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AGGREGATION OF DEMAND-SIDE FLEXIBILITY IN ELECTRICITY MARKETS: THE EFFECTS OF PORTFOLIO CHOICE

Abstract:

Aggregation of demand-side flexibility for balancing purposes is seen as one way to cope with the challenges imposed by increasing share of renewable energy sources in the future power system. The value of demand-side flexibility has attracted attention of researchers and industry a while ago. However, there is still a lack of discussion whether the composition of various flexibility sources could bring additional value in optimizing schedules of flexible load. This paper examines the role of flexible demand aggregators and the effects of their portfolio choice on payments in balancing market and compensations to flexibility providers. It also proposes a game theoretical model which allows to determine optimal flexible load schedules ensuring highest savings in balancing market. Seven scenarios representing portfolios with different compositions of flexibility sources are set to investigate the Nordic power market. Results show that the aggregator's payments in balancing market and compensations to consumers for provided flexibility depend on the type of flexibility sources in the portfolio. Also, the difference in forecasted and actual reductions in imbalance payments is affected by the portfolio composition. However, there is no significant value in combining all flexibility sources in the portfolio. This means that in order to maximize the value of flexible demand the aggregators might choose to specialize in certain types of flexibility sources.

Keywords:

Demand-side management, flexibility, aggregation, electricity market, smart grid