Long-term assessment of power capacity incentives by modeling generation investment dynamics under irreversibility and uncertainty

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Abstract

In actual energy-only markets, the high volatility of power prices affects the expected returns of generators. When dealing with irreversibility under uncertainty, deferring decisions to commit in new power plants, waiting for better information, is therefore a rational approach. Theoretical and empirical evidence suggests that such investment pattern determines the occurrence of construction cycles, which strongly compromise supply security. In order to supplement generators' revenues, several remuneration mechanisms have been devised over past years. Along this line, this work addresses the long-run dynamics of capacity adequacy and market efficiency with both a price-based and a quantity-based capacity remuneration policy. For that purpose, a recently-developed, stochastic simulation model is used as a benchmark. Hence, the optimal postponement of generation investment decisions is integrated into a long-run power market model by formulating the decision-making problem in the framework of Real Options Analysis. Results suggest that policymakers may exchange supply security (effectiveness) for energy prices to be paid by consumers (efficiency) when designing and implementing capacity remuneration mechanisms. By doing so, this article contributes to the ongoing debate regarding the design of incentive policies and efficient power markets by considering the microeconomics of investors' decision-making under irreversibility and uncertainty.