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Cross-Border Balancing Cooperation in the Alpine Region: Benefits and Challenges

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Agenda

1. Motivation
2. Setting
3. Model Structure
4. Results
Motivation

- **Balancing capacity/energy** is used by TSOs to **balance the electricity system** when **positive or negative deviations** from the scheduled production or consumption are occurring.

- Increasing share of fluctuating renewable energy sources could lead to an increasing amount of necessary balancing capacity.

- Continuous growth of intermittent share requires further actions as auction timing is limited.

- The new Network Code on Electricity Balancing by the ENTSO-E fosters cross-border exchange of balancing services with the objective to lower overall costs:
  - Harmonization of electricity balancing rules
  - Cooperation by imbalance netting, joint activation and joint reservation of reserves
  - IGCC allows for imbalance netting between German TSOs and different neighboring TSOs

→ We want to quantify the benefits of cooperation on balancing markets.
Setting

- We want to quantify the benefits of cooperation on balancing markets
  - Regarding the influence of balancing services on total system cost
  - Distributional effects of increased international cooperation

- Our case: Cooperation between Austria, Germany, and Switzerland
  - Different generation portfolios (Hydro in AT & CH, fossil in DE)
  - Good interconnection

- Scenario dimensions:
  - Different levels of cooperation
    - No Cooperation
    - Cooperation: Joint procurement of secondary and tertiary reserves with a common merit order list, allowing interconnector reservation to exchange balancing services
  - Anticipation of reserve activation costs
Model Structure

- Cost minimization unit-commitment model with hourly resolution, 53x 168 hours
- Block sharp representation of power plant portfolios
- NTC transmission constraints between AT, CH, DE
- Fixed import and exports for other neighboring countries’ cross border interaction
- Two-step model: 1) reservation and 2) reserve activation
- Optional: Anticipating the cost of activated reserve volumes

RESERVATION
Spot market: Cost minimal generation and reservation
-Generation schedule
-Reserve Commitment
Pre-solve:
-Storage boundaries

ACTIVATION
Real-time market: Cost minimal activation of reserves

Input:
-Demand (spot/reserve)
-PP characteristics
-RES
Optional:
-Imbalance probability

Input:
-Realized Imbalances

Input:
-Demand (spot/reserve)
-PP characteristics
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Optional:
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Positive Secondary Control Calls in Germany 2013

![Graph showing Call Frequency vs MW with Observed and Block Approximation lines.](image-url)
Results

- Preliminary results:
  - Four exemplary weeks
  - No consideration of scenarios with anticipation of activation cost

- Full Cooperation leads to cost reductions of **35%** on the balancing capacity market
- Strong shift of reservation to Austria and Switzerland from Germany

![Graph showing change in reservation between No Cooperation and Full Cooperation. The graph includes bars for SRL POS, SRL NEG, TRL POS, TRL NEG, with labels for AT, CH, and DE.]
Results: Positive Secondary Reserve – No Cooperation
Results: Positive Secondary Reserve – Full Cooperation

The chart illustrates the energy distribution across countries in the Alpine region, with separate sections for Austria (AT), Switzerland (CH), and Germany (DE). The vertical axis represents MW (megawatts) of energy production, while the horizontal axis lists years from 2008 to 2012. The diagram uses different colors to denote water, gas, and coal resources.

Key observations:
- Positive secondary reserve is noted with full cooperation among countries.
- The data shows significant variations in energy production across the years.
- The chart indicates a need for balanced cooperation across the region to optimize energy resources.
Results: Spot market exchanges – Full Cooperation
Results: Dispatch Germany
Conclusion

• Cross-border exchanges of balancing capacity leads to significant cost reductions

• Cost reductions are dependent on the generation portfolios of the participating countries

• Austria and Switzerland seem to be able to provide relatively cheap balancing capacity

• Assumptions regarding future market design are crucial
  • Bidding periods for SRL/TRL
  • Interconnector reservation

• Hypothesis: Cross-border exchanges are only beneficial with flexible interconnector reservation

Thank You for Your Attention!

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