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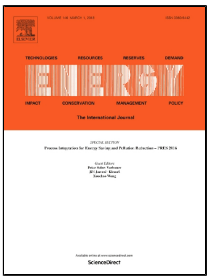

Network-constrained optimal bidding strategy of a plug-in electric vehicle aggregator: A stochastic/robust game theoretic approach

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Network-constrained optimal bidding strategy of a plug-in electric vehicle aggregator: A stochastic/robust game theoretic approach

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Abstract: This paper presents a strategic bidding model for several price-taker plug-in electric vehicle aggregators sharing the same distribution network that participate in both day-ahead energy and ancillary services (up/down-regulation reserve) markets. Since the strategic feasible space of an aggregator depends on the actions of the other aggregators due to the limited capacity of the existing feeders, the proposed problem forms a generalized Nash equilibrium problem. The aggregators' objective is considered to be the cost of purchased energy from the day-ahead and real-time market minus the revenue from the day-ahead regulation market. A hybrid stochastic/robust optimization model is employed to deal with different uncertainties an aggregator faces in the bidding strategy problem. These uncertainties include day-ahead energy prices, day-ahead up/down-regulation prices, and real-time energy prices. Day-ahead prices are modeled by different scenarios, while real-time prices are represented by the confidence bounds. Results of a case study are shown to demonstrate the applicability and tractability of the proposed model.

Keywords: Aggregator's bidding strategy, game theory, generalized Nash equilibrium, plug-in electric vehicle, robust optimization, stochastic optimization.

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