WEBINAR

How to make Power Markets ready for the future?

04.04.2023

All over the world, power markets have been put in the spotlight. Despite a substantial correction, electricity prices remain high and volatile. In reaction, policymakers are questioning current market structures. This is especially true in Europe, where the European Commission has launched a review of the market design intending to reduce price volatility and make power markets more resilient.

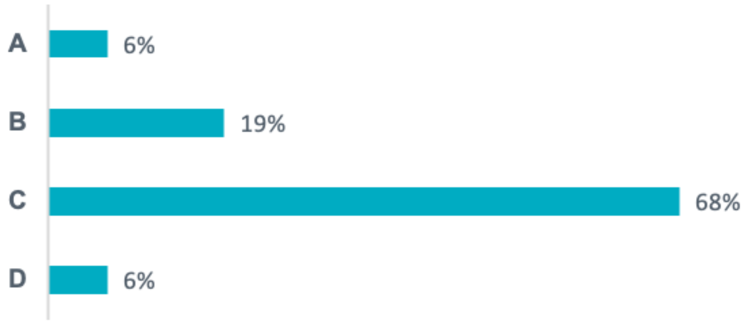
At N-SIDE, we help system operators, power exchanges, and market participants navigate challenges like those we're currently facing.

With all eyes on power markets, we decided to launch a webinar series to educate our community on the dynamics at play.

In the first webinar, we introduced the fundamental concepts behind power market auctions, while the second one focused on practical aspects, such as the inputs and outputs of market clearing algorithms, like EUPHEMIA[1]. In the third and final webinar of this series, we take a step back and look into the future. We explore how the energy landscape is evolving and how power markets can be future-proofed.

POLL #1 To what extent will short-term wholesale power markets change as we progress toward carbon neutrality?

A. They will be phased out and replaced by different types of mechanisms/instruments.
B. They will remain in place, but their design will change fundamentally.
C. They will evolve, but their fundamental design elements will stay the same.
D. They are here to stay, with no changes.



[1] The EUPHEMIA algorithm is the property of the Power Exchanges in the Price Coupling of Regions (PCR) project.

Three key takeaways

1 Moving to a finer market time unit is feasible, but attention must be paid to market design and algorithm performance

Intermittent energy sources, such as renewable energy, often have a less constant generation profile compared to traditional generation sources. This variability can lead to a potential mismatch between the traded volume and the actual delivery of energy. One possible solution to mitigate this issue is to reduce the trading granularity to a finer market time unit (MTU), for example from 60 minutes to 15 minutes. By doing so, it can facilitate the integration of renewable energy sources into the grid and improve overall energy market efficiency.

The transition to a finer market time unit comes with challenges. We focus on two areas that are particularly relevant for a market clearing Algorithm:

- Market Design, where we provide a non-trivial example, related to pricing rules when multiple time units are allowed in the same market.
- Algorithm performance, where we explain that complexity is usually exponential, and we provide four potential routes for improving the performance of a market clearing algorithm.

N-SIDE contributed to addressing such challenges for the implementation of the 15' MTU for the European Single Day-Ahead Coupling.

4 routes for performance improvements

Scalable bidding products	Some bidding products **suffer much less from scalability issues**. This is the case for the **Scalable Complex Order** (SCO) recently introduced in Euphemia
Smarter math modelling	**Some parts of the math model can scale poorly**. Reworking them can significantly help
Algorithm fine-tuning	As an **example**, recall the **Branch&Bound method** presented during Webinar 2. It may be beneficial to adapt the exploration of the tree, for instance via a more aggressive branching
Increase available resources	This may consist in • Using **more powerful machines** • Distributing the computation over **several machines** • **Increasing the time** allocated to the market clearing calculation

2 As complexity and price volatility increase, the value of co-optimization across scarce resources becomes clearer

In absence of co-optimization, market participants need to blind guess where other parties will bid and estimate what the opportunity cost across different markets (e.g. day ahead auction and reserves) is. In contrast, the co-optimization process automatically determines whether an asset is best utilized by providing energy and/or balancing services, based on what would provide the most system value.

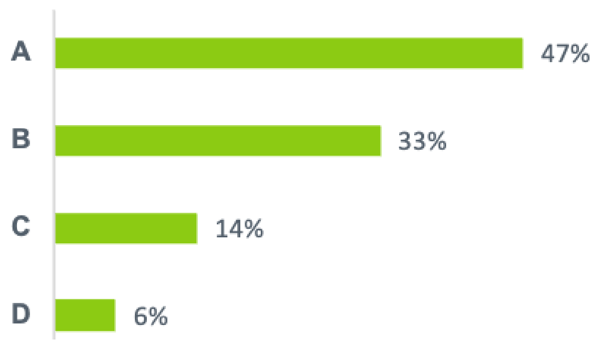
In doing so, co-optimization limits the errors involved in forecasting the opportunity cost, as well as the risk of having an oversupplied market while other markets are left under-supplied. In turn, this improves investment signals, by revealing more accurately and transparently the value of the different services.

Network capacity can also be part of the co-optimization process, with its granularity depending on the underlying market design (e.g. zonal, nodal). Finally, dispatch can also be considered, with the enforcement of network requirements in the clearing process, to ensure that the network can support any reserve activation pattern.

POLL #2

Which of the benefits of co-optimization do you consider the most important?

A. Reduces balancing costs through more efficient allocation of resources
B. Facilitates the splitting of an asset's capacity across different services
C. Enables the buyer (e.g.TSO) to substitute a type of reserve for another, where cost-efficient
D. I'm not convinced that co-optimization can deliver material benefits.



3 Bridging the gap between physics and markets through greater grid representation and bid expressiveness.

We recall the main inputs of a market clearing algorithm: Market data and Network data.

On the network data, it is often needed to find a trade-off between the accuracy of the grid representation and the complexity it adds to the power-matching algorithm.

A similar trade-off needs to be found in the market data, between the bids' expressiveness and the algorithm complexity.

In this webinar, we present two ideas that could bridge further the gap between physics into the markets:

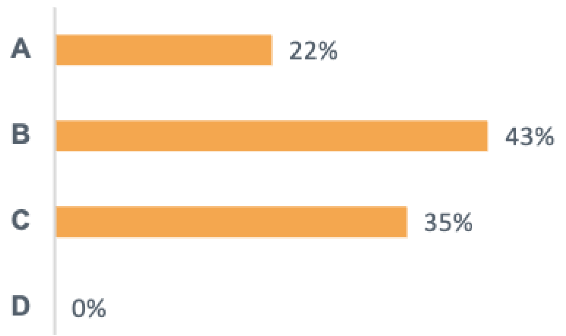
- **Market-based topology decisions.** Some transmission capacity decisions (e.g. PST and HVDC setpoints) could be made by the clearing algorithm based on actual market conditions, rather than based on assumptions made ex-ante. This idea was recently introduced by ENTSO-E in a discussion paper on options for the design of European Markets in 2030

- **Storage orders.** Today's European day-ahead market already exhibits a good level of bid expressiveness. However, some technologies such as large-scale batteries may still lack the right bidding product to accurately reflect their flexibility capabilities and requirements. Storage orders could be an interesting new bidding product, enabling storage technologies to arbitrage between periods and reducing price differences across the day and thus peak prices. The bidding product could include features such as the charging/discharging speed, the charging/discharging efficiency, and the initial/final charging level.

POLL #3

Where should the focus be for bridging the gap between Physics and Markets?

A. Bid expressiveness (e.g. storage)
B. Grid representation
C. Finer Market Time Unit
D. Elsewhere (please use the chat to specify)



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