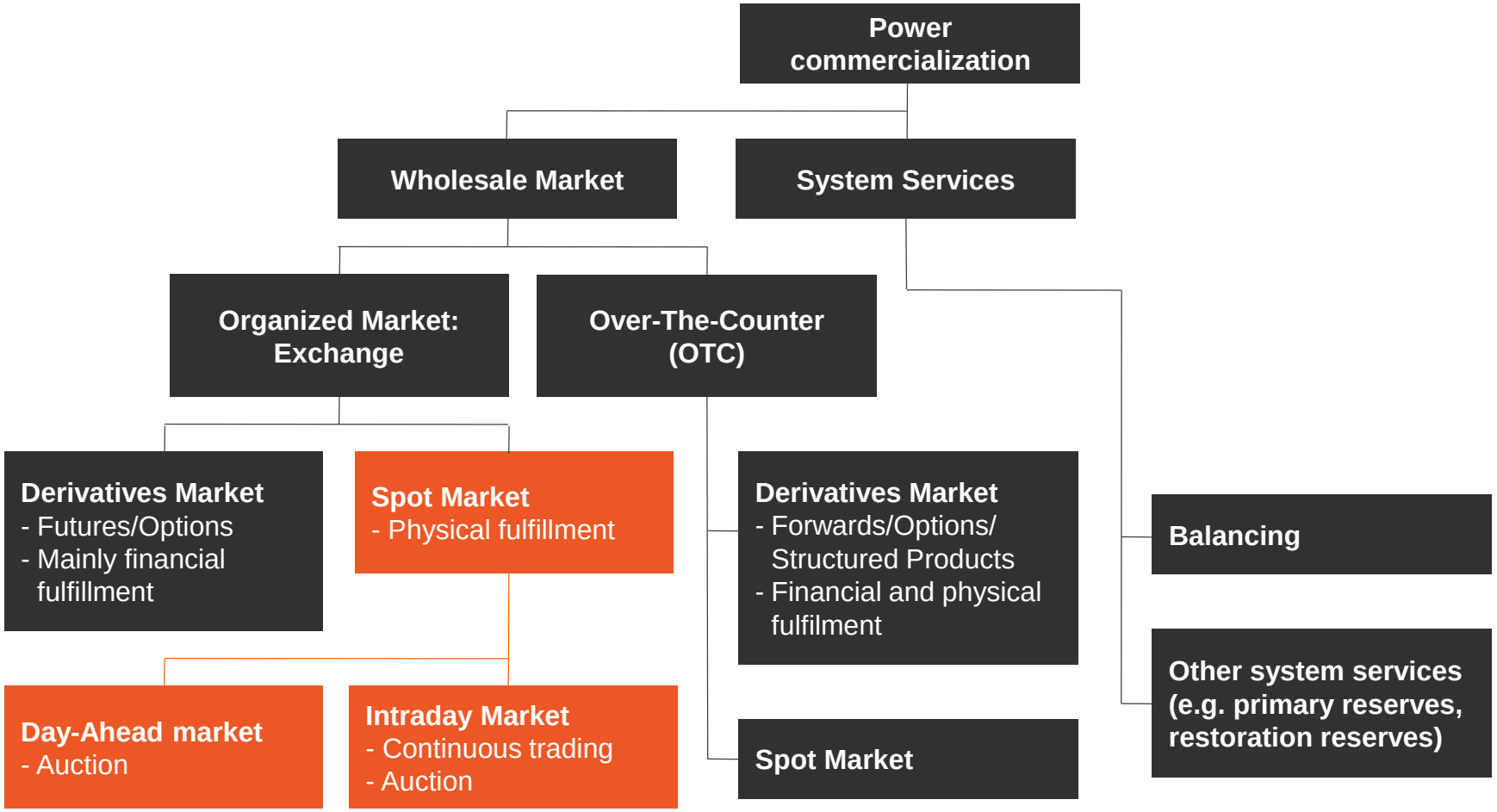
# Beyond the Status-quo

Local Flexibility Platforms: Which Design and Governance to Support an Efficient Interface with National and European Markets?

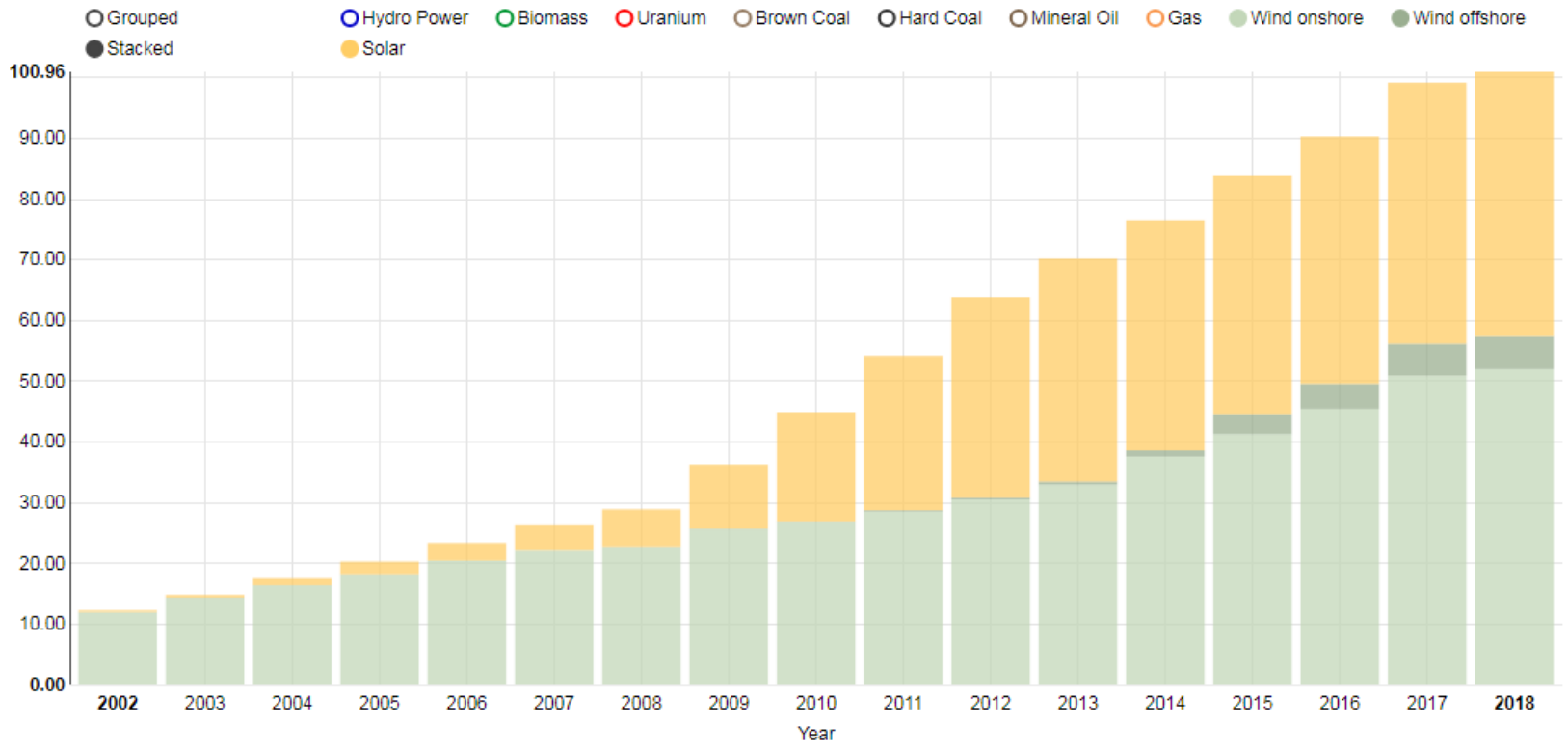
Dauphine, 29th of May 2019

# Ways of commercializing power on the European market



# Skyrocketing intermittent RES installed capacity in Germany and other European countries

**Installed RES capacity (GW) in Germany (2002 – 2018)**

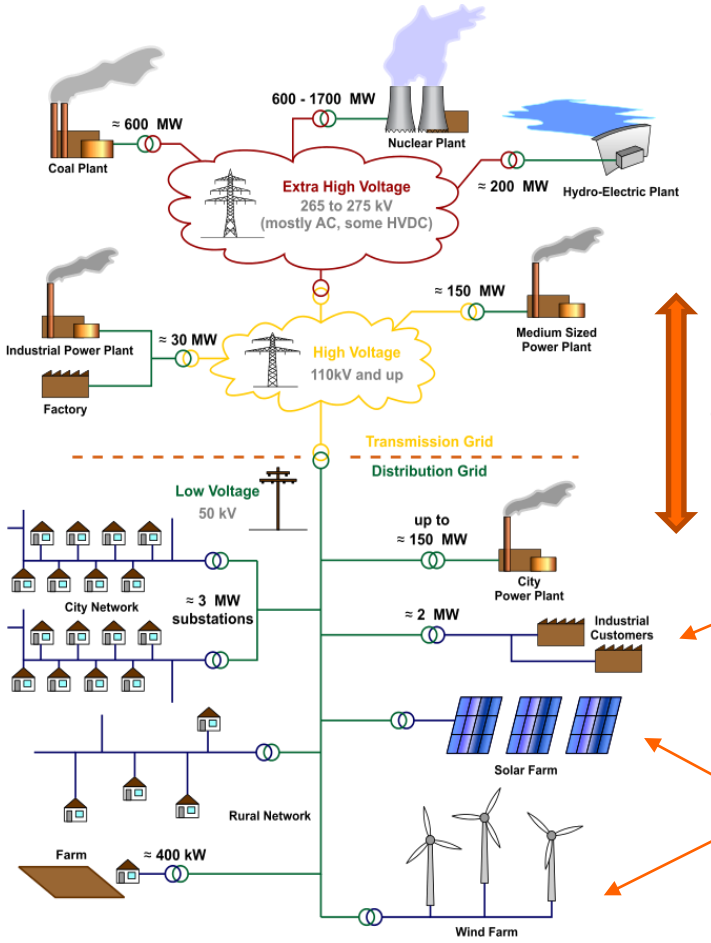



Datasource: AGEE, BMWi, Bundesnetzagentur
Last update: 02 May 2018 21:38

# Decentralization creates a need for vertical coordination

**Transmission grid**
➔ Management of large-scale flexibility

**Distribution grid**
➔ Decentralization towards digitalized, active system management and usage of flexibility




**Coordination between TSOs**

**Coordination across voltage levels TSO-DSO**

**Demand response**

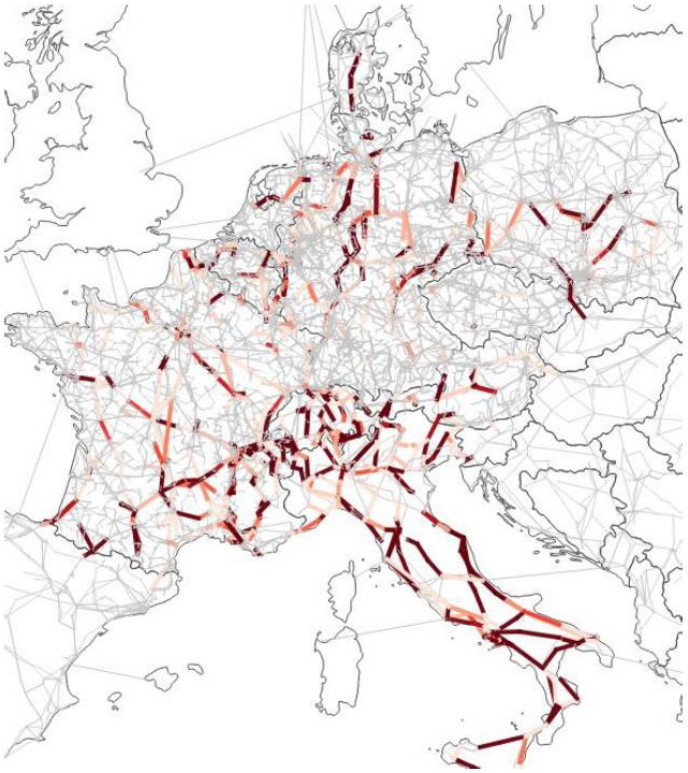
**Battery storage, IoT, smart metering…**

**Intermittent renewables**

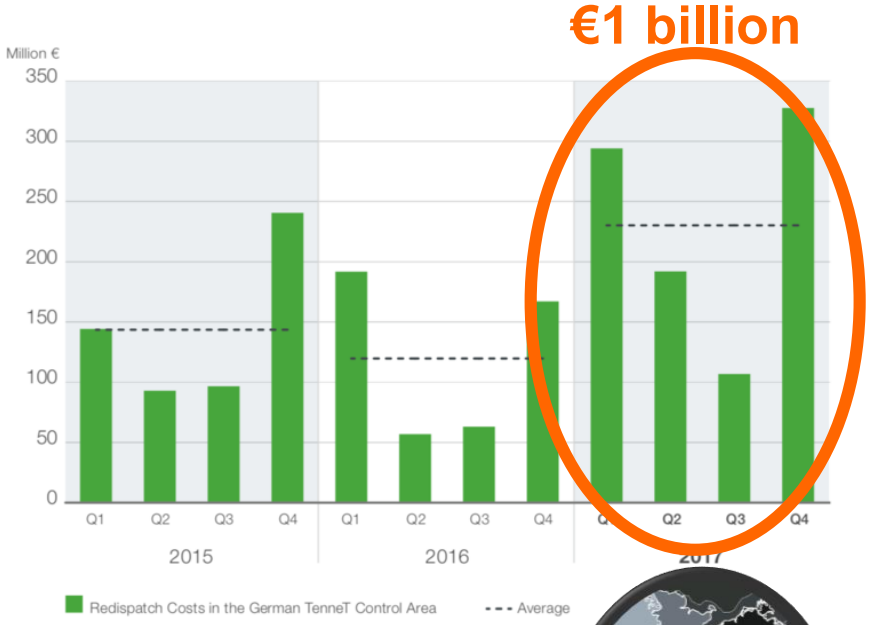
**Important questions:**
- How to foster the coordination between voltage levels?
- What new role for the DSOs?

# Congestions are slowly appearing in Europe

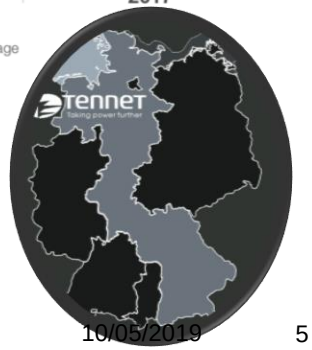
Study on congestion run by the RWTH Aachen University in 2018



Redispatch costs in the TenneT control area, spreading from the North-West to the South-East of Germany, between 2015 and 2017




*Source: ENTSO-E Transparency platform*

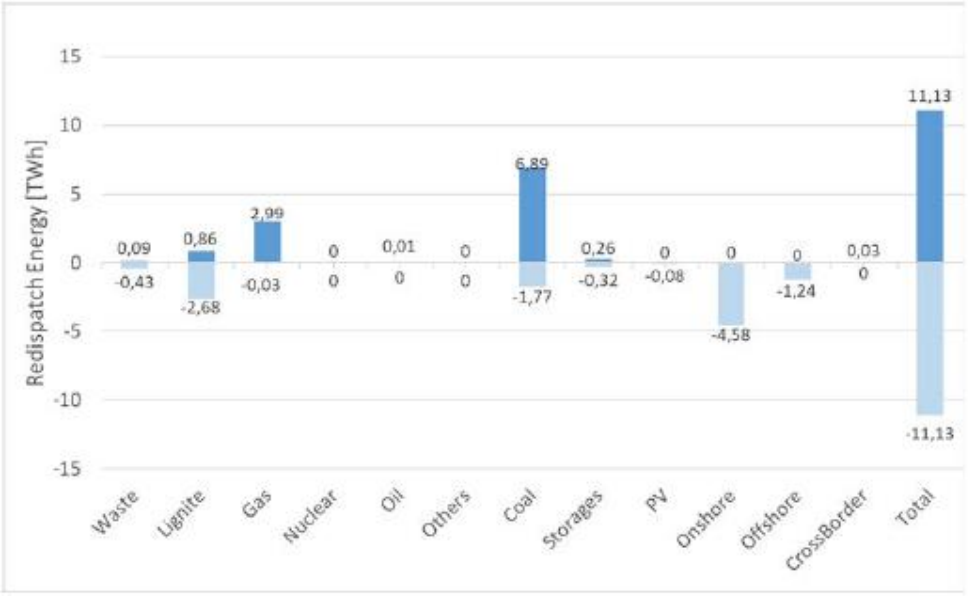


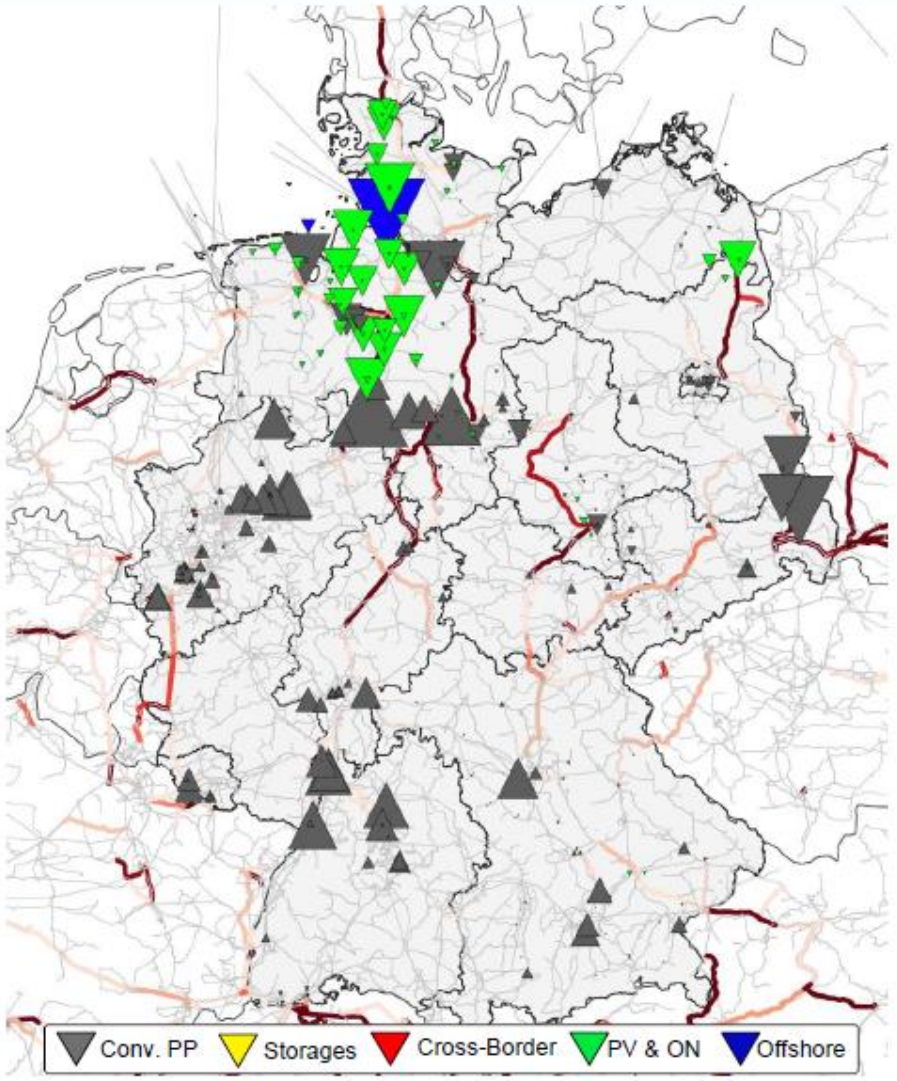
# Results – Scenario 2018

## Base Case (Dynamic Line Rating TSO 18)

### Annual redispatch energy (n-1)

- Overall redispatch volume of 22,3 TWh
- Curtailment of 5,9 TWh in RES generation in the northern area with an onshore share of 78 %
- Reduction of lignite and hard coal in Lusatia
- Increased use of lignite and hard coal in the load centres in the Rhine-Rhur region and southern Germany

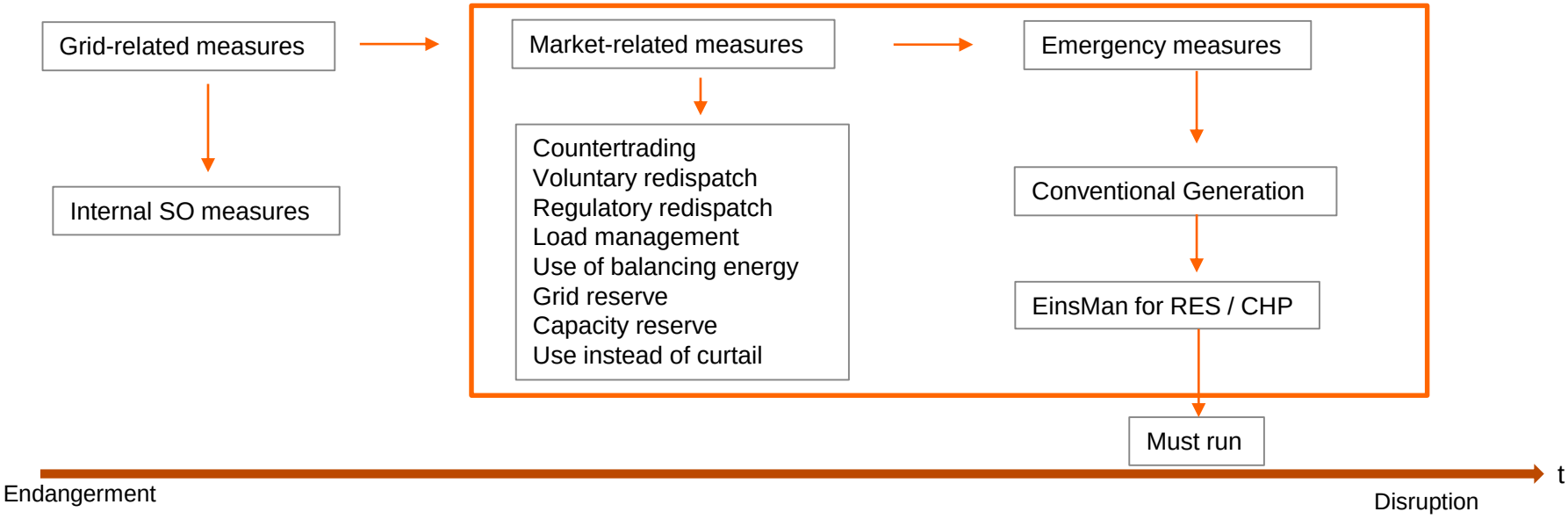


# Current German congestion management process

- The legal toolbox of SOs to avoid or eliminate network bottlenecks is extensive, but complex and cost-intensive. Redispatch is in general conducted as a regulated and cost-based mechanism, the two most prominently used processes are depicted in the table below
- The instruments address the generation and/or consumption side, whereby the SOs are bound by the sequence of measures as stated in the law and priority feed-in for RES

| Name | Minimum size | Legal basis | Type of instrument | Procurement | Incentive | Action time |
|---|---|---|---|---|---|---|
| Regulated redispatch | 10 MW | § 13a EnWG | Obligatory, but assigned to market-based measures | Direct access by SO | Appropriate renumeration of interventions | Intraday timeframe |
| Curtailment of RES (EinsMan) | 100 kW | § 13 Abs. 2 EnWG | Obligatory | Direct access by SO | Compensation of costs | Real-time |



# The regulatory framework to come: EU vs. Germany

## EU: Redispatch and the role of SOs in the Clean Energy Package, adopted Q1 2019

- Curtailment and redispatch to be done via market-based principles, but **derogations allowed…**
  - If there is no market-based flexibility
  - If all market-based flexibility is used
  - If congestions are structural and strategic bidding behavior might prevail
- Creation of new EU DSO entity by mid or end 2020. Obligation for TSOs and DSOs to cooperate. Member States must incentivize DSOs to procure flexibility
- TSOs and DSOs are not allowed to own, develop, manage or operate energy storage. Derogations can be granted by National Regulatory Authorities under certain conditions

## Germany: reform of redispatch procedure in Grid Extension Acceleration Act (NABEG)

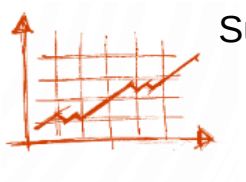
The Recasted Grid Extension Acceleration Act (“Netzausbaubeschleunigungsgesetz”/NABEG 2.0) simplifies grid extension procedures and introduces additional measures for efficient network use.

**Harmonisation of the redispatch procedure as of 01 October 2021**

- Redispatch process is harmonized with regard to cost recovery and technical conditions for power plants: conventional power plants, renewable power plants (RES) and combined heat-and-power power plants (CHP)
- System Operators (SOs) can use **smaller conventional power plants** for redispatch (nominal power higher than 100 kW, previous cap was 10 MW)
- SOs can **use RES and CHP power plants for redispatch** if most cost-efficient and not only for grid emergency measures (as previously in *Einspeisemanagement* (EinsMan))
- In case of curtailment, **RES power plants are balanced by SOs** and do not need to balance themselves anymore, as currently done under EinsMan. TSOs are in charge of balancing the RES power plant, even if curtailment occurs in DSO’s grid

# Roles on the local flexibility market

## Certified Flexibility Providers



Submit flex offers

## Flexibility Marketplace

Procure flexibility

## System Operators

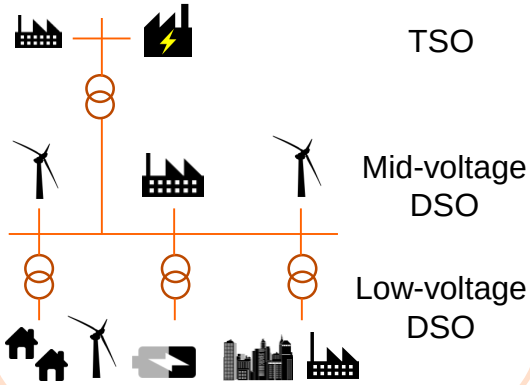
**Flexibility offer from:**

- Power plants
- Storage
- Renewables
- Aggregators
- VPPs

**Market platform**
**Standards**
**Transparency**
**Coordination**
**Neutrality**

- Defines market rules and product specifications
- Admits participants on the market
- Operates the markets by matching flexibility offers and demand from SOs continuously
- Monitors the markets

**Flexibility demand from:**

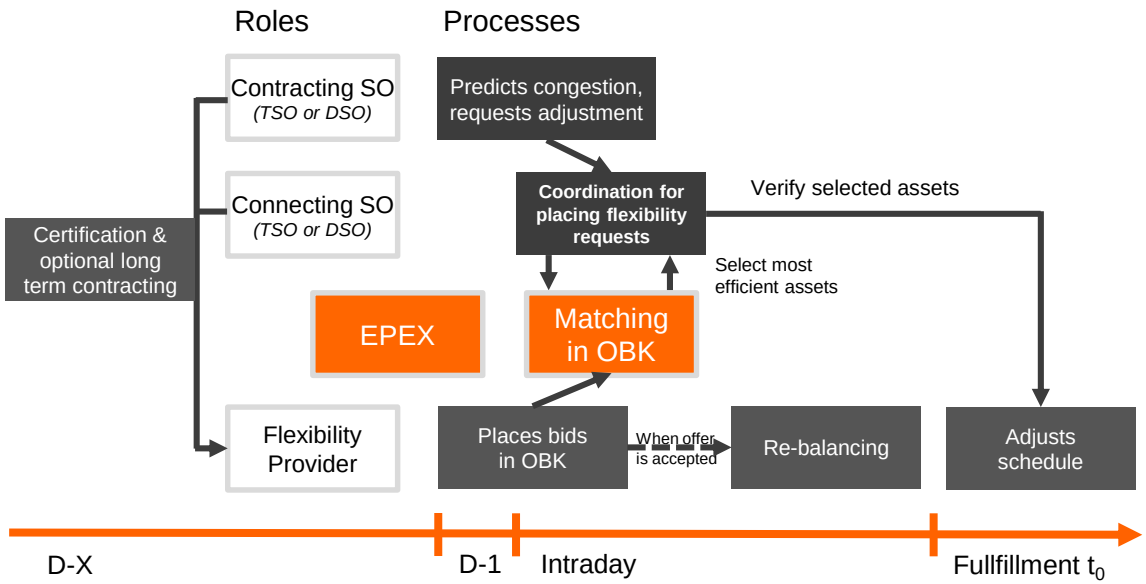


# A complementary marketplace to alleviate congestions and value flexibility

The Flexibility Providers can bid the same asset on both the zonal Intraday market and a locational order book (when certified by the relevant SO for this local market area).

The Local Flexibility Market (LFM) is complementary to the zonal Intraday and the balancing markets.

**New Local Flexibility Markets (congestion management)**




**Existing markets (Intraday and balancing)**

Balancing market

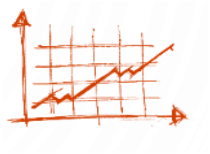
Continuous IDM

# The first local trade in Germany

| TradeID | RemoteTradeID | Exe Time | State | Product | Ctrct | TmZ | Qty | Prc | Cur | P/O | Phase | BOrdrID | BMbr Id | BMbr Name | BTrdr Id | BTrdr Name | Buy Area | BO/C | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | 04.02.2019 15:25:34 | ACTI | Non_RES_Hour_Pow | 17-18_NRES | CET | 2.0 | -45.50 | EUR | O | BALA | 6 | VWKEX | VW Kraftwerk G | TRD002 | JENS MEYERH | SOE_T1 | | P |
| 3 | | 04.02.2019 15:25:41 | ACTI | Non_RES_Hour_Pow | 18-19_NRES | CET | 2.0 | -45.50 | EUR | O | BALA | 7 | VWKEX | VW Kraftwerk G | TRD002 | JENS MEYERH | SOE_T1 | | P |

First trade on enera happened on 04/02/2019 at 15h25 with a contract for delivery on the same day at 17h00-18h00 in the market area SOET1 (Sögel)

**Certified Flexibility Providers**



Submit flex offers

**Audi**

- Disposes of a **Power-to-Gas asset** whose flexibility is marketed
- Sees the flexibility demand at an acceptable price from a system operator in the area where their plant is located
- Submits a matching flexibility offer order via the same interface

**Flexibility Marketplace**

epexspot

**Market platform**
**Standards**
**Transparency**
**Coordination**
**Neutrality**

Procure flexibility

**System Operators**

**EWE NETZ**

- **Forecasts a congestion** in a few hours due to high feed-in and therefore needs downwards flexibility to alleviate it
- Sends a flexibility demand order for 2 MW downward flexibility at – 45.50 €/MWh in the market are SOET1 for delivery from 17h00 to 18h00

**2 MW** have been traded at **-45.50€/MWh**. The orders are matched in the trading system and the transaction is executed. Audi now has the obligation to deliver the flexibility according to the contract specifications. These specifications are part of characteristics of the traded product and have been pre-determined. Based on this trade, Audi will increase their consumption at a given time and at the chosen location. The resulting BRP imbalance has to be closed on the intraday. This localized physical impact allows EWE NETZ to alleviate a congestion before it occurs in a safe and competitive way.

# Enera 1.0

## *which members are participating ?*

- **Already admitted**
  - EWE Netz (SO)
  - EWE Trading (CFP)
  - Volkswagen (CFP)
  - Statkraft (CFP)
  - Baywa Re (CFP)
  - Tennet (SO)
  - Quadra Energy (CFP)
  - Alpiq (CFP)

- **Admission process on going**
  - Avacon (SO)

- + Other 2 other asset owners in the membership process

# There are advantages compared to status-quo

- **Advantages of the enera approach compared to the current redispatch & Einsman procedures:**

- Allowing smaller or new assets to participate (current redispatch limit is 10MW), going closer to the end-consumer engagement (in line with local requirements)
- Giving alternatives to copper in the ground (alternative to delays in grid expansion, deferral of investments
- Putting renewable assets in competition with each other and with traditional assets (redispatch and einsman are currently different independent mechanisms)
- Enabling coordination between System Operators (all SOs can buy flex) with more proactivity
- Add an optimization layer for the activations, based on grid topology
- More efficient than Einsman (economically & operationally)
- Price and activations transparency at a nodal level, emergence of a new economic space,
- Automation and efficiency of trading and CM process, possibility to automate trading (APIs)

# Main criticism towards Market-Based congestion management

## 1. Increase-Decrease-Gaming

- Strong susceptibility to strategic behavior ("Increase-Decrease-Gaming"). If flexibility providers can anticipate bottlenecks sufficiently well, they optimize their position using both the global and the local market (B. Hobbs, 2000)
- As a result, bottleneck volume is increasing and redispatch costs are rising.
- The efficiency of the market price signal and thus also the efficiency of the markets based on it is weakened.
- Market power is not necessary for this behavior, but it further increases the problem.

## 2. Combination with current redispatch regime?

- If there is a flexibility market in addition to existing redispatch mechanisms, network operators will only procure flexibility on the market if it is cheaper there. The price scope for generation-side offers on the flexibility market is therefore likely to be very small. Nobody offers below its costs.
- German regulatory changes in NABEG 2.0 (inclusion of RES and smaller power plants into redispatch) already introduced the benefits to be expected from a flex market.
- Natural price barrier through redispatch does not prevent an inefficient price level from forming below this price barrier.

## 3. Nodal pricing is more efficient

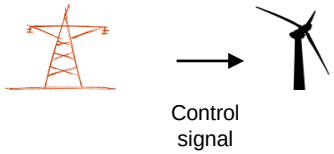
- If locational price signals are needed, the only way to get there is nodal pricing
- “The best out of two worlds” does not work, as market interaction leads to distortion

# Increase-Decrease Gaming

Serious concern that comes with full market-based congestion management, in a structurally congested network

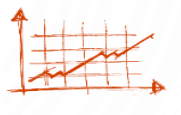
However …

- Status quo of redispatch is no viable solution for decentralization and decarbonization: network stability and mounting redispatch costs as nodal/BZ split is not foreseen
- How do you integrate new distributed flex? How do you account for current redispatch inefficiencies and Einsman complexity/risk?
- Purely cost-based redispatch does not create sufficient incentives for development of new flexibilities such as batteries, demand-side response or power-to-x,…
- Smart market design and real life experience can help to prevent or severely limit gaming & strategic bidding behavior




## The Hybrid solution

Combination of cost-based and market-based mechanisms



- The hybrid solution is combining cost-based & market based elements
- Several mitigation measures can be implemented in order to:
  - Increase transparency and facilitate monitoring (incl. unit-based monitoring)
  - Surveillance from ALL authorities
  - Bidding/price caps
- New market design that provides local signals, opens up scope for flexibility and offers security of supply in a safe and reliable market that limits gaming behavior while grid is being expanded to remove the structural congestion

# Concrete mitigation measures

- **Long-term contracting**: If flexibility is traded day-ahead and not intra-day in a flexibility model, the gaming risk decreases because flexibility providers are less able to anticipate network bottlenecks. However, long-term contracting is also associated with disadvantages. Liquidity may be withdrawn from the market. Network operators are also less able to eliminate bottlenecks in a targeted manner. Here, the advantages and disadvantages must be weighed against each other. However, contracting can also be even more long-term, e.g. through options in the long-term market, which can be activated in the short-term flexibility market.

- **Diversification:** Flexibility models should be diversified. If further flexibility models are contracted in parallel, an Inc/Dec player under these conditions has great uncertainty as to whether the bottleneck triggered by him will also be eliminated by him. Hybrid models can limit Inc-Dec-Gaming.

- **Competition:** The more players offer flexibility, the more transparency there is in the flexibility market and the riskier gaming is for market participants who cannot be sure that they will be called on the flexibility market.

- **Price and bid limits/caps:** Price and bid limits are one way of limiting the damage caused by Inc Dec gaming. It is quite conceivable that technical units may already set an individual price limit when registering on the marketplace.

- **Penalize gaming:** Gaming is currently not subject to anti-competitive sanctions. Nonetheless, a flexibility marketplace could set corresponding market rules in the terms of use which could lead to sanctions in the event of malicious intent. Contractual penalties or a complete exclusion from the marketplace would be possible. The role of regulators in monitoring and penalizing adverse behavior can also be substantial.

- **Use baseline:** By implementing a baseline, necessary to verify physical influence on the bottleneck, an Inc/Dec behaviour could be identified for many asset categories. In contrast to many power plants, which are completely free to choose their operating point, flexibilities such as CHP and Power-to-X plants have a very clear baseline. Pilot projects have shown baselines can identify gaming. Baselines that are unbiased (the baseline should on average be the same regardless of the occurrence of a bottleneck) can help shape market rules that make gaming sanctionable.

# Appendix

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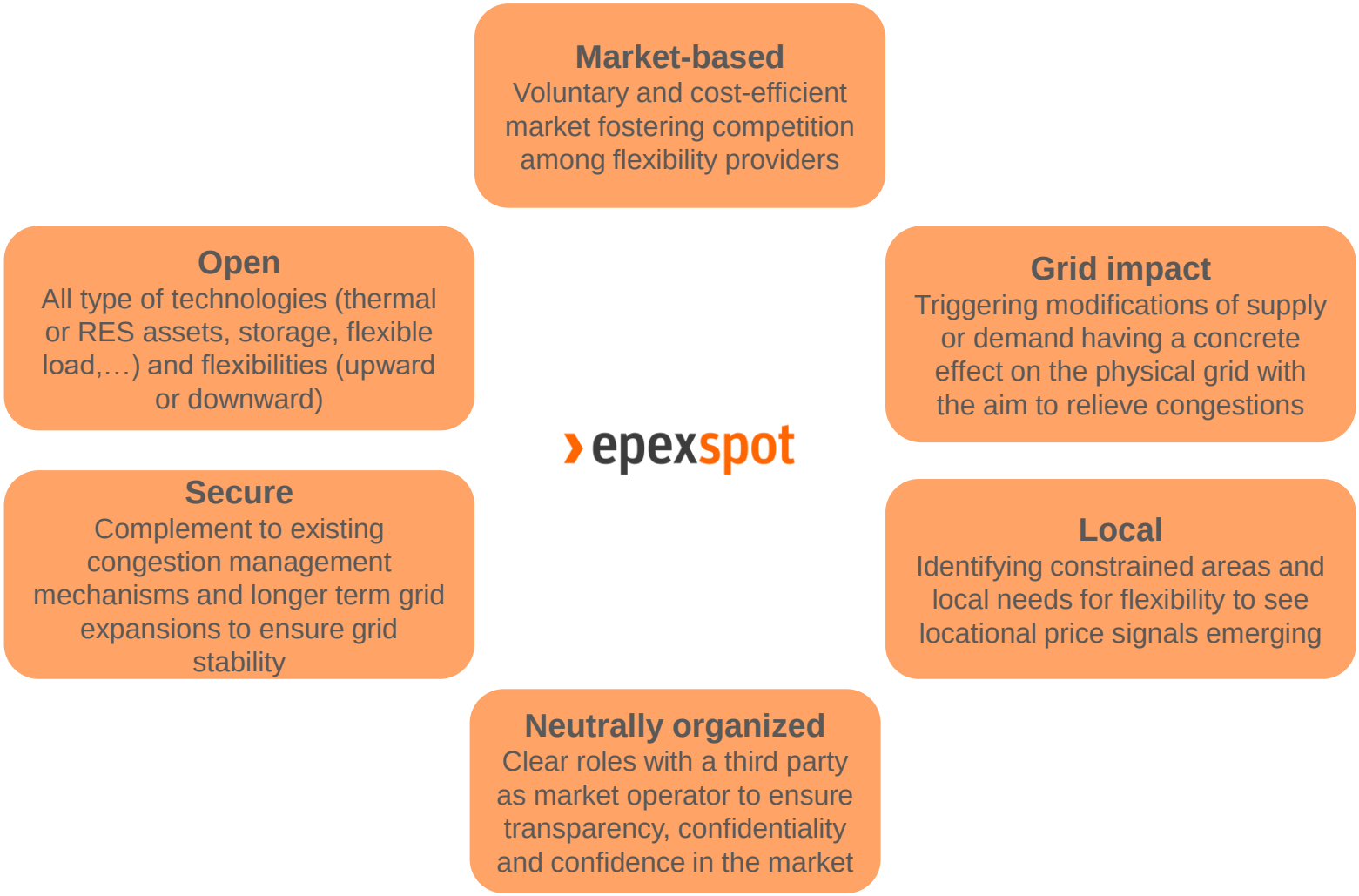
part of eex group

# Main principles for Local Flexibility Markets



# Local order book system

A global market…

| EU XBID \| EPEX | Bid | | Ask | |
|---|---|---|---|---|
| **Product** | **Qty** | **Price** | **Price** | **Qty** |
| DE 03:00 | 10 | *32* | *33* | 25 |
| DE 03:00 | 3 | *31* | *34* | 5 |
| DE 03:00 | 8 | *30* | *35* | 1 |
| DE 03:00 | 7 | *29* | *38* | 4 |

In parallel with…

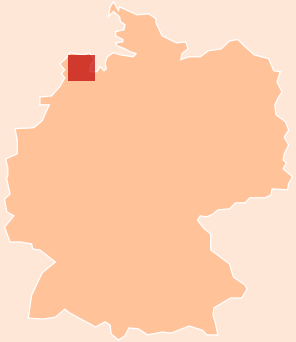
Local Market 4 | Bid | Ask

Local Market 3 | Bid | Ask

Local Market 2 | Bid | Ask

Local Market 1 | Bid | Ask

| **Product** | **Qty** | **Price** | **Price** | **Qty** |
|---|---|---|---|---|
| DE 03:00 Local 1 | 10 | *32* | *42* | *34* | *43* | 5 | 25 |
| DE 03:00 Local 1 | 3 | *31* | *30* | *30* | *35* | *50* | 1 | 5 |
| DE 03:00 Local 1 | 8 | *30* | *27* | *38* | *55* | 4 | 1 |
| DE 03:00 Local 1 | 7 | *29* | *21* | *58* | 4 |



“On-demand” local markets

Main principle:

➔ Opening of “on-demand” locational order books in the intraday timeframe to solve congestion issues

*Important elements*

- ✓ *Local trading certifications delivered by System Operators to market participants*
- ✓ *“2 C’s rule” ➔ need of Congestion AND Competition to open a locational order book*
- ✓ *Strict compliance rules for local trading*
- ✓ *Cooperation between transmission and distribution over locational trading*

# Physical grid bottlenecks appear in the region on three SO grids