ZONAL PRICING IN GERMANY – A PREFEREABLE TRADEOFF BETWEEN NODAL AND UNIFORM PRICING?

Alfredo Zamora, Workgroup for Infrastructure and policy TU Berlin, 017661327253, alz@wip.tu-berlin.de
Christoph Weyhing, Workgroup for Infrastructure and policy TU Berlin, cw@wip.tu-berlin.de

Overview

The outcome and efficiency of electricity markets is heavily influenced by their geographical configuration. Market zones often align with national borders, whilst generation and load patterns differ on smaller geographical scales. Zonal configurations with historically grown centralized energy infrastructures are outdated by fast growing decentralized renewable generation, which leads to network congestions and inefficiencies. These inefficiencies, in form of redispatch and curtailment, result into the overpricing of electricity since the market fails to adapt by allowing electricity to be sold anywhere regardless of its generation area. This problem can be resolved by either adapting the infrastructure or changing the zonal configuration.

Although being a controversial topic, market splitting is a very well-known method to increase market efficiency with many successful implementations around the world. As early as 2004, Eherenmann et al. already discuss the achievement of different market splitting applications at the end of the twentieth century. Furthermore, the integration of the European electricity network promotes the exchange between independent market zones in order to expand the available generation capacity while maintaining certain constraints and protocols. Academic publications that investigate optimal zonal configuration often use electricity system data prior to 2015 with renewable shares under 30%, while in 2019 this number increased to over 45% in Germany. Hence, studies on market coupling and zonal pricing have focused their efforts on figure out the most efficient way to combine already established national energy markets.

In the German context, the territorial differences in non-dispatchable renewable energy sources have force the increase of redispatch measures. Against this issue, the ongoing discussions are focused on the transformation of the generation and transmission network while maintaining the market model intact. While the European approach is more open to market splitting to avoid bottlenecks within market zones, Germany has opted for maintaining a uniform market. For that reason, this research aims to give an update for 2020 on the discussion on market splitting by the example of Germany.

Methods

To inquire into the effects of market splitting in Germany, first a specific zonal configuration has to be selected. For this research we took as starting point a configuration proposed by Ergerer et al. (2016) which consist in a four-zone split (South, West, East and North) based on generation levels and bottlenecks. This design was then further expanded by adding a zone in the northern region due to additional bottlenecks spotted in the transmission lines. Subsequently, based on a model of the German transmission grid including demand and supply, market clearing is simulated for a defined multi-zonal configuration with subsequent redispatch using the power markets tool POMATO. The data used for this simulation is taken from the open data access OPSD and Gridkit. The results are processed and displayed to show the implications of the zonal arrangement on system costs, market prices, congestion management and regional generation. We pay special attention to the exchange between zones to estimate the impact of different inter-zonal trading capacities. The zonal configuration is benchmarked against a nodal pricing and a uniform pricing approach.

Results

Preliminary nodal results show significant price differences within Germany. While in the north prices are low and sometimes negative, nodal prices are higher in the west and south. The obtained nodal pricing results justify the chosen zonal alignment since zonal borders mostly separate nodes with similar price levels.

Zonal pricing results show a reduction of redispatch and curtailment to almost negligible values compared to uniform pricing by shortening the available trading capacity between zones significantly. Hence, market outcome aligns better with the physical infrastructure and generation is properly allocated in the market. While redispatch costs drop with more restricted trade, generation costs rise. An optimal trading capacity setup cannot be identified, because differences in total system costs are small between the different setups. Furthermore, limited trading capacities lead to price spreads between northern and southern zones, which increase with decreasing trading limits. Market prices in the southern zone deviate from the others averaging 40 €/MWh over the other in the month of January.

Conclusions

The present work provides additional insights on the debate of a split-market in Germany by addressing the impact of inter-zonal trade capacity. The market price deviation illustrates the dependency of some regions in Germany to low-cost energy due to disproportionate distribution of renewable generation capacities. It also highlights the increment in efficiency gained by reducing the redispatch amount. Though, market splitting into zones leads to higher generation costs.

References

Egerer, J., Weibezahn, J., and Hermann, H.September 2016. "Two price zones for the German electricity market — Market implications and distributional effects."Energy Economics59 ():365–381