging and discharging for EVs. In this study's new context, they explored how a battery swap station (BSS), implemented as an alternative solution to a charging station, can decrease the long waiting time for charging as well as battery degradation due to fast charging. The main objective of this study was to optimize the charging–discharging schedule for several BSSs in the ancillary services of the public transportation system in Berlin, Germany. In addition to BSSs, a mobile swapping station (MSS) concept is introduced to increase flexibility in power systems. The results show that while a BSS is a great tool in the ancillary services market, an MSS concept provides more advantages in power systems.

Oh et al. addressed the matter of DR participation strategy as an aggregator that offers appropriate DR programs to customers with flexible loads. This study formalized the DR strategy as a Markov decision process (MDP) and used the reinforcement learning (RL) framework. In the RL framework, the DR aggregator and each customer are allocated to an agent that interacts with the environment and is trained to make optimal decisions. The proposed method was validated using actual demand and market price profiles. Simulation results demonstrated that the proposed method could optimize DR participation strategy.

Noorfatima et al. addressed the issue of managing local market transactions with many participants through community-based peer-to-peer (P2P) energy trading. This study implements discriminatory pricing-based P2P energy trading by aggregating participants' trading profiles based on K-means clustering to improve the P2P energy trading results and the computation process. To overcome fairness issues between members of each cluster, the participants' trading results and contributions to network usages due to P2P energy trading are taken into account and the resulting Shapley value is incorporated to distribute profit. The results show that the proposed method is a suitable option to obtain an optimal local electricity market in a distribution system with an increasing number of participants.

3 Conclusion

Four high-quality manuscripts have been published in this Research Topic. We would like to submit our new editorial to continue the research on the subject.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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