



Simulation and Evaluation of Zonal Electricity Market Designs

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Abstract Zonal pricing with countertrading (a market-based redispatch) gives arbitrage opportunities to the power producers located in the export-constrained nodes. They can increase their profit by increasing the output in the day-ahead market and decrease it in the real-time market (the inc-dec game). We show that this leads to large inefficiencies in a standard zonal market. We also show how the inefficiencies can be significantly mitigated by changing the design of the real-time market. We consider a two-stage game with oligopoly producers, wind-power shocks and real-time shocks. The game is formulated as a two-stage stochastic equilibrium problem with equilibrium constraints (EPEC), which we recast into a two-stage stochastic Mixed-Integer Bilinear Program (MIBLP). We present numerical results for a six-node and the IEEE 24-node system.

Keywords Two-stage game, Zonal pricing, Wholesale electricity market, Bilinear programming

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