

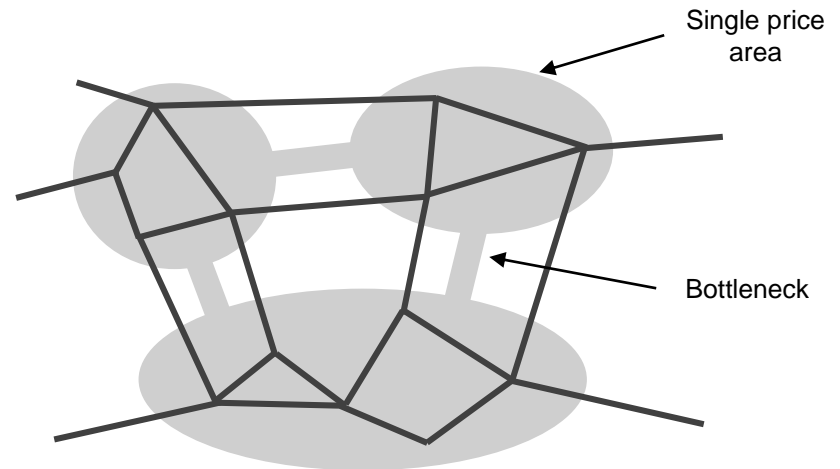
Nodal Pricing in the EU: the PX perspective

20 November 2019, Paris
Dauphine

Zonal and Nodal market designs

Two different market designs

The **nodal** and **zonal** market designs differ in how they model and address the physical constraints of the grids. This leads to very different market paradigms in terms of grid operations, market algorithms, price signals and distribution of responsibilities.



| Nodal market design (US) | | Zonal market design (Europe) |
|---|--|---|
| Congestion management and market clearing | <ul style="list-style-type: none"> → Market clearing with implicit allocation of available transmission capacity between transmission nodes → 1 LMP per transmission node | <ul style="list-style-type: none"> → Market clearing with implicit allocation of available transmission capacity between price areas → 1 wholesale energy MCP per bidding area/zone → Occurrence of intra-zonal congestions, requiring topological changes or redispatch |
| Operations | Independent System Operator [ISO] | Transmission System Operators [TSOs] Spot Power Exchanges |
| Market participants perspective | <ul style="list-style-type: none"> • Central dispatch algorithm • Unit-based logic | <ul style="list-style-type: none"> • Self dispatch market • Portfolio-based zonal balancing responsibility |

Challenges in congestion-management



Source: EPEX SPOT

Cross-zonal congestions implicitly considered in the pan-European market coupling



Source: RWTH Aachen study, 2018

Intra-zonal congestions slowly appearing in Europe with increasing costs

Nodal is optimal, in theory...

• **Nodal** : best theoretical solution for short-term market-based dispatch \neq **optimal dispatch!**

- **Nodal pricing:** energy prices reflect transmission constraints. The price equals the marginal value of energy at each time and location. LMPs send price signals to support the real-time dispatch respecting transmission constraints.
- Central dispatch Vs Self-dispatch
- Non-convexities lead to large side-payments
- Network flexibility/topology
- Impact of intermittency on the day-ahead nodal dispatch optimality
- Integration of storage/dynamic intertemporal constraints,
- Computational tractability taking into account T&D nodes/constraints

Implementation complexity

- **Technical complexity:** Probably manageable (working solutions exist, e.g. US) but a lot of work to adapt systems, processes, rules, ...
- **Regulatory complexity:** Need to change EU power market regulation and rethink the EU model
- **Political complexity** (Redistribution effects, post-stamp tariffs, etc...)
 - >> High transition costs
- **Institutional complexity/Governance:** the ISO model
- Nodal pricing can take 10+ years to implement, we don't have that much time...
- And zone splitting is at best a partial solution as constraints change over time

In addition to expanded grid, how can we make T&D congestion management work as best it can?

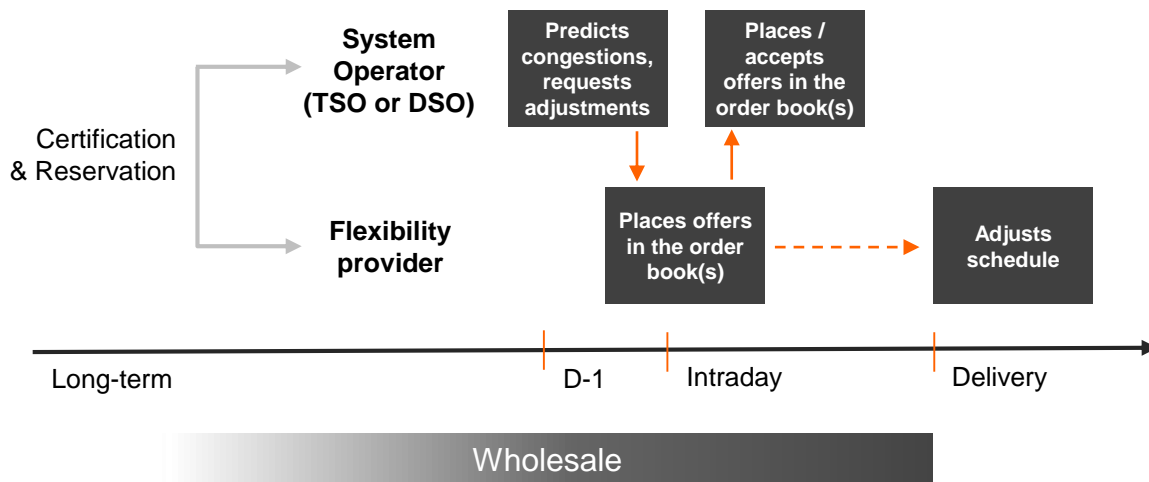
The Local Flexibility market concept

How can we introduce a locational/nodal+asset granularity into a zonal market to address internal congestions and involve new decentralized flexible resources?

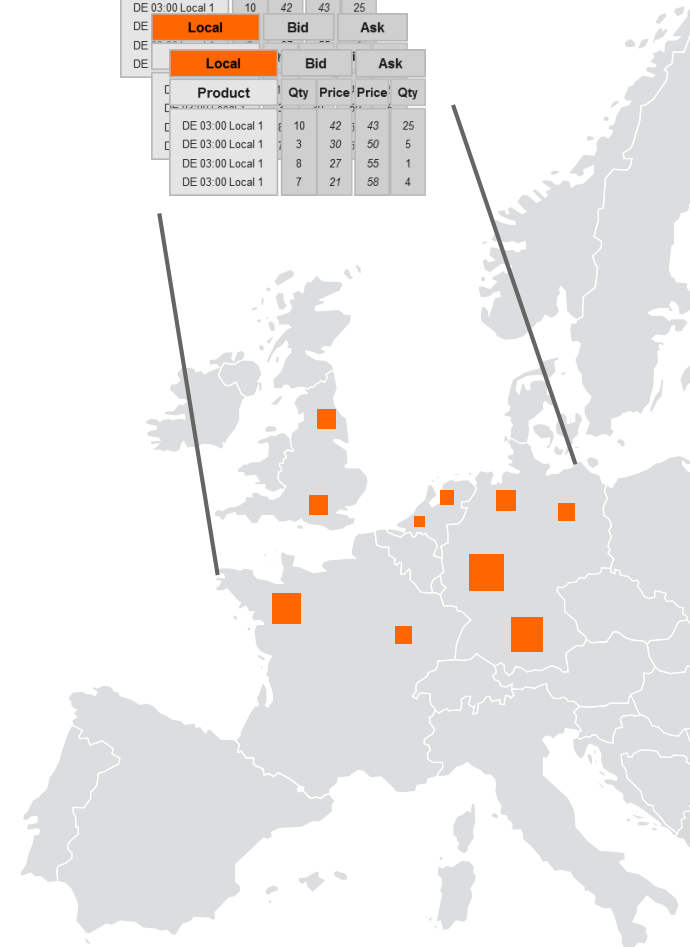
Implementation of a complementary market mechanism to:

- **Efficiently centralize** localized flexibility potentials **where and when needed**
- Facilitate grid-oriented **T&D coordination and optimization**
- Foster the **development of new decentralized flexibility sources**

And therefore **improve the intra-zonal congestion-management process and security of supply.**



| Local | Bid | Ask | | |
|------------------|-----|-------|-------|-----|
| Product | Qty | Price | Price | Qty |
| DE 03:00 Local 1 | 10 | 42 | 43 | 25 |
| DE 03:00 Local 1 | 3 | 30 | 50 | 5 |
| DE 03:00 Local 1 | 8 | 27 | 55 | 1 |
| DE 03:00 Local 1 | 7 | 21 | 58 | 4 |



The enera local flexibility market activity is increasing

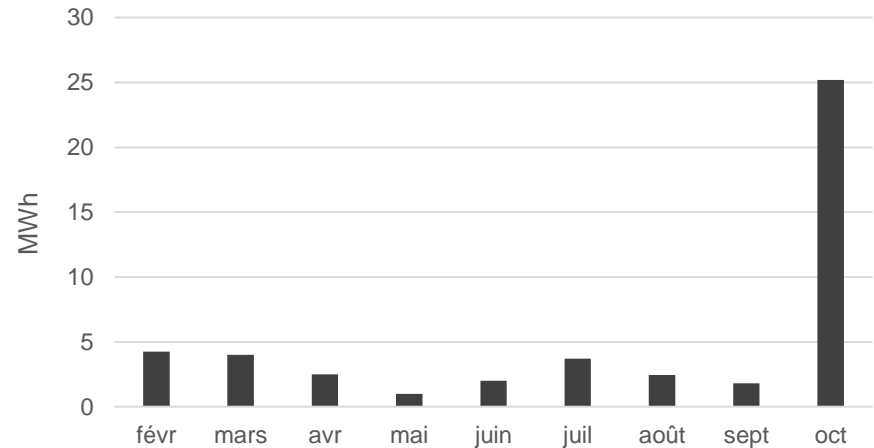
Since Go-Live

- 23 Local market areas
- 9 market participants
 - 6 Flexibility Providers
 - 3 System Operators
- 3000 orders
- 70 transactions

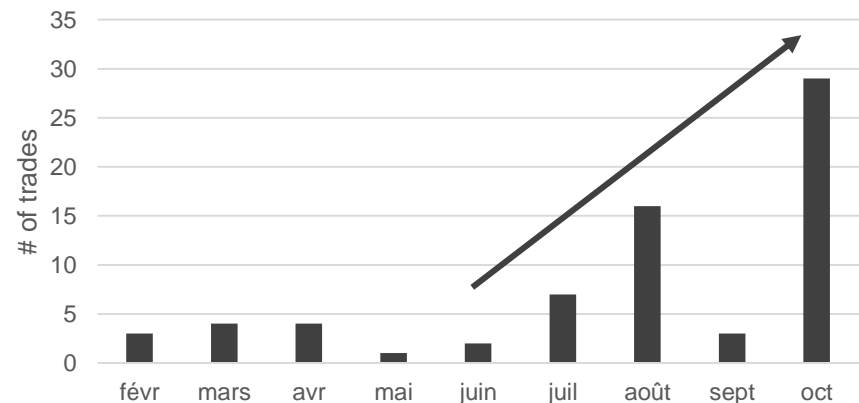
Recent developments

- Increase to 23 market areas
- Activity from the 3 system operators:
 - TenneT: testing
 - Avacon: testing → real congestions
 - EWE Netz → real congestions
- Increase in # of transaction and volumes

Total activated volume in the enera market



Number of transactions in the enera market



Gaming is not a reason to justify the status-quo

Current regulated compensation mechanisms limit gaming but cannot foster development of flexibility. Flexibility is offered not as an opportunity to provide a valuable service, but as a regulatory obligation. This limits the offering and development of flexibility.

- Market-based mechanisms in hybrid zonal-nodal markets are prone to Inc/Dec gaming and/or local market power with structural congestions.

Mitigation strategy:

- Hybrid of market-based and cost-based. Cost-based backstop assures SOs will have enough flexibility to manage the system at reasonable cost. Market-based expands set of participants offering flexibility: more options for SOs to manage constraints.
- Voluntary and complementary with green/red traffic light
- Transparency of price, volume, location, activations,...
- Verifications (baseline that varies with congestion?) and focus on the assets that can Inc/Dec...
- Bid caps can be implemented and a closer link between DAM /Local Flex
- Longer-term contracting/hedging tools: flexibility reservations (MW/h)
- Regulation and monitoring/surveillance with sanctions in case of gaming

Despite imperfect mitigation approaches, market-based redispatch is the second-best solution at hand. Integration of demand-side flexibility is a necessity and cannot be achieved in a cost-based regime.

Thank you for your attention!