181

Flexibility Investments in Germany under Alternative Electricity Market Designs: A Mid-Term Perspective

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Extended Abstract

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Abstract Summary

The transformation of the European electricity system towards a more decentralized system based on renewable energy sources and heterogeneous actors imposes challenges for the efficient short-term and mid-term operation under the given market design with mostly uniform price zones. In the given market design, neither spatially differentiated investment incentives for new generation capacities nor market incentives for a grid-supporting behavior of flexibilities are provided. This by itself leads to inefficient investment decisions in generation and flexible capacities as well as their operation, imposing high system cost. Additionally, uncertainty regarding prices, system conditions and policy interventions influences these incentives by affecting potential scarcity signals from the system. This study provides a comparison for different market design realizations for the German uniform price zone and their effect on investment decisions for generation and flexible capacities as well as their operation within the European electricity system. The analysis uses 2040 as a mid-term target year and covers the European electricity market as well as an aggregated grid model for Germany. Market design realizations include price zone reconfigurations and market interventions into the scarcity-pricing mechanism. For this purpose, a multi-level electricity market model is used to analyze optimal endogenous investment decisions of multiple heterogeneous market participants like generators, electricity storages and electrolyzers. Market-based results are then analyzed regarding their regional effects in an aggregated version of the German transmission grid. Results suggest, that market design changes like price zone reconfigurations can have a positive effect on the efficiency of investment decisions and their operation on the market. However, market interventions affecting the free formation of market prices can have desirable effects in the short-run, but impose uncertainty for the market participants' investment decisions and should be implemented with caution.