**WEBINAR**

Power Market Auctions 101

06.12.2022

With the current situation on the electricity markets, such as the Day-Ahead markets, the need to understand how the prices are determined has never been as important. Getting a better understanding is critical for any energy professional.

As a provider of auction algorithms for multiple Power Exchanges and System Operators worldwide, N-SIDE has decided to open the box and to explain how power market auctions work.

In this first webinar of the trilogie, we start from the very basics: why and how energy markets were created? How is the EU Day-Ahead market organized? What are the main economic principles ruling any auction-based markets, such as long-term capacity, day-ahead energy or balancing markets?
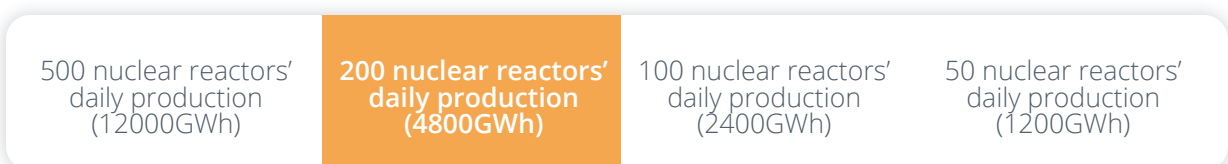
POLL #1   **When did the first restructuring initiative for the creation of electricity markets take place?**

Before 1970	Between 1970 and 1980	**Between 1980 and 1990**	Between 1990 and 2000
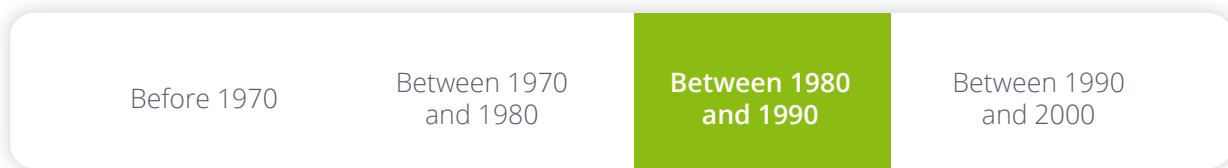
Answer: The first major initiative occurred in England and Wales starting in 1989. Restructuring and competition initiatives in the US, Canada, Australia, the EU and other countries proceeded in the late 1990s and early 2000s. Chile, which unbundled generation, transmission and distribution in 1982, is sometimes identified as the first system to adopt these reforms. However, while Chile restructured and unbundled generation, transmission and distribution, its system remained highly regulated with relatively little real competition.

POLL #2   **The daily average volume traded on the EU Day-Ahead market in 2021 was equivalent to:**

500 nuclear reactors' daily production (12000GWh)	**200 nuclear reactors' daily production (4800GWh)**	100 nuclear reactors' daily production (2400GWh)	50 nuclear reactors' daily production (1200GWh)

Answer is 200 nuclear reactors, corresponding to a daily average of 4.72 TWh

POLL #3 How much is the producer surplus of order B in the following example?

Price [€/MWh]

| **6€** | 4€ | 10€ | 0€ |

Answer: The answer is 6 €. Indeed, the producer surplus of order B will be equal to what they will receive from the market (market clearing price times its volume) minus the cost of the producer (its submitted cost times its volume). Since the market clearing price is 5€/MWh because of the intersection between the demand and the supply curve, the producer surplus of order B will be computed as 5€/MWh * 2 MWh - 2 €/MWh * 2 MWh = 6 €.
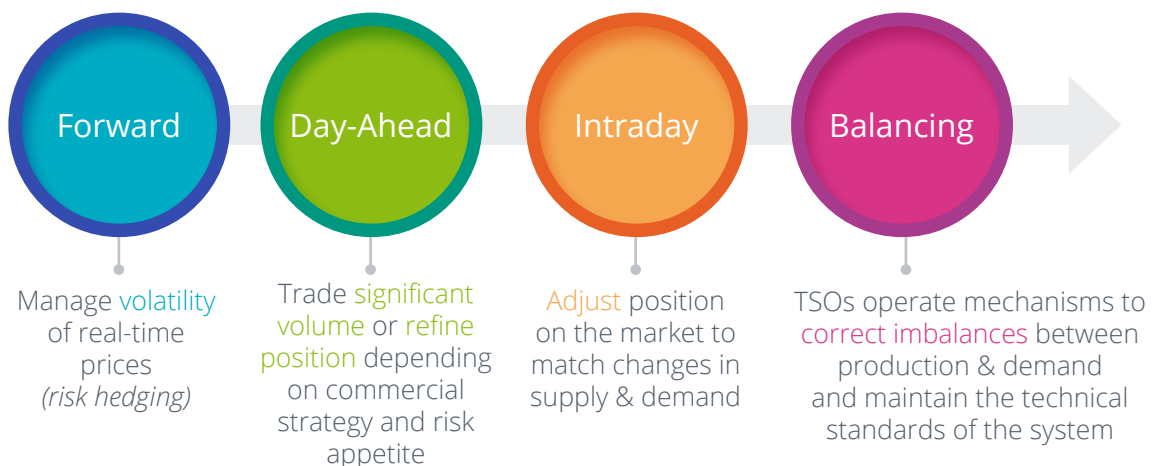
Three key takeaways

1

A unique combination of properties and a diverse set of actors shaping electricity markets

❯ To ensure instantaneous matching of supply and demand, a set of markets has been developed with the aim to enable actors to manage volume & price volatility as more and better information becomes available.

❯ Market participants (and related technologies) have different technical capabilities, risk profiles and commercial strategies. These differences are reflected in the way market participants trade. For instance, the extent to which they hedge on the forward market versus relying on the short-term (spot) markets.

...use the electricity markets' "toolbox" in different ways

Forward — **Day-Ahead** — **Intraday** — **Balancing**

Forward
Manage volatility of real-time prices *(risk hedging)*

Day-Ahead
Trade significant volume or refine position depending on commercial strategy and risk appetite

Intraday
Adjust position on the market to match changes in supply & demand

Balancing
TSOs operate mechanisms to correct imbalances between production & demand and maintain the technical standards of the system

2 Organisation of European electricity markets

› The European market is organised in bidding zones. A bidding zone represents the largest area where market participants can trade electricity without having to acquire transmission capacity.

› 'Over-the-Counter' (OTC) and exchange-based trading are complementary and essential for the sake of competition, liquidity and the overall efficient functioning of European wholesale energy markets.

› Single-Day Ahead Coupling (SDAC) is the most liquid market place in Europe, allowing it to serve as a reference price for forward contracts, power purchase agreements and support schemes (e.g. contracts for difference).

› An algorithm developed by N-SIDE, EUPHEMIA, is used for the calculation of prices and flows as part of SDAC. SDAC is also referred to as "implicit day-ahead auction", because the auctioning of transmission capacity is included (implicitly) in the auctions of electrical energy - a process known as "market coupling".

3 Economic theory behind electricity markets with auctions and its three main ingredients

› Assuming "perfect competition", markets allocate resources efficiently, and send signals for the right level of investment and production: every good or service is produced up to the point where the last unit provides a marginal benefit to consumers equal to the marginal cost of producing it.

› The three main economic ingredients for electricity markets with auctions:

› **Ingredient #1** - Competitive equilibrium: In a competitive equilibrium, acceptances of orders and market clearing prices are such that, given these market prices, no market player would prefer other order acceptance levels.

› **Ingredient #2** - Producer & Consumer surplus: Economic measure of an order's benefit/profit.

› **Ingredient #3** - Social Welfare: Equivalent to the amount consumers are willing to pay for their energy to which the cost of the produced energy has been removed.

› Reaching a competitive equilibrium is equivalent to maximizing the total welfare of each participant. The latter can be done by means of an optimization program.

Crossing Supply & Demand Curves: Step by Step

The market clearing price is found at the intersection of the two curves.
In this example: market clearing price is **7€/MWh** and traded volume is **8MWh.**
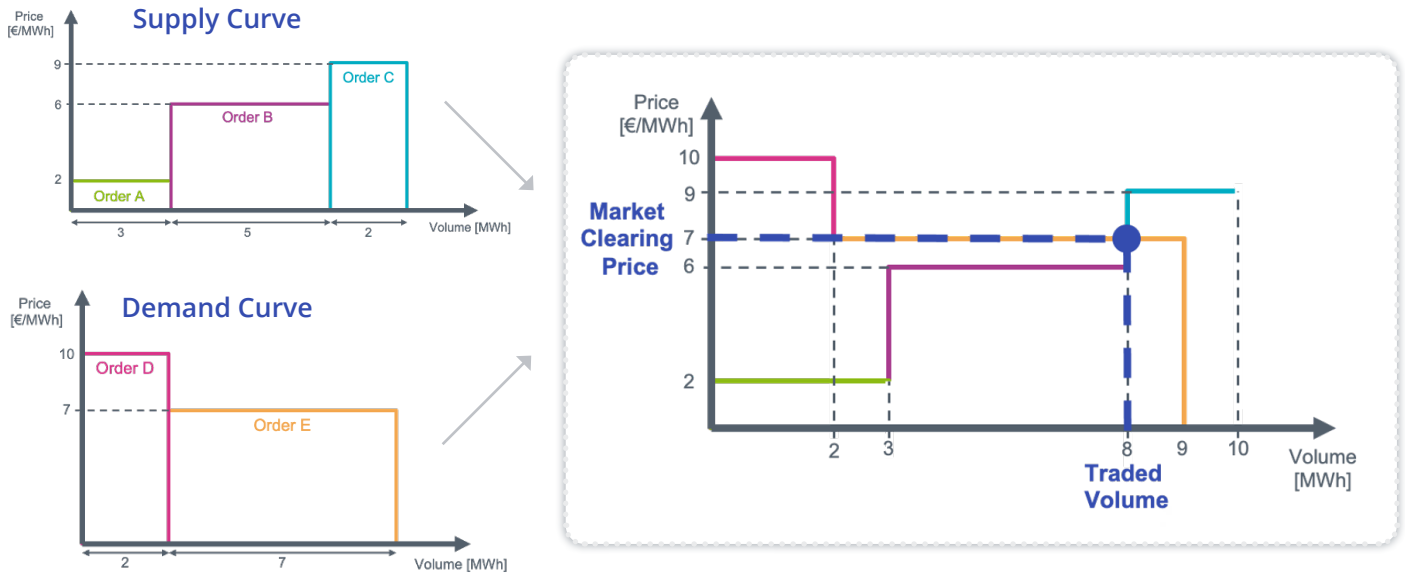
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