Master thesis
*Research area: Electricity market modelling, transmission grid simulation*
**Development and implementation of a methodology for the optimization of available cross-border capacities in flow-based market coupling**

Since May 2015, flow-based market coupling (FBMC) is used to calculate available cross-border transmission capacities in Central Western Europe (CWE). The flow-based method differs significantly from the formerly used ATC-based market coupling approach. On the one hand, the physical limits of individual grid elements is explicitly taken into account during market coupling. On the other hand, cross-border capacities available for electricity exchanges are calculated and allocated simultaneously by taking into account a system of linear inequalities in the market coupling algorithm. This system represents the technical constraints of the transmission grid and defines the set of all theoretically possible market outcomes that are feasible.

The set of feasible market outcomes can be influenced by the consideration of power flow controlling devices such as high-voltage direct current (HVDC) lines and phase-shifting transformers. By optimizing the power flow controlling devices' set points prior to market coupling an even more efficient utilization of the transmission grid can be achieved. In addition, the application of remedial actions in terms of re-dispatching conventional power plants and feed-in management of renewable energy sources, is also conceivable in order to optimize the capacities available for cross-border exchanges even before market coupling.
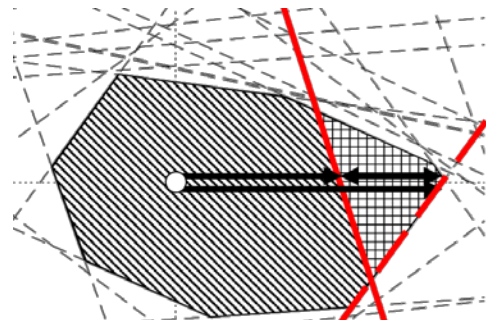


Figure 1: Schematic representation of the change in available cross-border capacities as a function of the transmission grid's constraints

The aim of this thesis is to develop a methodology for the optimization of cross-border transmission capacities within the flow-based capacity calculation procedure.

The following structure of the work is proposed:

- Familiarization with flow-based market coupling (FBMC)
- Literature research on degrees of freedom in flow-based capacity calculation
- Development of an optimization problem for target-oriented capacity maximization
- Implementation of the optimization problem in market and grid simulation framework
- Exemplary application and evaluation of the methodology with provided test data

Following this thesis, a short presentation will be given on the results of the work.

With immediate effect, this thesis is to be awarded to students of electrical/information technology and industrial engineering as master's thesis.

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