Dynamic pricing for demand response considering market price uncertainty

Retail energy providers (REPs) can employ different strategies such as offering demand response (DR) programs, participating in bilateral contracts, and employing self-generation distributed generation (DG) units to avoid financial losses in the volatile electricity markets. In this paper, the problem of setting dynamic retail sales price by a REP is addressed with a robust optimization technique. In the proposed model, the REP offers price-based DR programs while it faces uncertainties in the wholesale market price. The main contribution of this paper is using a robust optimization approach for setting the short-term dynamic retail rates for an asset-light REP. With this approach, the REP can decide how to participate in forward contracts and call options. They can also determine the optimal operation of the self-generation DG units. Several case studies have been carried out for a REP with 10,679 residential consumers. The deterministic approach and its robust counterpart are used to solve the problem. The results show that, with a slight decrease in the expected payoff, the REP can effectively protect itself against price variations. Offering time-variable retail rates also can increase the expected profit of the REPs.