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**Abstract** For a generation company trading in an electricity market, efficient control of the financial risks and robustness is as vital as maximizing profit. A robust approach is preferred since the generation company can obtain an optimal self-schedule considering price volatility as a source of uncertainty. The goal of this paper is to implement and compare different robust approaches such as robust optimization methods with different uncertainty sets, conditional value-at-risk based stochastic programming, and information gap decision theory for self-scheduling of generation companies. Moreover, all robust methods are applied to test cases with different price behaviors in the long-run to demonstrate the performance and features of each method. Finally, the different self-scheduling strategies based on the price data and the generation company's desired robustness level are proposed.

**Keywords** Self-scheduling; Robust optimization; Uncertainty set; Stochastic programming; Information gap decision theory