EFFICIENT PRICING AND INVESTMENT IN COMPETITIVE ENERGY-ONLY MARKETS

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Overview

Electricity is an undifferentiated commodity with limited storage capability, low demand elasticity and wide seasonal variations. All producers with wide range of generation technologies have to bid based on their short term marginal cost in the electricity market and it makes difficulties for most expensive producers i.e. gas plants, to recover their capital costs. This issue causes less incentive for investment in new capacity which leads to resource adequacy problem. In this study, the main question is that how competitive energy-only market can mitigate the resource adequacy problem by imposing efficient pricing and investment planning. In other words, how an energy-only market can make incentives for new investment by adjusting regulator-imposed price caps and capacity obligations in presence of both price-sensitive and price-insensitive consumers.

Methods

System dynamics is an approach to study the casual effects of the interactions within the components of a system during time. In this study, system dynamics approach is used to comprehend the dynamics of different interactions between the components of the energy market such as market price, supply, demand, and profitability and investment decisions. In system dynamics method, a casual loop diagram is an appropriate tool to represent the feedback structure of the system. In our study, the casual loop diagram is depicted in Fig.1 which shows the impact of different components in decision making process for new investment decisions. The dotted lines show the contribution of this paper, which mainly focus on the impact of demand response and optimal scarcity price on the incentives for new investment.

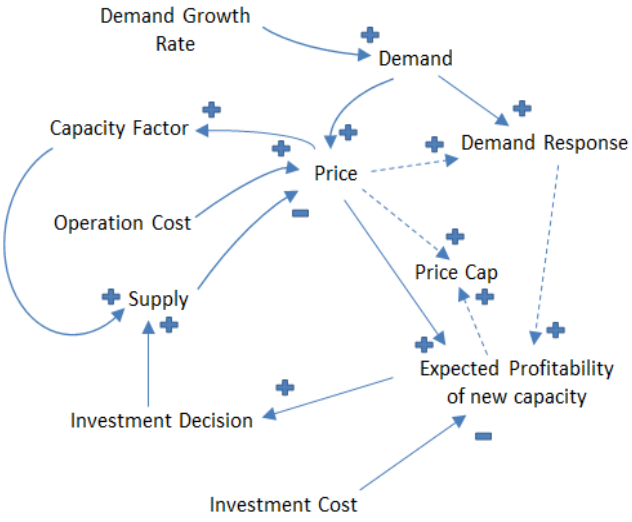

Fig. 1. Casual loop model for new investment in the market

Results

German energy-only market with perfect competition is the main structure of the simulated market. A perfect competition is assumed in the market in which all generators have complete information about installed capacity and new investment decisions. Also, stochastic demand growth rate is derived from Monte Carlo simulation. We analyze the interrelationships between scarcity prices and capacity obligations and load rationing. The preliminary results show that the optimal load shedding period has a negative correlation with the frequency of scarcity prices and the level of price cap. Also, it is shown that the higher price cap results the lower average utilization of the price-sensitive loads in a fixed demand response capacity. The reason is that the higher price cap leads to higher revenue for new capacity and higher new installed capacity compared to the lower price cap scenarios.

Conclusions

In this study, the optimal and efficient price and investment for an energy-only market structure is derived in which price-insensitive consumers may have to be rationed under some contingencies. Then, it is proved that the resource adequacy problem could be mitigated under the achieved optimal price and investment planning. The German electricity market is studied as a case study and the optimal prices and investment patterns are discussed. The preliminary results show the correlation between the scarcity prices and frequency of scarcity situations and the volume of price-sensitive loads.

References

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