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New Cross-Border Balancing Arrangements in Europe: What are the Efficiency Gains and who Reaps them?

Paper Proposal

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Overview

The European electricity system is currently subject to significant changes, not only with respect to developments in generation and networks but also concerning the arrangements for operating the system. These are to a large extent laid out in Network Codes endorsed by regulators, network operators and the European Commission; their objective is to create an "Internal Energy Market". Recently, European network operators have adopted the Network Code on Electricity Balancing (NC EB) which foresees arrangements to foster cross-border exchange of balancing services with the objective to lower overall costs and to increase social welfare. As both the electricity system and the proposed rules to re-design existing balancing arrangements are highly complex we perform a quantitative analysis of the region consisting of Switzerland, Austria, and Germany. Assuming that Switzerland adopts the "Electricity Agreement" (which would make EU Electricity rulings binding also in Switzerland) the new rules on Balancing would apply in all three states which have a long, common history of electricity system planning.

Methodology

To conduct our analysis, we approximate the electricity transmission network between the countries and use a detailed representation of power plants, scheduled power withdrawals and localized imbalances leading to the need to activate balancing energy. This includes ramping, must-run and startup restrictions that are essential for the cost of balancing provision. We use actual data in the form of hourly time-series from 2013.

We apply a rolling planning approach to be able to solve the problem for an entire year. Every single week is solved consecutively. Prior we solve a simplified version of the model for the entire year, to generate storage limitations for the staring and end point of each week.

We examine the potential of overall system cost savings by allowing for gradually increased cross-border exchange of balancing services, also taking into account implications for the dispatch at the day-ahead time-frame. The different levels of integration we consider are:

i) netting of balancing imbalances only,
ii) sharing of balancing energy activation options without strictly relying on them, and
iii) conducting common balancing capacity procurement across borders.

Further, we estimate the cost-minimizing level of network capacity to be used exclusively for cross-border balancing services.

Results

Our results allow us estimate the impacts of the proposed arrangements in terms of system costs, and redistribution between countries and generators/consumers. Our results indicate that benefits are the largest for full cooperation. Furthermore the reservation of balancing capacity shifts towards specific countries. Therefore the benefits do not need to be distributed evenly between the countries. The resulting lower total cost can lead to higher cost for single countries. Hence compensation mechanisms will become necessary to give incentives for all countries to join such cooperation. Furthermore the optimal level of network capacity reserved for cross-border balancing varies significantly depending on spot market conditions.

Conclusion

Our analysis shows that increased cooperation in the provision of balancing reserves is always beneficial for the entire group. However the distributional effects can be very different for the participating countries and compensation mechanisms will be needed in order to reach cooperation agreements. Furthermore the reservation of cross-border capacity for balancing should not be static but depending on the whole system's status.

Keywords: balancing markets, regional cooperation, network code electricity balancing