Optimal Price Zones for the German Electricity Market: Effects of Regional Price Signals on Investment Incentives

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Agenda

1. Motivation
2. Model Setup
3. Results
4. Next steps

The introduction of price zones could be a possible solution for recent challenges in the German electricity market.

Initial Situation

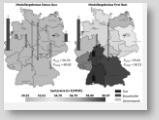
Current Challenges in the German Electricity Market

- Missing / wrong investment incentives in liberalized electricity markets
- No signals for adequate electricity consumption
- Growing share of highly fluctuation renewables

Possible Solution: Price Zones for the German Electricity Market

- ✓ Adequate Investment Incentives
- ✓ Locationally differentiated incentives for flexible consumption

Before the introduction of price zones, several questions need to be answered.

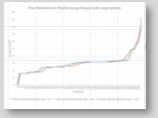


How many price zones do we need?

What is the best partition for a given number?

Which interzonal transmission capacities are optimal?

How will investments in generation capacity change?



What is the impact on prices?

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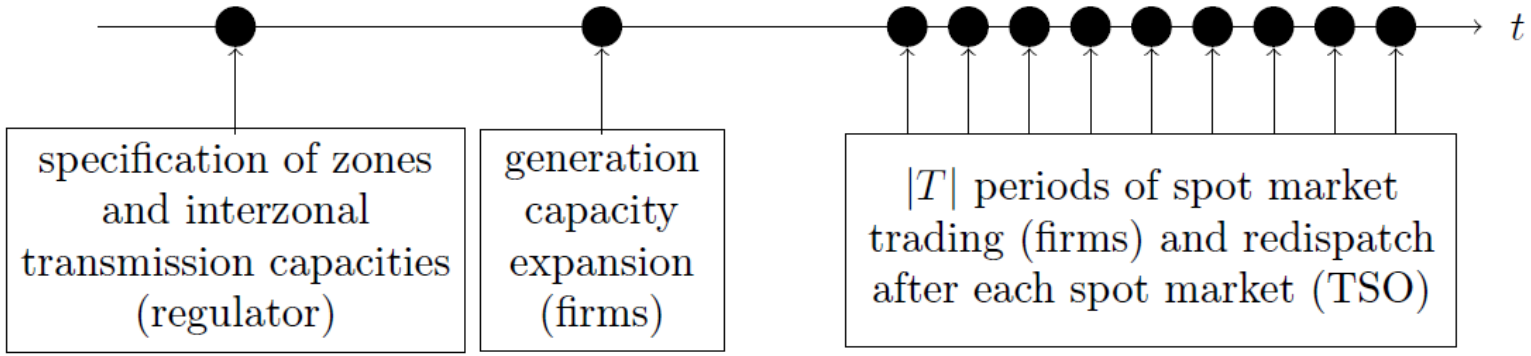
Our model represents the sequence of decisions in the electricity market.



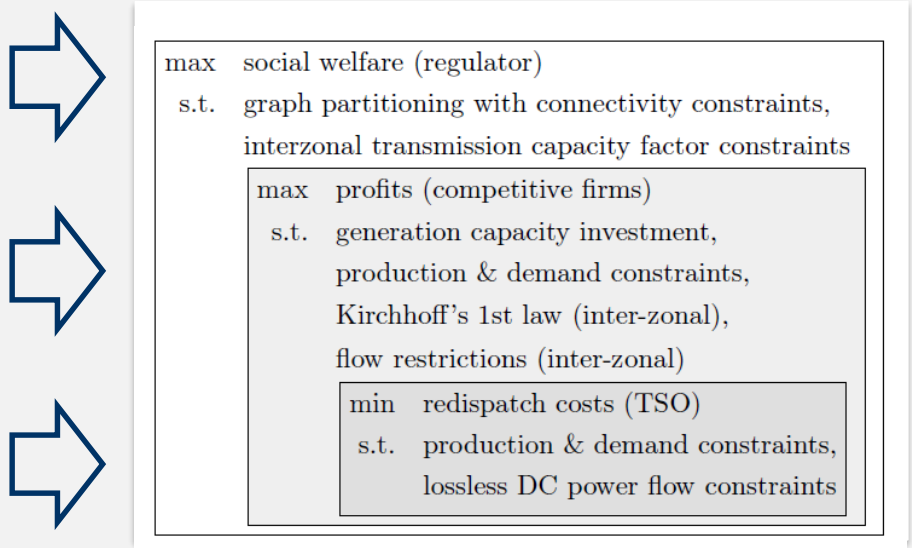
Based on Grimm et al. (2016)

The GATE* model translates the sequence of decisions into a three stage optimization model.

Sequence of decisions of different actors in the market environment

Consideration of physical transmission capacities via DC lossless approach

Inclusion of neighboring countries via export functions



Assumption: No market power to obtain unique equilibria (cf. Zöttl (2010))

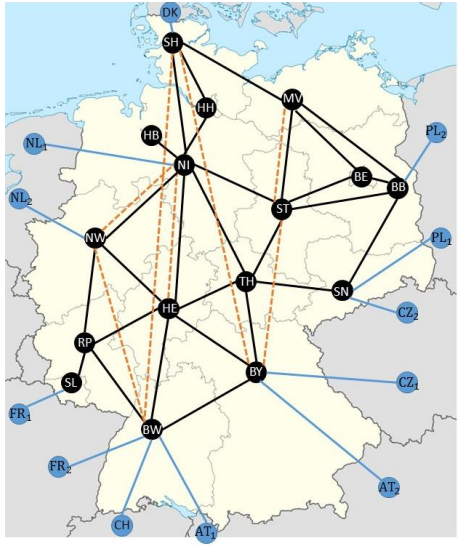
*Generation And Transmission Expansion, see Grimm et al. (2016)

Input data is mainly taken from NEP 2030.

Input Data

- Projection for 2035, with hourly spot market auctions (8760h).
- Hourly demand values for Germany and export/import to neighboring countries from Entso-E.
- Hourly RES feed-in, RES capacities taken from Network Expansion Plan (NEP)
- Production & investment cost of different conventional technologies taken from Konstantin (2013)

Network: Each federal state represented by a node



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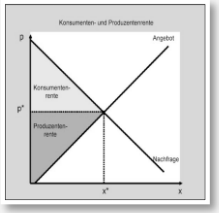
Preliminary results show that a north-south partition is optimal.

Partition

If two price zones are implemented, a north-south division is optimal.

Prices

Prices are higher in the south and lower in the north compared to status quo.



Welfare

Positive impact of price zones on welfare
due to less redispatch and load-shedding

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Next Steps

- Scenario reduction (k-means clustering)
- Test for more than 2 price zones
- Include investment in transmission line expansion

Thank you for your attention!

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Sources

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