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Local Market Power Through Bidding Zone Split: An Equilibrium Analysis for the German Electricity Marke

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Germany currently operates as a single Bidding Zone (BZ), maintaining a uniform market price regardless of regional disparities in production and consumption. This configuration faces increasing challenges: structural imbalances between wind generation in the North and load centers in the South lead to severe grid bottlenecks. Managing this internal congestion required redispatch (RD) measures costing approximately €2.9 billion in 2023. Consequently, the Agency for the Cooperation of Energy Regulators (ACER) has proposed reconfiguring the German BZ into smaller segments to improve price signals and grid stability. However, a critical side effect remains under-discussed: the potential for increased local market power. The fragmentation of the national market risks reducing liquidity and competition. The proposed zone boundaries exhibit structural similarities to historical area monopolies. While unbundling separated network operations from generation, it did not mandate the spatial unbundling of assets; thus, the capacities of major incumbents remain concentrated within their former territories. Currently, the four largest generation companies (RWE, EnBW, LEAG, and Uniper) hold over 54% of Germany's capacity. A BZ split could isolate these fleets in smaller markets with less competition, potentially restoring their ability to exercise market power and causing welfare losses that outweigh efficiency gains.

This study closes a research gap by moving beyond the "perfect competition" assumptions prevalent in existing BZ literature. We develop a Cournot-Fringe competition equilibrium, modeled as a Quadratic Constraint Problem (QCP), following Egging-Bratseth et.al. (2020), which allows to capture the interaction between regulated constraints and strategic behavior. The six largest generation companies are strategic Cournot players, while smaller units and RES act as a price-taking fringe. To rigorously capture network constraints, the methodology integrates Flow-Based Market Coupling (FBMC) constraints derived from a detailed physical network model based on Joint Allocation Office (JAO) grid data. This approach allows for the endogenous determination of market outcomes under realistic loop flows, contrasting with simplified net transport capacity (NTC) assumptions. For generation capacities in Germany, we use the BNetzA Powerplant list, the Marktstammdatenregister and collect announced project, which are relevant for the target year 2030. For the generation fleet outside of Germany, we use the TYNDP 2024 National Trend scenario. Similarly, the demand assumption is taken from the latter scenario. For robustness, we conduct the analysis for the weather years 1995, 2008 and 2009.

Calibrated for 2030, this study quantifies the interplay between grid congestion and strategic market power. By deploying a Cournot-Fringe competition as a QCP with FBMC constraints, it departs from simplified NTC and perfect-competition models. The analysis provides a detailed estimation of welfare effects, highlighting whether the proposed ACER configurations introduce significant regulatory risks. Preliminary results suggest that the potential for exercising local market power is particularly pronounced in the 3 and 4-zone configurations.

Author: DIERS, Hendrik (Energiewirtschaftliches Institut an der Universität zu Köln (EWI))

Co-authors: Prof. BUCKSTEEG, Michael (Energiewirtschaftliches Institut an der Universität zu Köln (EWI) & Fernuniversität Hagen); TERHORST, Stephan (Energiewirtschaftliches Institut an der Universität zu Köln (EWI))

Presenter: DIERS, Hendrik (Energiewirtschaftliches Institut an der Universität zu Köln (EWI))

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