Real-Time Procurement Strategies of a Proactive Distribution Company with Aggregator-Based Demand Response

In this paper, we present a real-time trading framework for distribution networks where a rational aggregator is identified as a broker by contracting with individual demands and dealing with the distribution company. Demand response capability is characterized by the coexistence of elastic and inelastic demand components. A one-leader multi-follower bilevel model is proposed to derive the procurement strategies, i.e., the upper-level problem intends to maximize the profit of the proactive distribution company, while the lower-level expresses the profit maximization per rational aggregator. The proposed model is then transformed into a solvable mathematical program with equilibrium constraints through a primal-dual approach. A modified 33-bus distribution network is utilized to demonstrate the effectiveness of the proposed model.