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Title: Chance-constrained Flow Based Market Coupling Domains for Zonal Market Clearing under Uncertainty

Abstract: Power flow physics and transmission limits constrain electricity market transactions. With increasing uncertainty, mainly driven by the proliferation of intermittent renewable generation, a precise calculation of securely available transmission capacity can improve market efficiency and system reliability. In May 2015 the transmission system operators (TSOs) of central western Europe (CWE) inaugurated flow based market coupling (FBMC) to replace net transfer capacities (NTCs) as cross-border trading constraints. Unlike NTCs, the amount of cross-border trading capacity (domain) made available to the market by FBMC, is computed by solving a security-constrained optimal power flow (SCOPF) for the interconnected transmission system based on a forecasted point-of-dispatch (base case).

The base case is determined from forecasted load profiles and renewable energy feed-in two days in advance (D-2) so that the resulting FBMC domain can be communicated to the day-ahead market (D-1). Previously, the FBMC domain has been computed deterministically, i.e. without explicitly considering the uncertainty inherent to the forecasted base case. To robustify the solution against real-time deviations from the forecast, fixed security margins have been employed which arbitrarily increase the conservatism of the solution. In this work, we propose a chance-constrained (CC) formulation of the forecasted base case. The resulting FMBC domain explicitly internalizes uncertainty parameters of the available forecast and can be tuned to accommodate various levels of forecast quality and desired risk levels.

While comprehensive simulations are still pending, preliminary results suggest that the CC formulation leads to a less conservative day-ahead dispatch, thus enabling more trade capacity and better price convergence. Furthermore, we will investigate various assumptions regarding the grid representation in the base-case, forming a comprehensive summary on different implementations of FBMC.

Key words: Flow Based Market Coupling, FBMC, SCOPF, Zonal Market Clearing