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Abstract Distributed energy resources aggregators (DERAs) are permitted to participate in regional wholesale markets in many counties. At present, new market players such as aggregators participate in China's power market transactions. However, studies related to market trading strategy have mostly focused on centralized wind power and PV generation units. Few studies have been conducted on the decision-making strategies for DERAs in China's power market. This paper proposes an auxiliary decision-making model for distributed energy systems to participate in the day-ahead market with more reasonable trading strategies. Firstly, the Gaussian mixture model (GMM) is used to deal with the uncertainties of wind power and photovoltaic (PV) output in the distributed energy system. Secondly, the information gap decision theory (IGDT) is used to deal with the uncertainty of price fluctuations in the spot electricity market. Thirdly, according to the different risk preferences of the DERAs facing market price fluctuation, the robust decision model and opportunity decision-making model in the day-ahead market are constructed, respectively. Finally, to deal with the irrational behavior of the DERAs' perception of "gain" and "loss" with market risks in China's two-tier market environment, the prospect theory and the marine predator's algorithm (MPA) are employed to obtain a day-ahead trading decision scheme for DERA. The analyses show that RDES with robust preference can withstand greater price volatility in the day-ahead market; they will reduce the bidding expectations and increase the system operating cost to improve the achievability of the expected revenue. However, DERAs under the opportunity strategy is more inclined to sell electricity to the market and offset system operating costs with revenue. The proposed model can provide strategic reference for DERAs with different risk preferences to bid in day-ahead market and can improve the level of aggregators' participation in electricity trading.

Keywords distributed energy resources aggregator; day-ahead transaction strategic; information gap decision theory; marine predators algorithm.