

Study Committee C5 Electricity Markets And Regulation

Paper ID_10601

DEVELOPMENT OF MARKET MONITORING SYSTEM WITH REGARD OF UNEXPECTED MARKET DISTURBANCES

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Motivation

Proper functioning of an electricity market monitoring system is necessary since it ensures transparency and reliability of the information about electricity market dynamics for market participants, authorities and regulators especially when unexpected market disturbances occur (weather anomalies, social upheavals, COVID-19, impact of economic contour).



vs



Real-life markets are oligopolistic
 $\frac{\text{market price}^{\text{oligopoly}}}{\text{market price}^{\text{competition}}} \sim \frac{\text{max market share}}{\text{demand elasticity}}$

→ risk of price fluctuations because of manipulative strategies and market power abuse.

Even with a low concentration ratio in a market equilibrium prices can rise up to the highest values and deviate from competitive prices significantly.

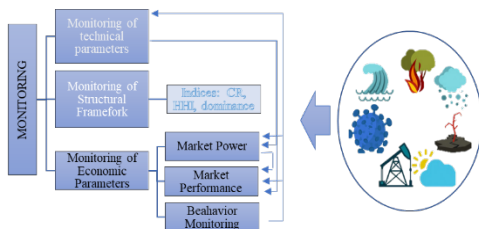
→ Importance of market monitoring system development

Objects of investigation

- Multi-nodal electricity market
 - 2 price zones, 90 generating companies and 240 energy consumers,
 - marginal nodal pricing
- > 10 000 nodes, > 2 600 generating units, ~ 100 GW load, > 15 000 lines, > 1 300 power flow constraints in groups of lines



Market Monitoring Framework

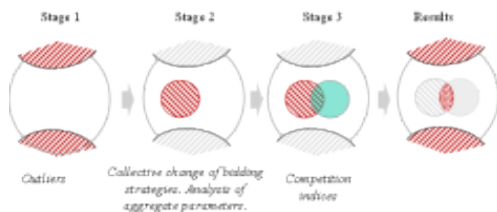


Method/Approach

The following methods were used for the Market Monitoring System development:

- Economic theory for justification,
- Game-theoretical approach for justification,
- Statistical analysis of real market outcomes and bidding strategies,
- Benchmarking,
- Screening thresholds,
- Authors' indices (adjusted Residual Supply Index and new Parameters Dependent Index),
- Congestion analysis,
- Load factor analysis.

Stages of the Market Monitoring System



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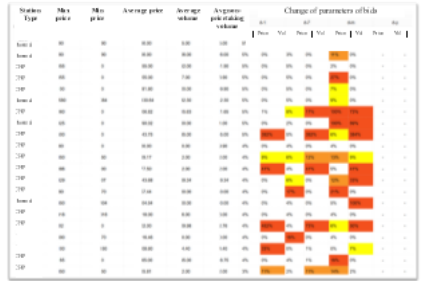
DEVELOPMENT OF MARKET MONITORING SYSTEM WITH REGARD OF UNEXPECTED MARKET DISTURBANCES continued

The FIRST stage – Operational Monitoring

Detects obvious changes in bidding strategies, for example, significant price rise in producers' offers.

- For less notable differences of bids parameters, behavior of a participant may be ignored.
- Risk of spending excessive efforts on the analysis of justified changes in the participants' parameters.

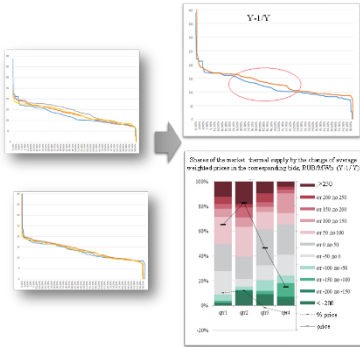
→ At the first stage we detect outliers or monitor the behavior of a predefined list of participants.



The SECOND stage – Analysis of collective behavior and aggregated market performance

- The consequences of unexpected disturbances are not necessarily immediate.
- Market participants later reaction (capacity withholding, risk premium) may become a collective strategy that seems to be a normal trend.

→ Sort and midterm analysis: statistical methods on the market data to identify patterns that signal a significant and systematic participants' behavior change.

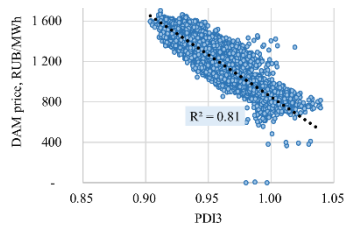
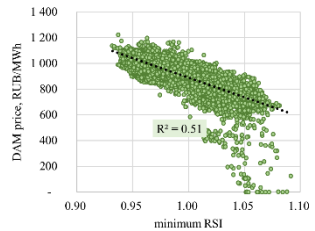
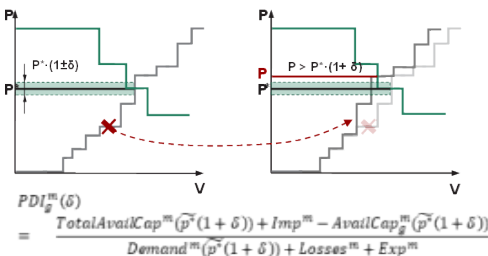


The THIRD stage – Assessment of the state of competition

- Based on statistical analysis, a list of indicators is determined to reflect adequately the state of competition in the market and the competitive positions of individual participants.

- The values of the indices and the dynamics are monitored.

$$RSI_g^m = \frac{\text{TotalAvailCap}^m + \text{Imp}^m - \text{OperatingRange}_g^m}{\text{Demand}^m + \text{Losses}^m + \text{Exp}^m + \text{OperRes}^m}$$



Conclusion

The Market Monitoring System:

- combines a **short-term** (the first stage) and **mid-term** (the second and the third stages) monitoring for market with nodal pricing;
- was **designed and tested** with and in response to **natural, weather, economic, social, and epidemiological** shocks;
- allows to **simplify** monitoring by using **aggregate approach**, analysis of the market **performance indices** and the corresponding methodology:
 - **reduces** analysis that leads to **false-positive** and **false-negative** results,
 - **identifies significant and systemic** changes in the behavior of participants.