Demand Response in Organized Markets

Chaire European Electricity Markets
Université Paris-Dauphine

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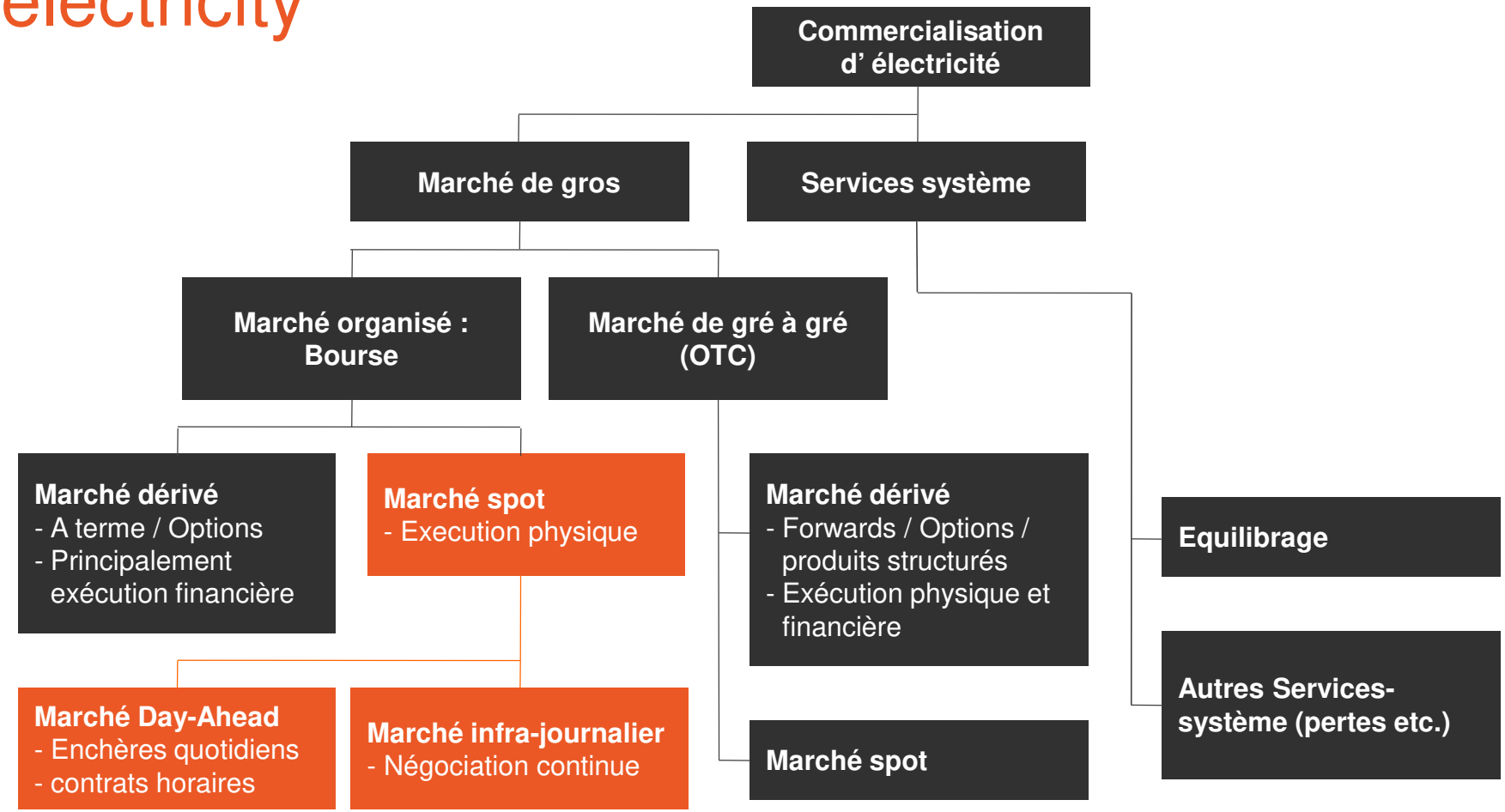
Outline

1. Demand response in the French electricity market
2. Demand response in Local Flexibility Markets
3. Design elements from the enera project in Germany

Freedom of choice for commercializing electricity



+Capacity markets

+soon Local Flexibility Markets

How can a MW of DSM flexibility be valued on the market?

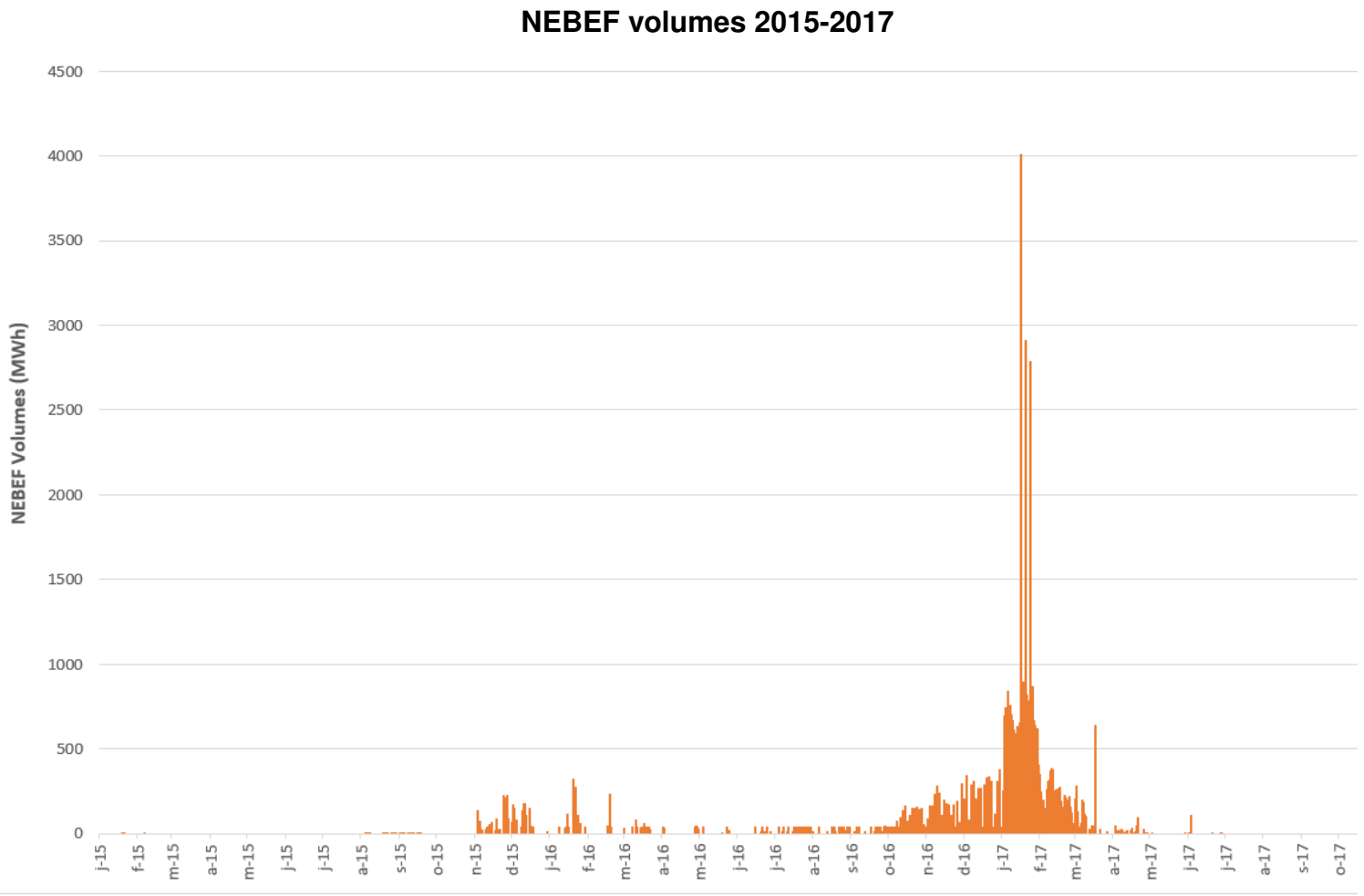
Demand response is a change in the power consumption of an electric utility customer to better match the demand for power with the supply.

	Means of valorization	Description	Implementation date	Demand-response valued volumes
RTE-HANDLED MECHANISMS	Réserve primaire et secondaire	Servoing the flexible means of production to handle the very-short term unbalances on the network. RTE can activate these assets in less than 30 seconds or 15 minutes	July 2014	70 MW in 2017
RTE-HANDLED MECHANISMS	Réserve tertiaire – Mécanisme d'ajustement	Made to handle the Intraday balancing by calling on to flexible power sources which are paid if their offers are accepted by RTE.	2003	12 GWh in 2016
RTE-HANDLED MECHANISMS	Réserve tertiaire – Réserve rapide	To ensure power availability in case of a largely unbalanced network, RTE uses production and demand-response capacity contracts. These assets can be activated in less than 13 minutes or 30 minutes.	2003	500 MW in 2017
RTE-HANDLED MECHANISMS	Réserve tertiaire – Réserve complémentaire			≈ 0MW
RTE-HANDLED MECHANISMS	Réserve tertiaire – Appel d'offre effacement	Each year, RTE launches a call for tender which is only addressed to the demand-response actors.	2011	Between 750 and 1400 MW in 2017
RTE-HANDLED MECHANISMS	Interruptibilité	This mechanism rewards large industrials demand-response capacities (> 40MW) by servoing their process, which can be activated if need be, in less than 5 seconds.	2012	1,5 GW in 2017
NEBEF		Allows demand-response operators to value their asset by selling on the power markets rather than being limited to RTE's adjustment market.	2013	10,5 GWh in 2016

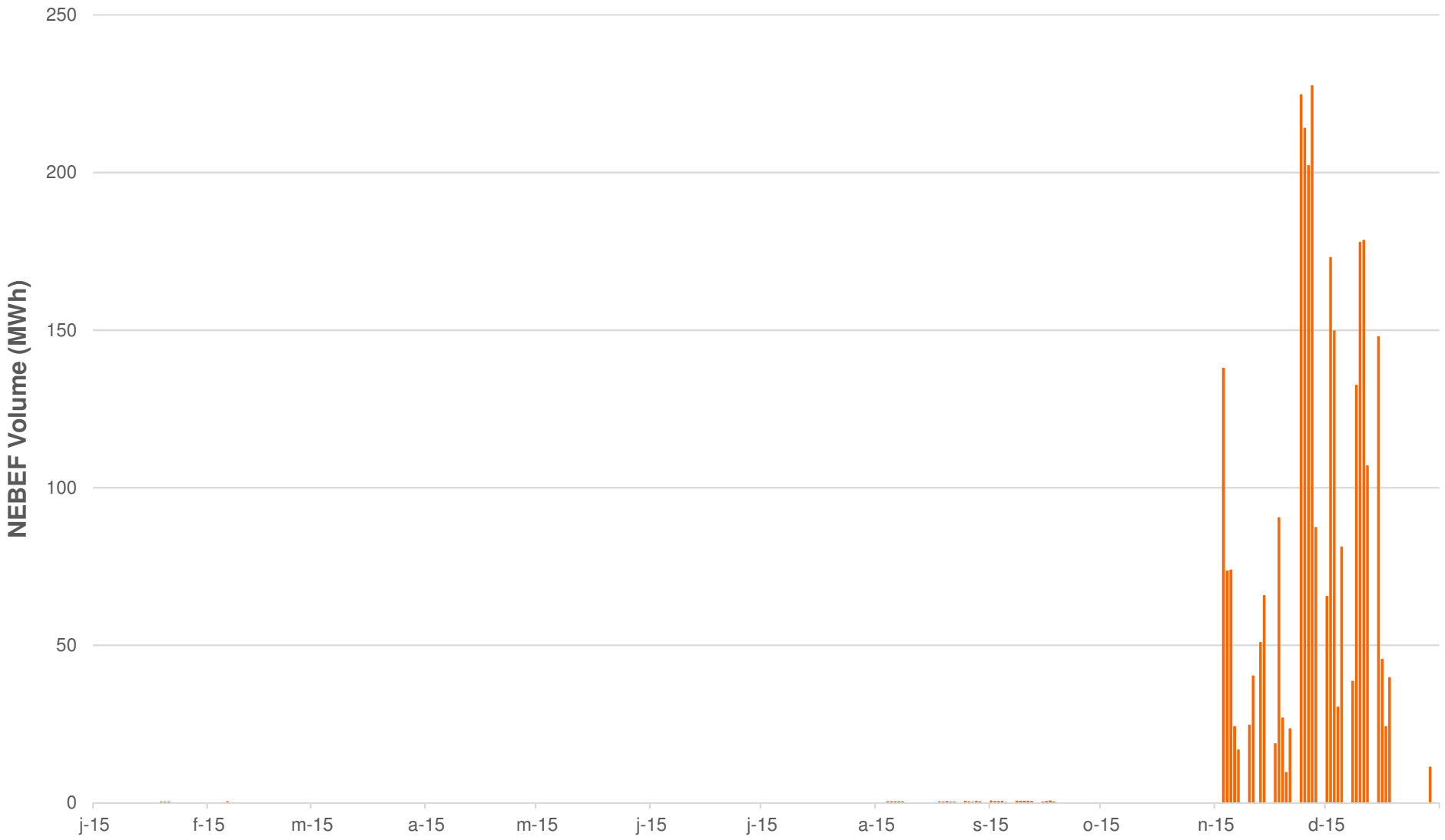
+Capacity market

Source : ADEME, figures from September 2017

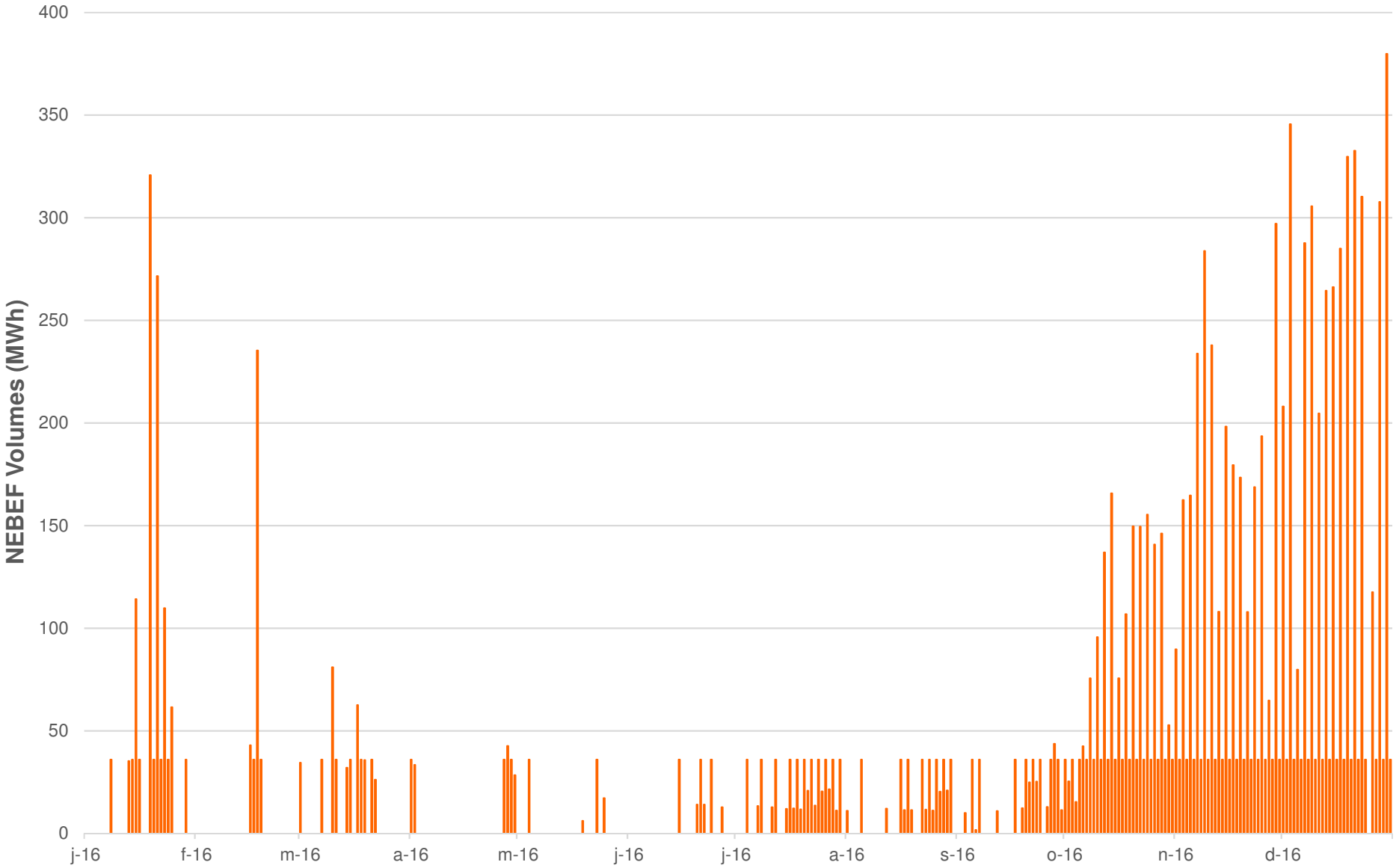
The NEBEF mechanism: slow start but very encouraging signs



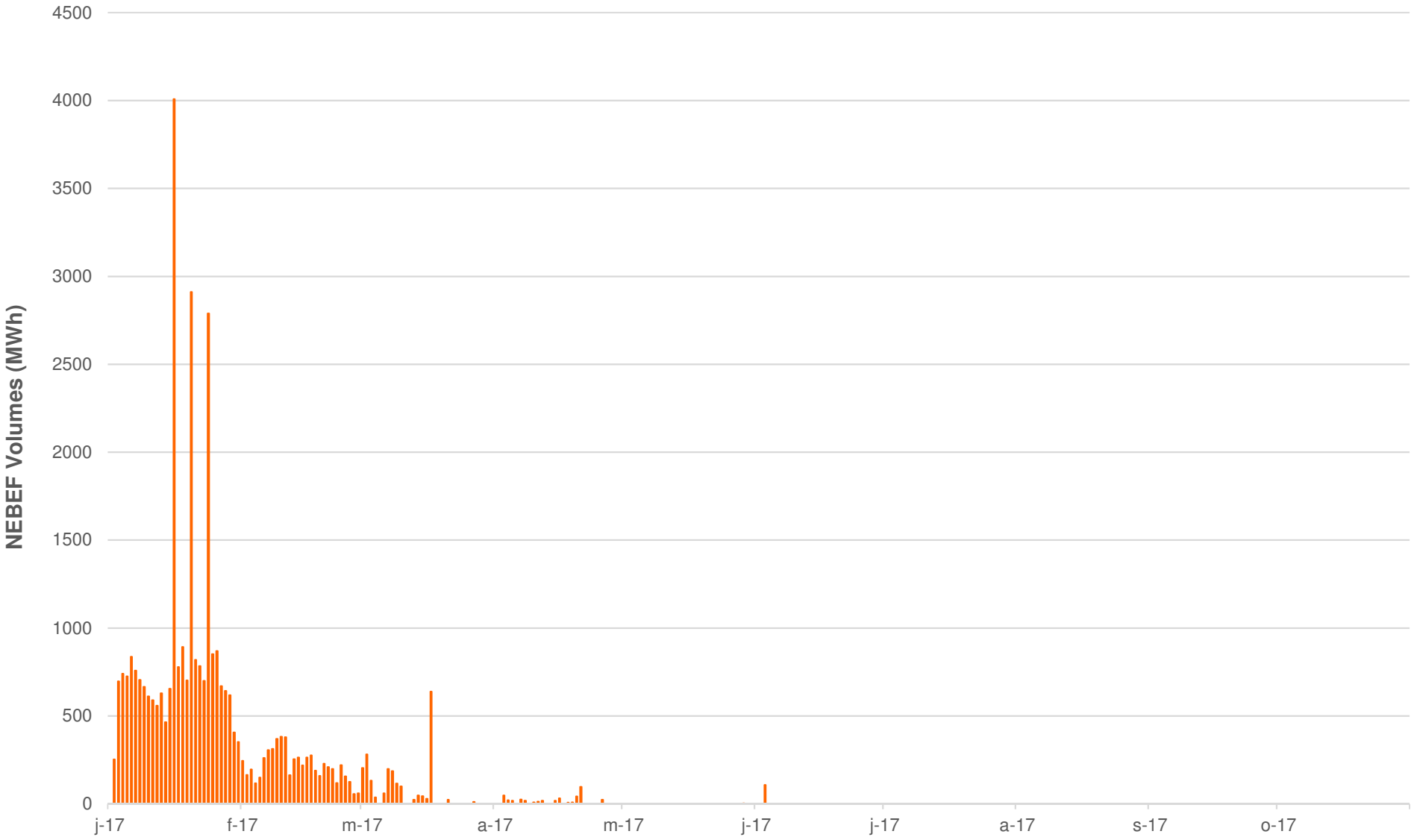
NEBEF 2015



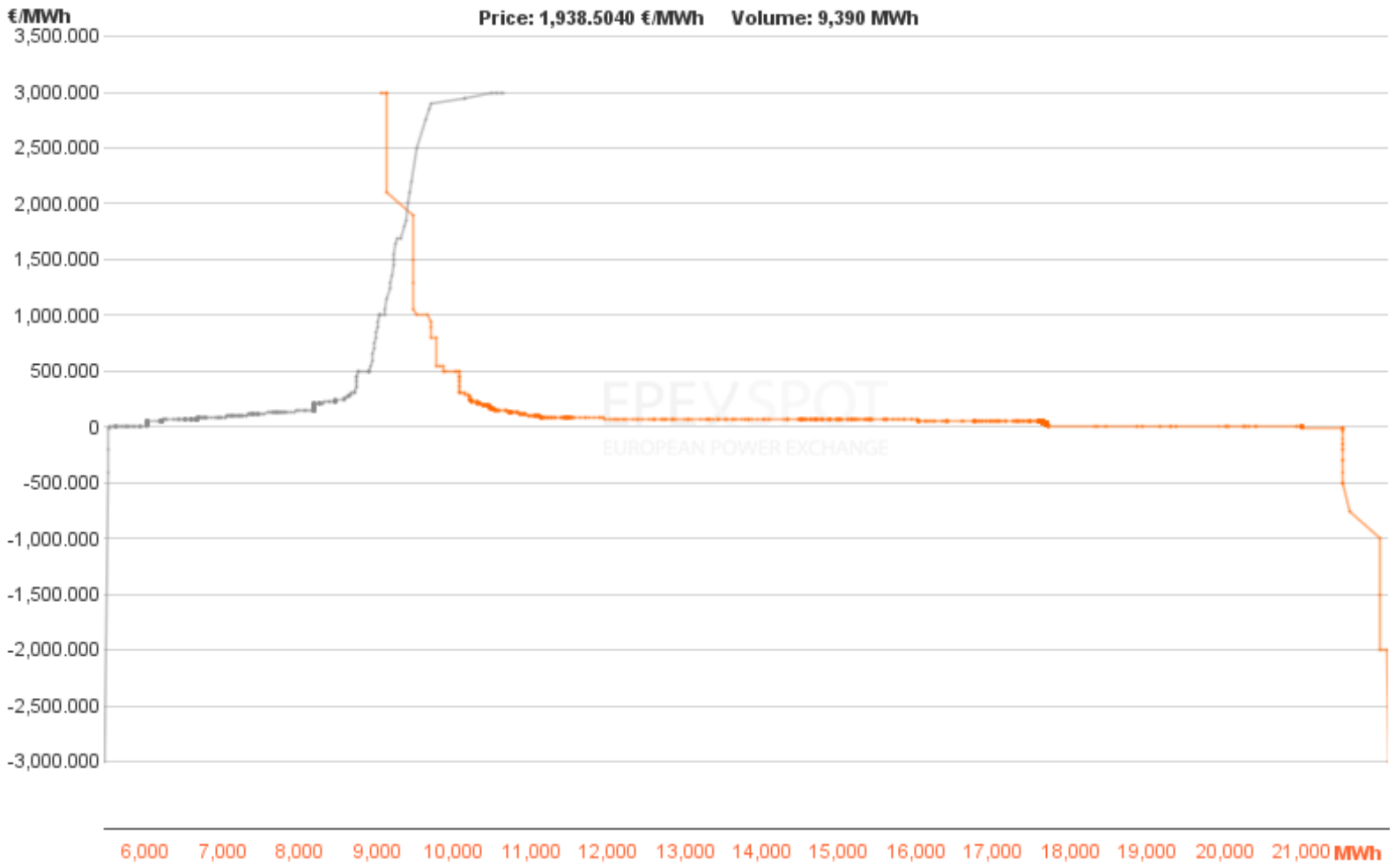
NEBEF 2016



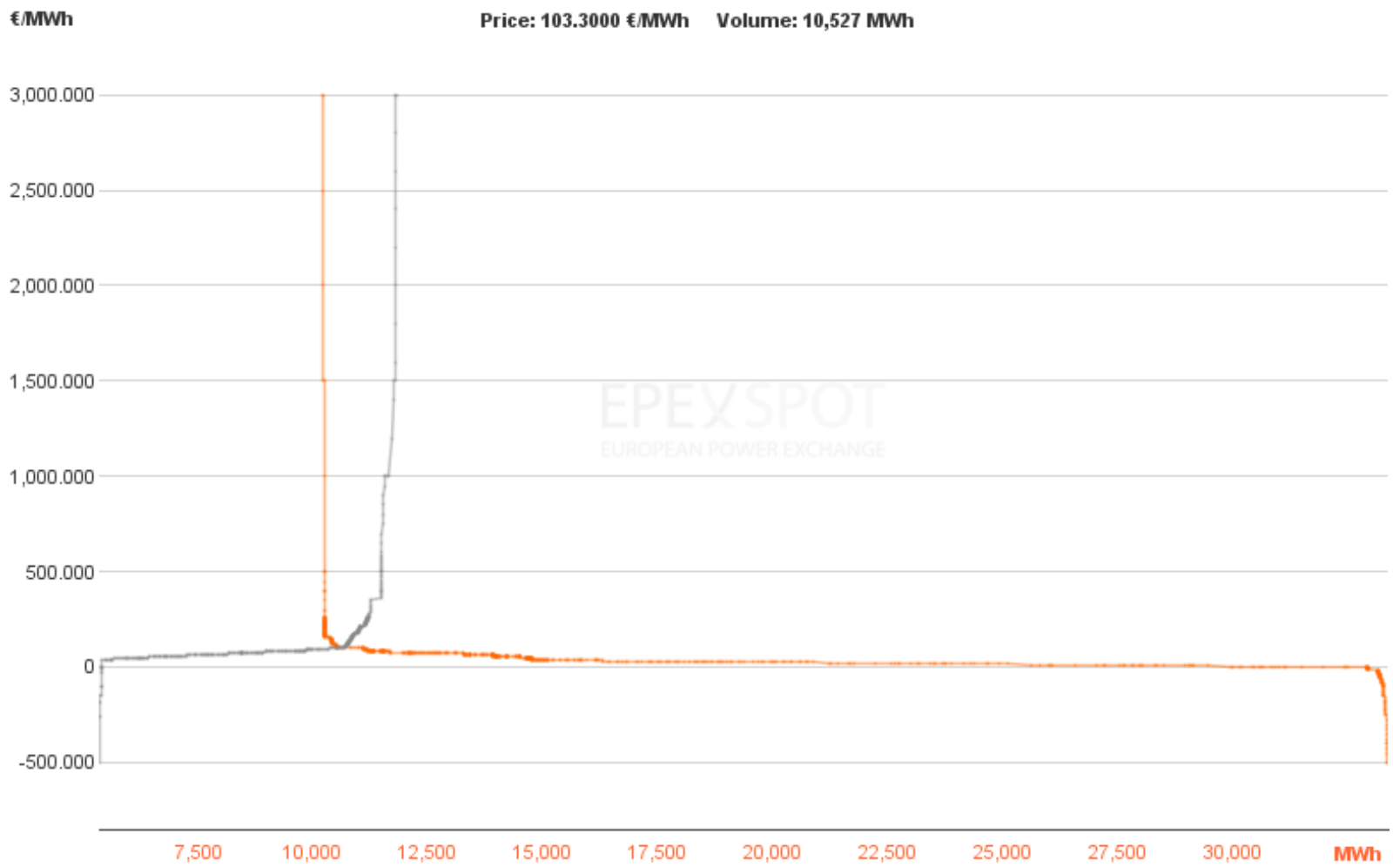
NEBEF 2017



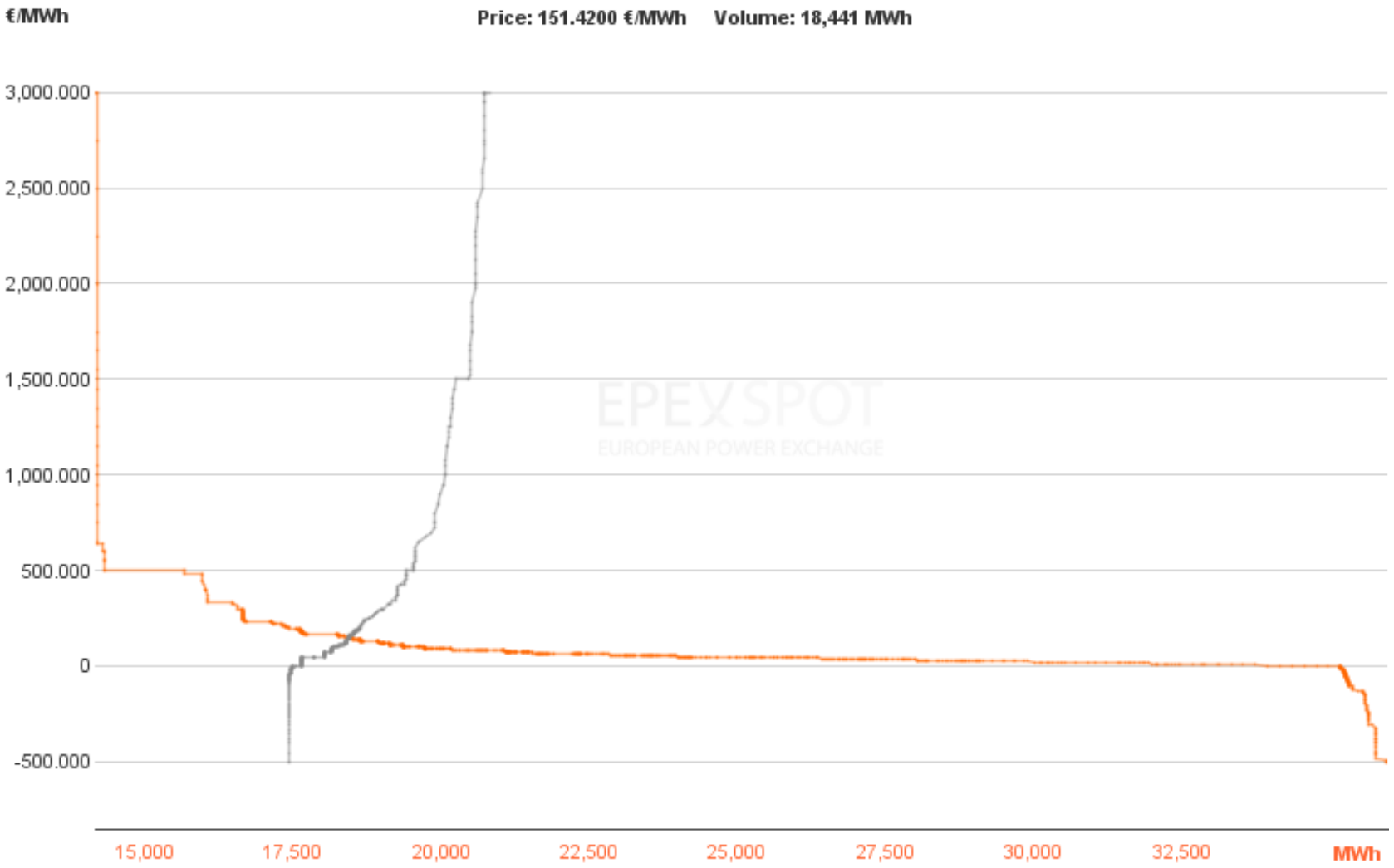
9/2/2012 18-19h



10/01/2017 18-19h



27/02/2018 18-19h



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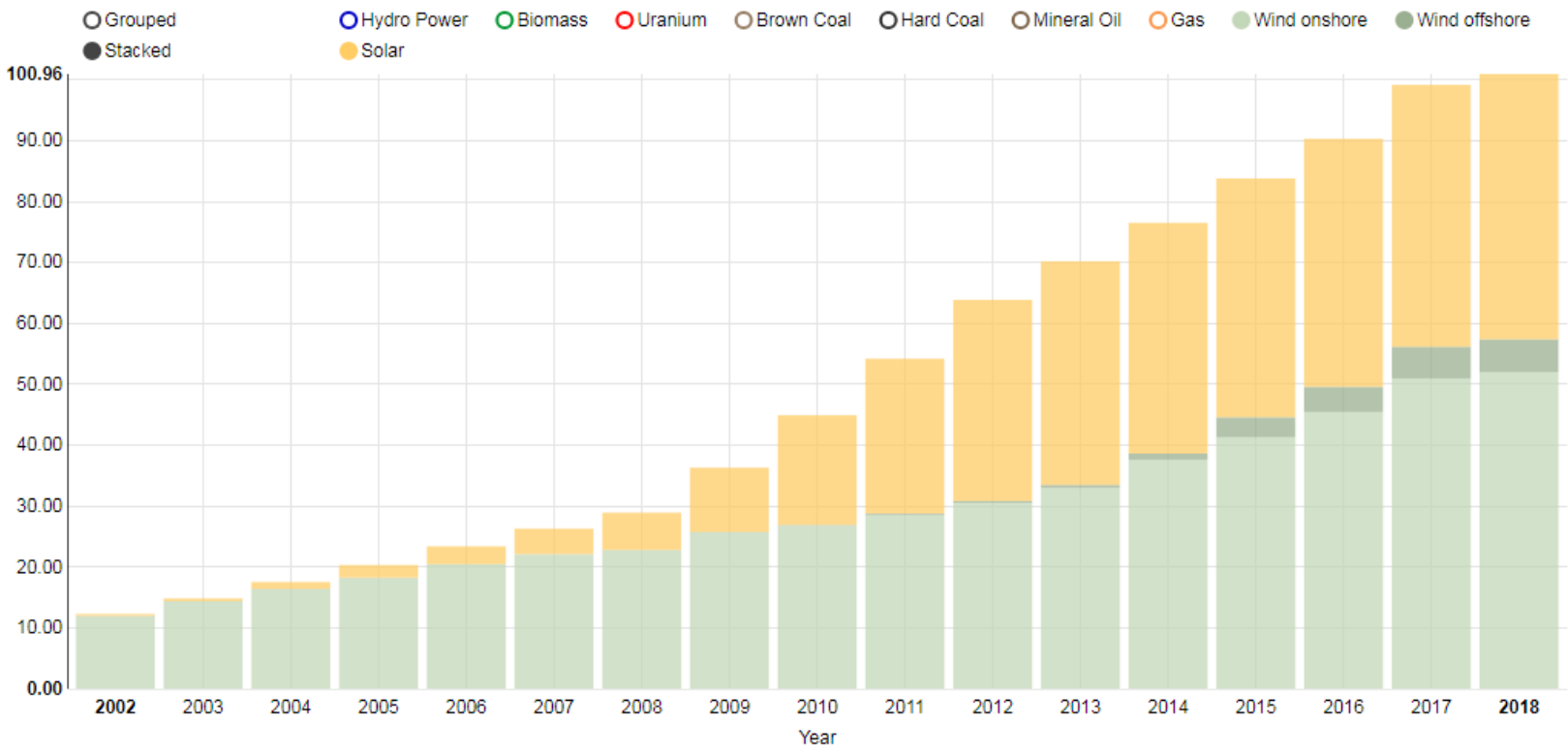
Strong development of renewable energy resources



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

High-level perspective

The current power system is expected to be **facing significant challenges in the future**, regarding the integration of much more decentralized intermittent energy resources.

How to make the power system more efficient and able to deal with foreseen challenges?

Current wholesale market

- Considering very large price zones
- Intra-zonal grid topology not considered at the moment (study on zone splitting carried out by Entso-e)

Future challenges

- Adapt the power system to the integration of much more decentralized intermittent energy (wind and solar power)
    - Find a way to handle congestions

New technologies

- The development of new technologies (Internet of Energy, smart grids, demand response, blockchain, smart metering, etc.) has the potential to meet our future challenges.

New paradigm for the future power system

- Design new market-based solutions for the power system to overcome the foreseen challenges
- The use of new technologies will need to be integrated and organized such that the whole system remains efficient
- The role of demand response will be key

The main objectives

The concept in a few words:

Implementation of a market-based congestion management platform efficiently centralizing local flexibility offers to allow System Operators to reliably and economically relieve physical congestions and bottlenecks from the grid.

A clear and transparent market mechanism	• **Clear and transparent market rules** for actors participating in the market-based congestion management ➔ Asset Certification by the SOs, Verification of the physical impact, Strict Compliance • Definition as an addition to all existing wholesale markets to solve specific local issues.
Development of distributed flexibility	• **Unveil the potential of distributed flexibility** ➔ Provide transparent locational flexibility prices and foster the development of distributed flexibility (demand-side management, renewables, aggregators, batteries…). • The platform can become **the short-term activation mechanism of long-term local flexibility contracts** if there are any, but also **be open to any other flexibility provider**.
Coordination between System Operators	• **Clear guidelines and communication protocols to increase and develop the cooperation between TSOs and DSOs**. It is a key element to reach optimality in the congestion management solution and avoid inefficiencies. • **EPEX SPOT is a neutral and objective third party** that will be able to efficiently run the platform, adapt to current System Operator processes and Grid management rules, and ensure compatibility with the current European zonal markets

Locational OBKs

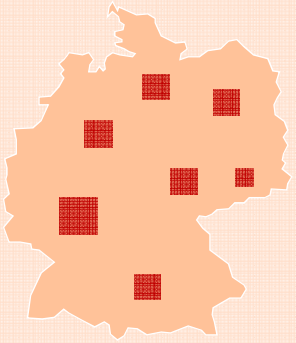
A global market…

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 / Local Market 3 / Local Market 2 / Local Market 1

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



"On-demand" local markets

Main principle:

➔ Opening of "on-demand" locational order books on the Intraday continuous market to solve local congestion issues

➔ A same volume can be placed on both the global market AND a locational order book

Need to proceed with caution:

- ✓ *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*

Open questions:

- *Same power volume ⇔ Same price on the 2 markets?*
- *Possibility to re-sell local volumes?*

Key design elements

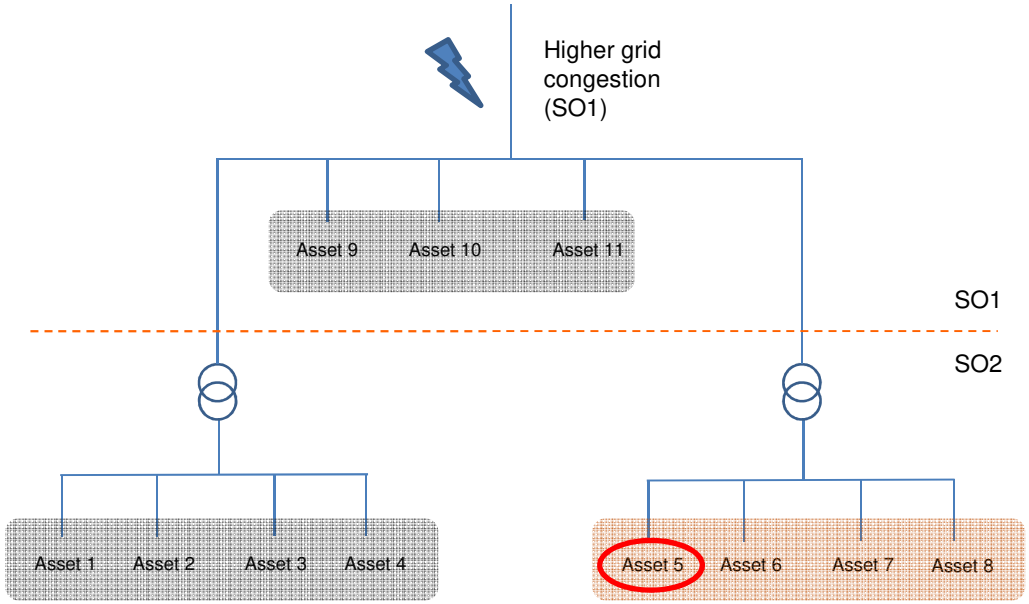
The experience from many workshops and discussions around the topic of Local Flexibility markets helped us to understand the following key aspects:

- **Clear definition of roles and responsibilities:** TSOs – DSOs – Market Operator – Flexibility Providers
- **2 C's rule - Congestion & Competition:** there is a need to have a problem to solve (Congestion) and sufficient amount of Competition for a market-based solution to be efficient.
- **Certification:** the assets that can bid in the locational order books are assets that have been certified by a System Operator.
- **Physical impact need and verification:** when a flexibility is activated in the Local Flex Market, it must deliver **a physical impact at a given point of the grid**. This impact can be verified by a System Operator ex-post.
- **Who can trade?**
  - Step 1: Trades possible only between System operators and Flexibility Providers
  - Step 2 (to be assessed): Secondary market with trades possible between Flex Providers
- **How to maintain global control area balance?**
  - Option A: the flexibility provider to rebalance its perimeter on its own
  - Option B: the System Operator needs to balance the second leg
  - Option C: quote spread products directly between different locations in the grid

Coordination between System Operators

Coordination between different System Operators (consider the verticality of the grid, different grid levels):

- Need to avoid conflicting / inefficient activations
- Aggregate willingness-to-pay from different system operators



If SO1 wants to activate Asset 5 to lift the higher grid congestion:

➔ Does it create a new congestion for SO2?

➔ Maybe SO2 also needs this activation. Cost sharing?

Offer net valuation opportunities to LECs

- Decentralized energy production and Local Energy Communities (LECs) are likely to strongly develop in the coming years
- EPEX can support decentralized actors, offering trading opportunities to value their net and their flexibility capabilities

LECs onboarding on the exchange

Connect distributed and decentralized resources within microgrid communities to the wholesale market, for prosumers to trade and value their netted production and consumption using a trustworthy and **transparent price signal**.

Local marketplaces

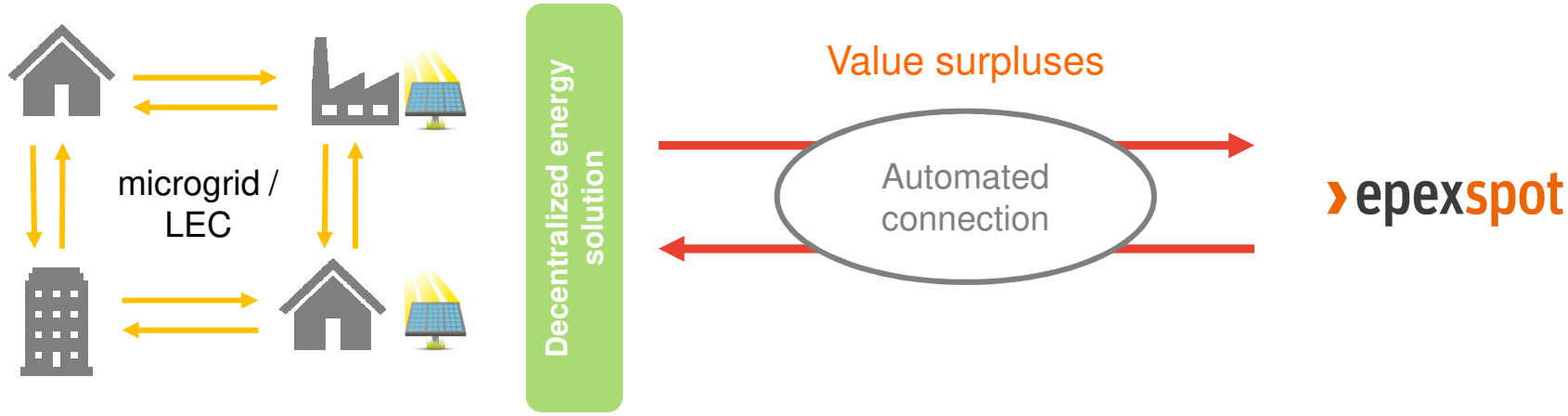
Connect LECs to local flexibility markets when available: LECs will be part of tomorrow's flexibility providers

Connect LECs to the wholesale market

Our partner: LO3 Energy

- US start up based in Brooklyn aiming at **developing local marketplaces** using state-of-art technology
- **Up and running microgrid** in Brooklyn connecting **60 households** together and launched in 2016
- LO3 technology allows secured and trusted **peer-to-peer transactions between prosumers and consumers** (residential or business) in the microgrid: blockchain, hybrid smart meters and mobile app.
- Several other microgrids projects being implemented worldwide and in Europe (e.g. publicly announced in Germany and UK).

Both partners are working on connecting LO3 microgrids in Europe to EPEX market



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Presentation of the enera project

The challenge

- **The increasing share of installed renewable capacity is creating new challenges for system operators to manage the grid efficiently and economically**

The enera Project

- **The German ministry of Economic Affairs and Energy is funding the enera project to explore new smart market mechanism to allow for more renewable energies in the future**
- **The 3 pillars of the project are: Network, Market and Data**

A project to experiment a new kind of market to solve growing grid congestions, as a complement to grid reinforcements (software & hardware)

Flexibility supply

Flexibility providers:

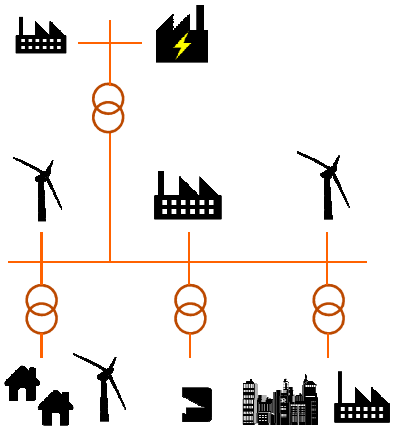
- Power plants
- Aggregators
- VPPs
- Storage
- Renewables

Flexibility market platform

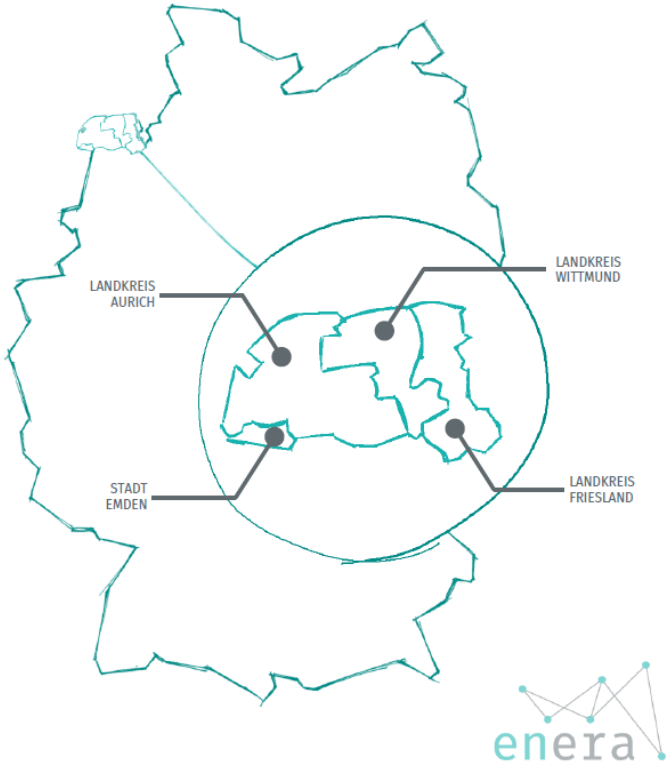
Market-based congestion management

Trading systems
Standards
Transparency
Coordination
Neutrality

Flexibility demand from system operators

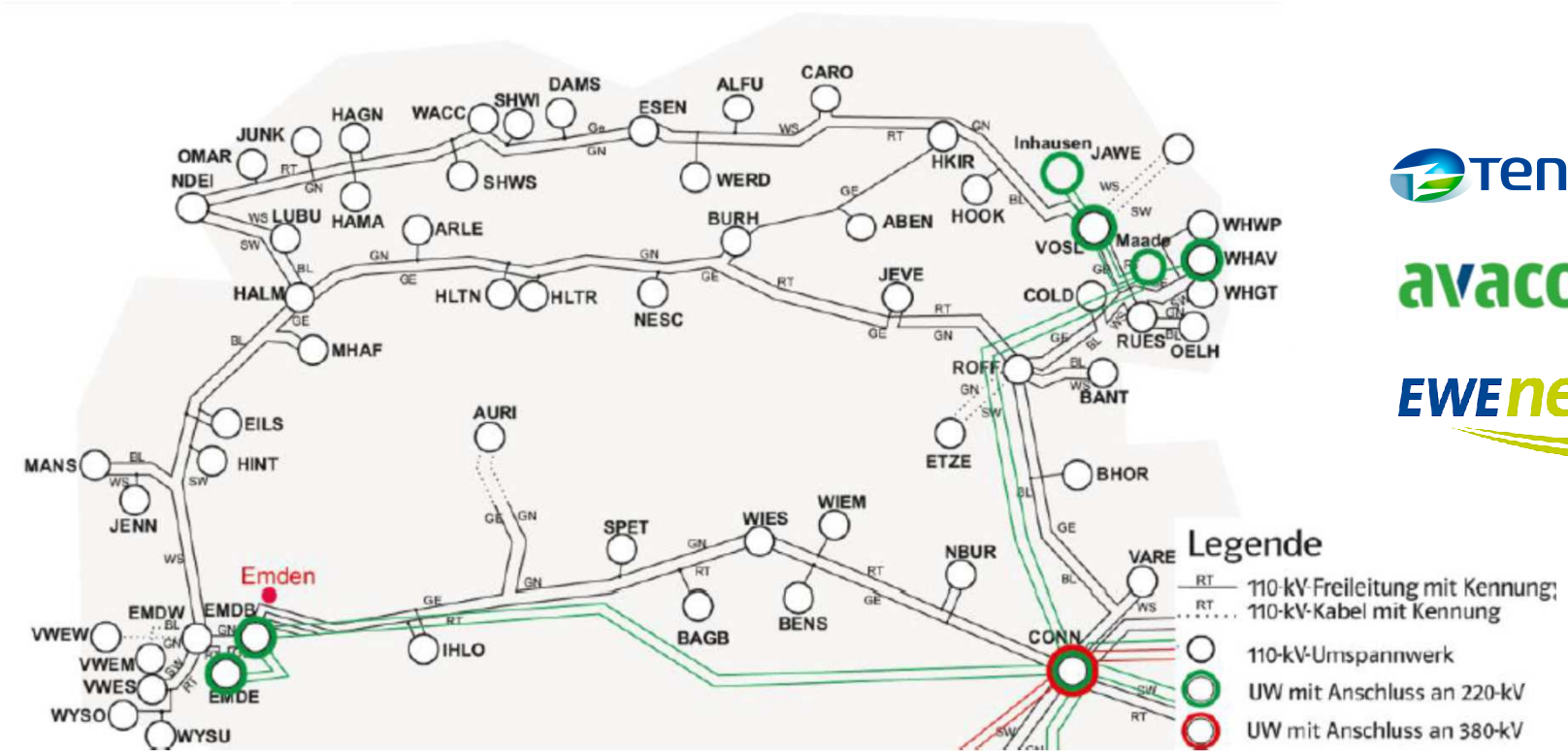


ENERA Region: A significant wind production

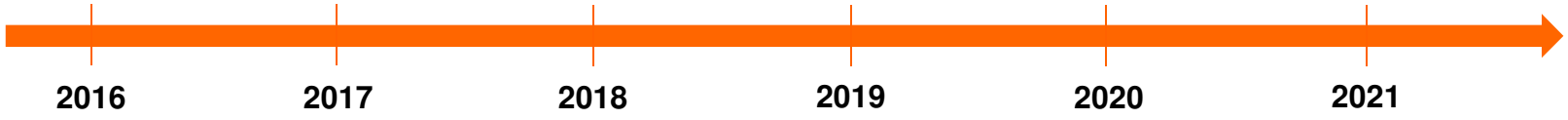


ENERA partners: Consortium

Physical grid bottlenecks appear in the region on three SO grids



EPEX Spot in Project Mode



Enera — Design Phase | Implementation | Demonstration

Other initatives — Other projects initiated

EPEX SPOT is designing the solutions to **address power system challenges** by:

- congestion management;
- enhancing the current design of liquid and large bidding zones.

This will create **new opportunities** for:

- market participants to value their flexibility;
- system operators to avoid too costly grid expansion.

➔ The design can serve as a **blueprint for a much larger implementation.**

➔ First Market results will be available as of 2020**.**

Thank you for your attention

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