Balancing market and locational pricing

in the context of flexibility of the market

18 September 2018

Polskie Sieci Elektroenergetyczne S.A.

Efficient electricity market

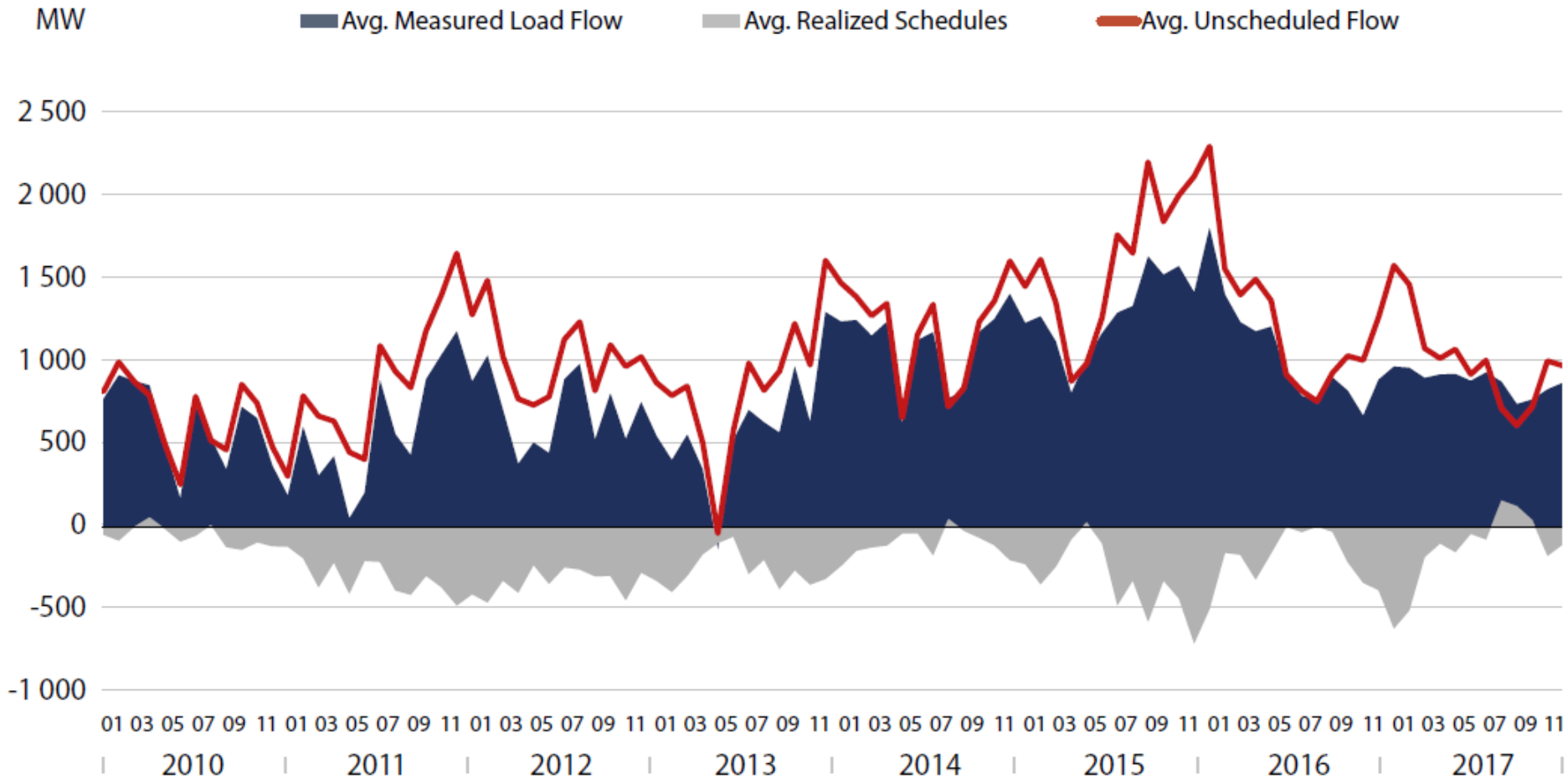
- **Transmission and generation are scarce resources**
  - Market is the **best known means** for achieving optimal allocation of these

- **Key requirements for efficient market/system operation**
  - **System Security** – ensure secure system operation by including detailed representation of both transmission and generation unit constraints directly in market clearing processes (forward, day-head, intra-day and balancing market)
  - **Economic Efficiency** – ensure comprehensive maximization of total social welfare by including all energy delivery cost components in market clearing processes (costs of energy, reserves, congestions and losses)
  - **Incentive Compatibility** – ensure coherency between market participants strategies and secure & costs effective use of the grid by applying correct price signals
  - **Transparency** – ensure that market participants get access to the full set of market data, allowing to understand both power system and market outcomes

However, we are quite far from that…

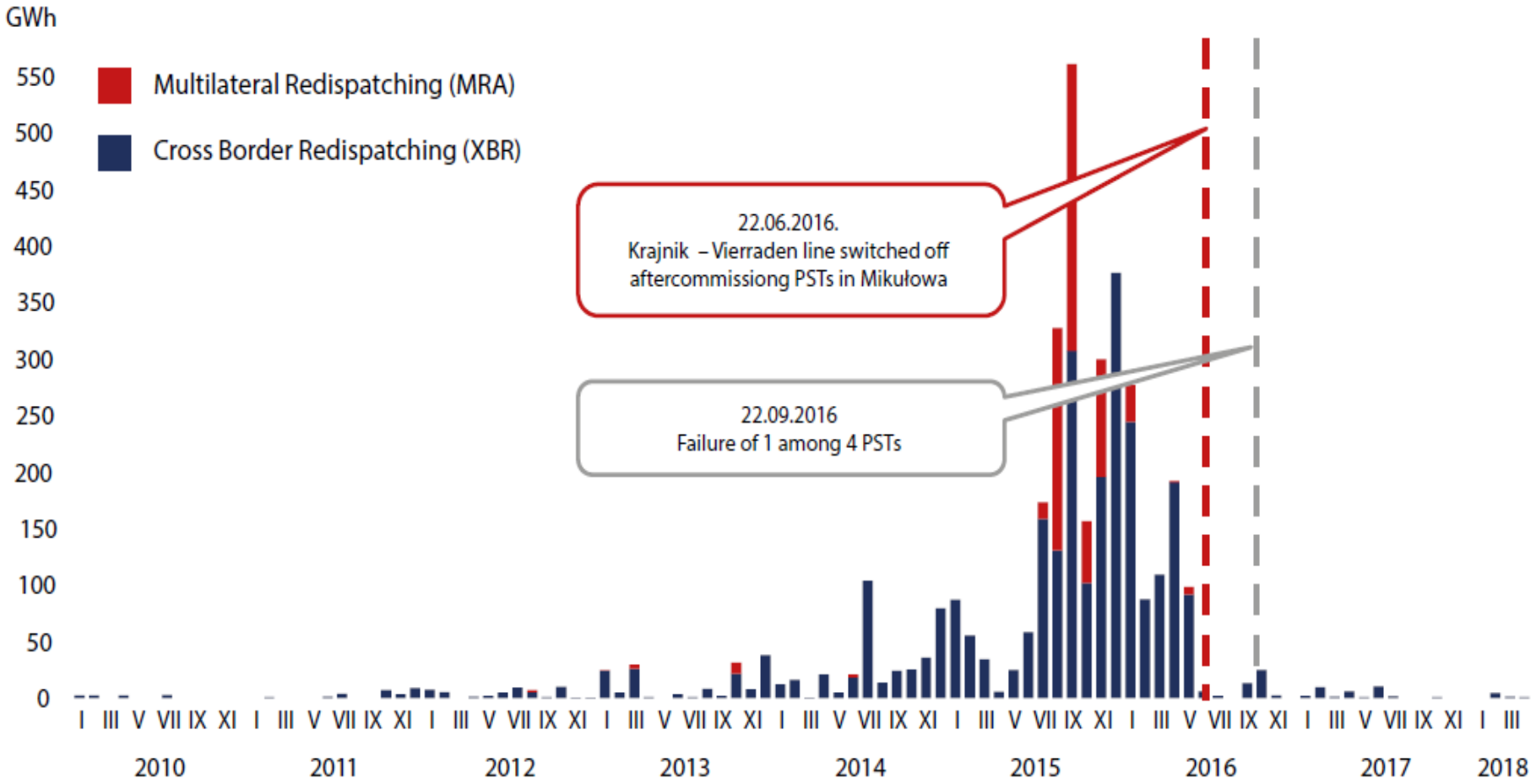
Reality check

Unscheduled power flows on German-Polish border. [Source: PSE].

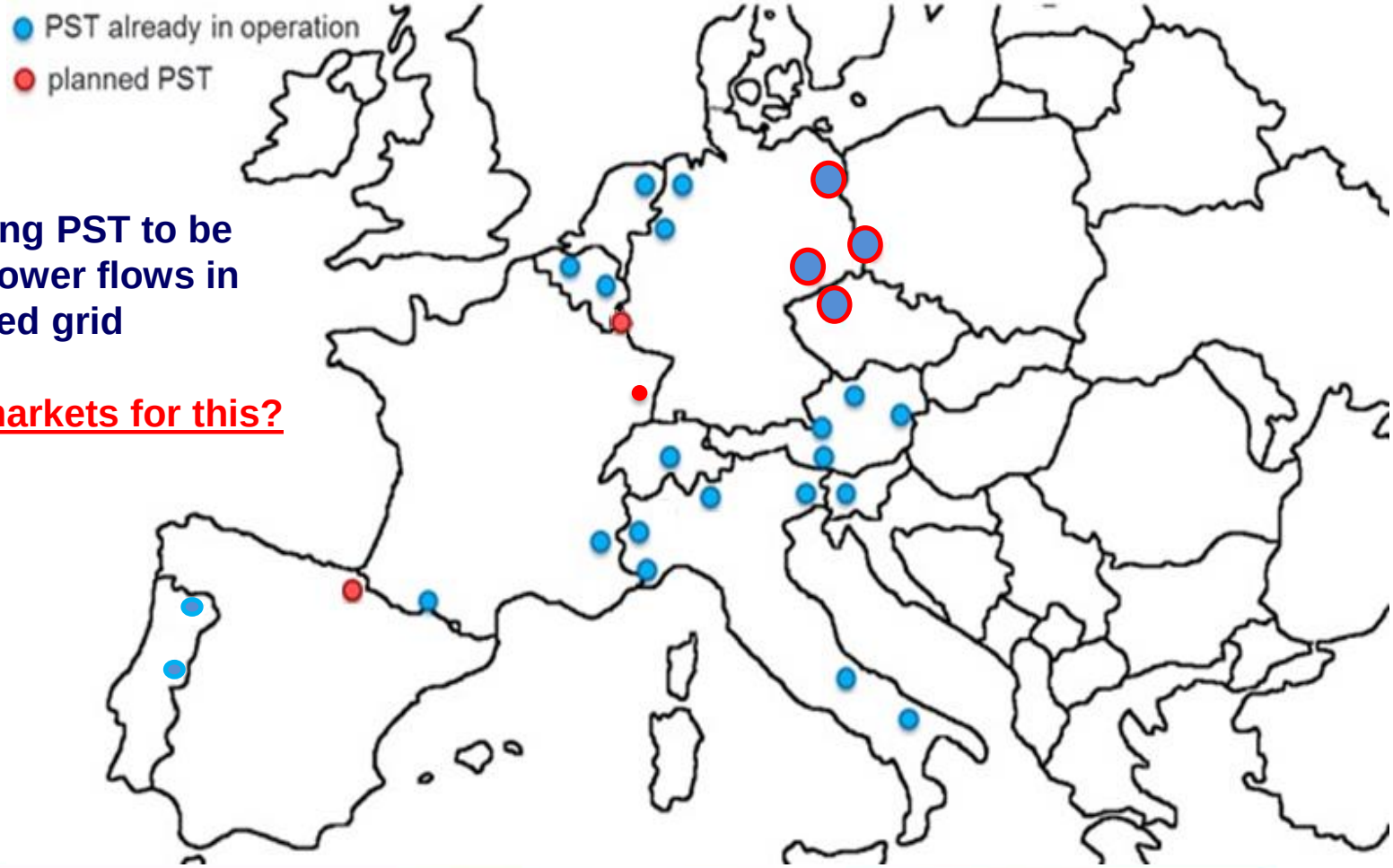


Reality check

Cross-border redispatching (bilateral XBR and multilateral MRA) measures necessary to ensure secure operation of the German-Polish border, monthly volumes. [Source: PSE].



Reality check

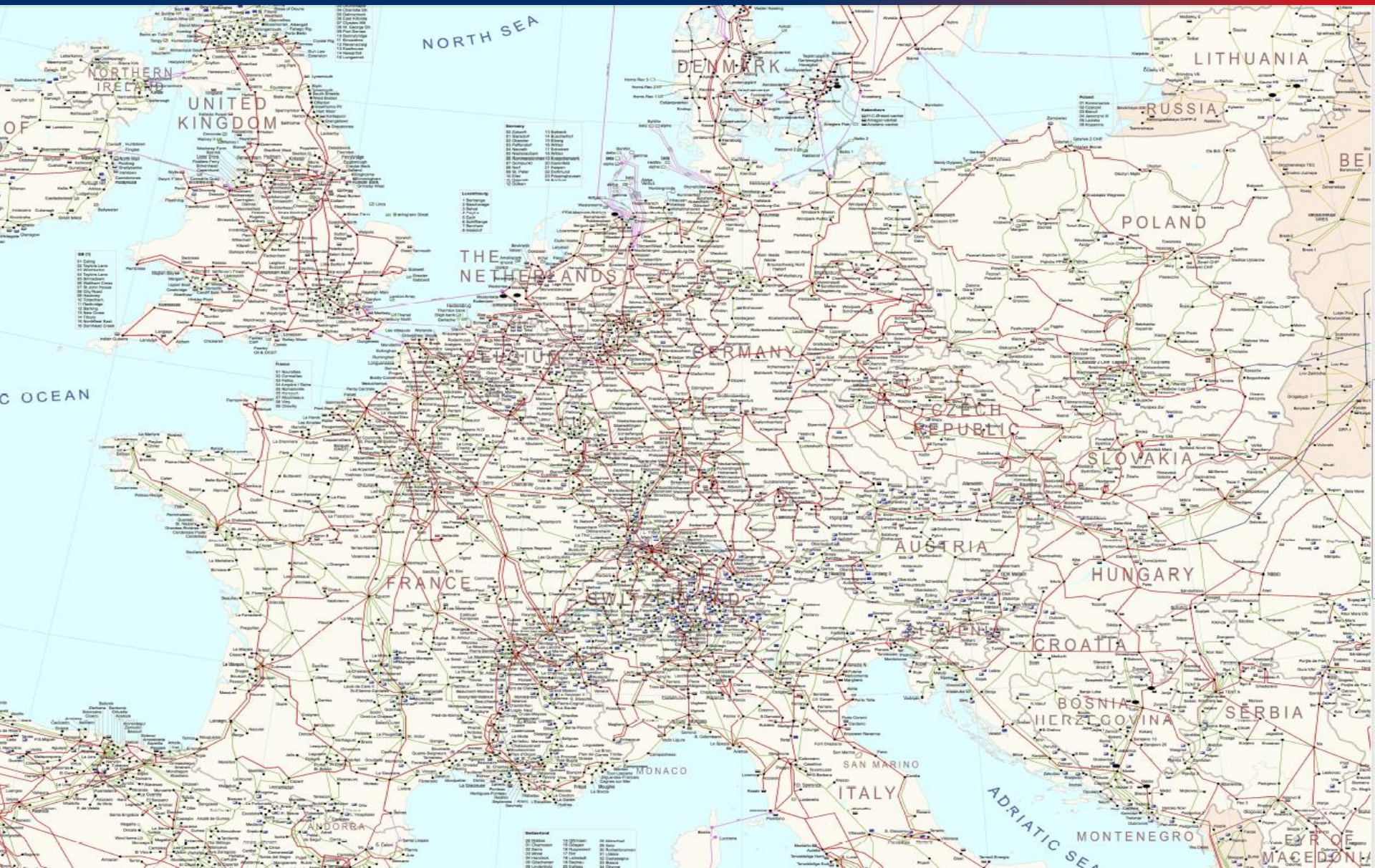


TSOs are installing PST to be able to control power flows in the interconnected grid

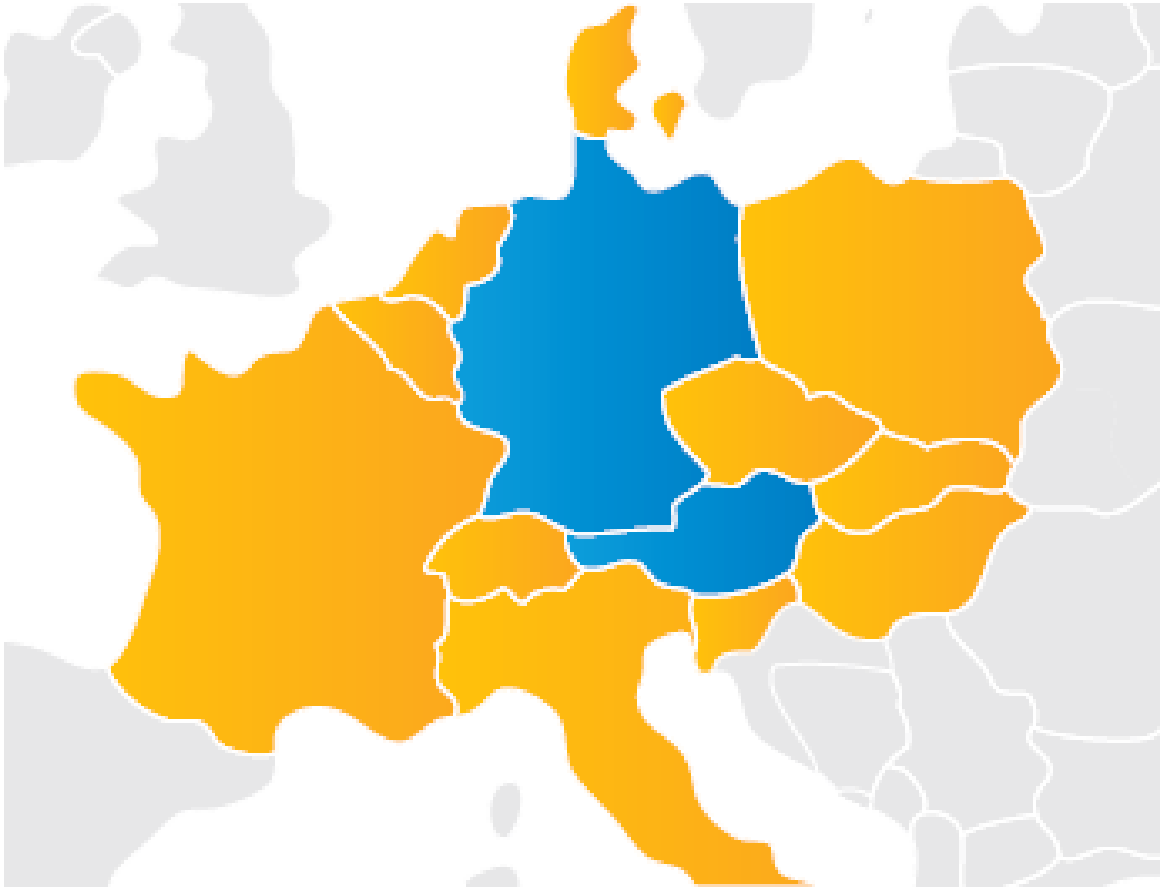
Why not using markets for this?

So what is the problem?

European power system:
one of the most complex systems built by men



Yet, from market perspective, transmission grid is very simple



European market:

making it (too?) simple

- **Premise of the zonal market design**
  - Zones are copper plates, hence generation localization is not important
  - If localization is not important, portfolio bidding is OK (less complex)
  - Any „occasional" congestion should be resolved out of the market by TSOs
  - Interconnection capacity is to be allocated market based
- **Now what if this premise is not really valid?**
  - Internal congestion is more frequent than expected
  - Size of the redispatching market is exploding
  - Pressure for maximizing cross-border capacities (more than just *„leftovers"*)
- **Challenge: how to manage the grid with more distributed resources**
  - Lack of locational information makes system management more difficult (expensive)
  - Congestion management in DSO grid based on portfolio bids? Makes no sense!

European market:

making it (too?) simple

- **Fixing the unfixable?**
  - **Split bidding zones (which some Member States strongly oppose, traders reject it as well)**
  - **Improved coordination of cross-border trade (yet, FBA still using *zones* as locations…)**
  - **Implement minimal cross-border capacity thresholds to facilitate more trade (TSOs oppose)**
  - **More intermittent generation and „*artificially*" high cross-border capacities will lead to further detachment of markets and operations**
  - **Hence, coordinated redispatching market needed to *„repair"* the infeasible market outcome!**

- **The cruelest irony: getting the grip on the zonal market requires nodal redispatching market**
  - **However, this implies two worlds: wholesale market and redispatching market**
  - **Both will be governed by different rules (portfolio bidding vs units local bidding)**
  - **Untransparent and artificial wholesale market and untransparent redispatching**

so why not doing it right from the beginning?

Challenges with current EU market design

- **Suboptimal market results**
  - **Disrupted competition** – (i) not all capacity offered to the market; (ii) socializing significant part of energy delivery cost since reserves, congestions, losses are not reflected in electricity prices
  - **High risk of insecure system operation** – significant out-of-market TSO measures necessary in order to make the market outcome technically feasible
- **Distortion of price formation**
  - Wholesale prices in EU countries are determined based on „approximated" cross-zonal capacities, giving incorrect signals to generation dispatch and mid-to-long-term generation investments
  - Generous subsidies for RES exercise downward pressure on wholesale prices
- **Energy-only market provides insufficient incentives for new generation**
  - Scarcity pricing is not implemented (very high price caps is *not* scarcity pricing)
  - Subsidies for particular technologies (RES) reduce competitive market, pressing prices down
  - Changing regulatory risk creates unstable conditions to invest in new resources (i.e. CO2 regulation)

Market and System operations are currently disintegrated

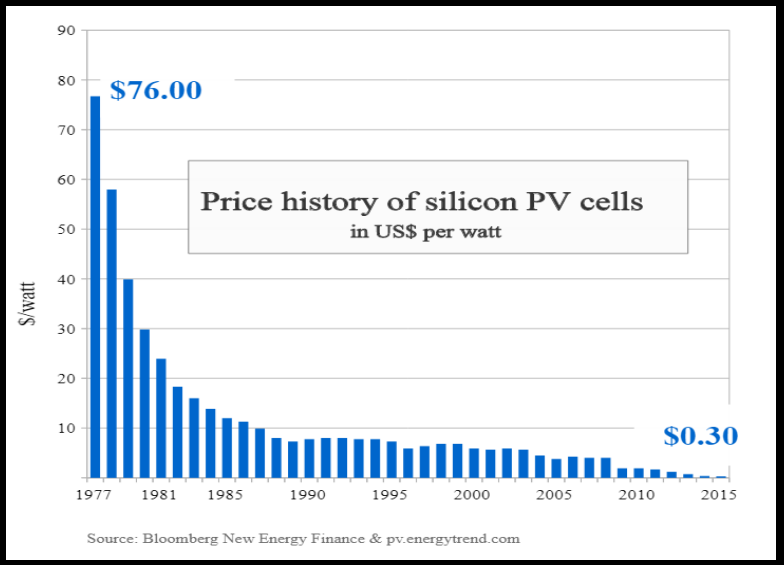
New types of generation technologies are changing the energy landscape, challenging power system operation

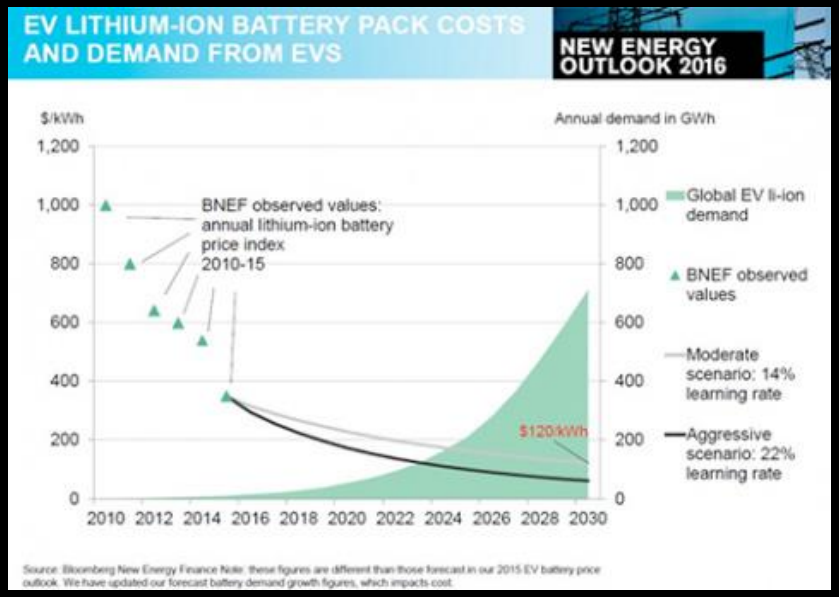
Vauban Community, Freiburg (Germany)

Bavary, Germany

Solar PV revolution has only just started.
Immense growth of PV penetration expected.

Gujarat solar park, Charanka village, India

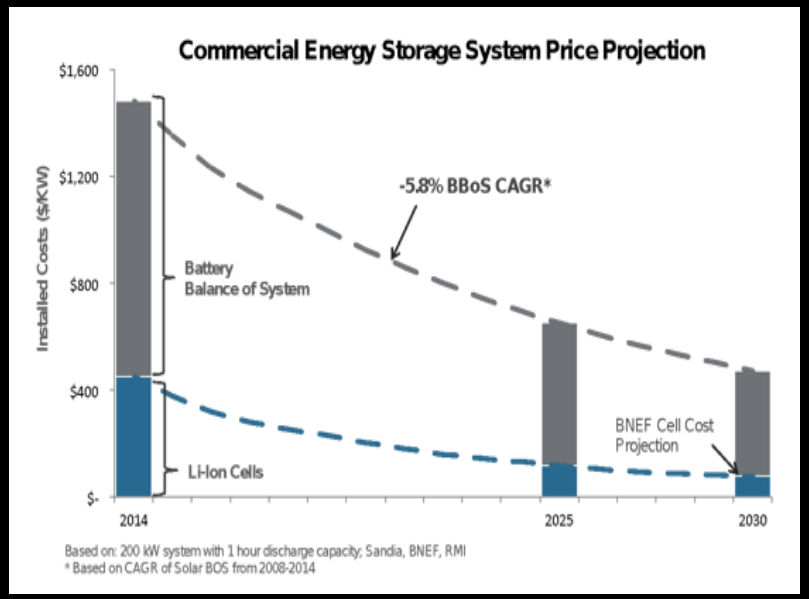




Tesla battery project in Hawaii

Falling costs of batteries are shaping future power system

Tesla battery project in Australia



Expected path of development

Deep digitalization of trading/DSO/TSO

Growing penetration of RES and DER

Further EU market integration

Deep decarbonization

Growth of zero-marginal costs resources

Electrification of transportation

Batteries and storage

Business as usual for the sector?

Necessity to (re)design EU Electricity Market

- **It is often claimed that development of the transmission and distribution network is an ultimate solution to all problems related to inefficiencies of current electricity market**
- **However, this message is not correct due to the following reasons**
  - Development of the network to the copper plate equivalent is economically unjustified - some congestion is economic
  - Rapid development of distributed generation, usually subsidized RES with variable output, brings uncertainty not only to electricity market but also to power systems operation and development
  - Development and management of elastic demand (DSR) requires appropriate price signals
  - Increase of cross-border trade across EU requires appropriate market mechanisms to ensure adequate level of coordination for long-distance power trades and level playing field for market participants from all countries
- **Therefore, appropriate market design, including congestion management mechanism, is a cornerstone of efficient management and development of a power system, giving correct incentives to all system users**

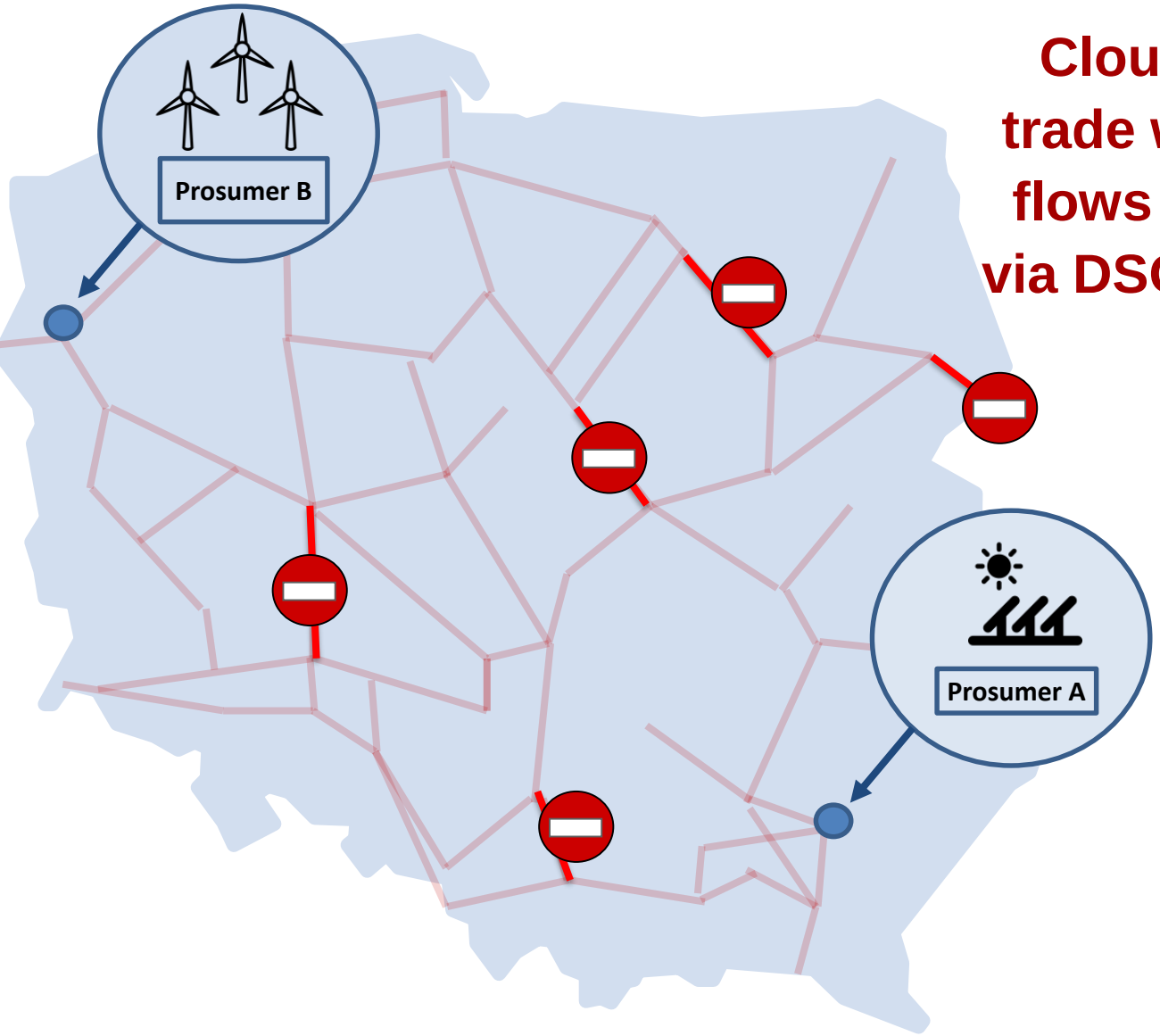
Why **incentive compatibility** is important?

- **Energy market is multitude of players with often conflicting goals**
  - Generators: make revenue from generation, allowing for new investments
  - Traders: exploit all arbitrage opportunities by trading different time frames and products
  - Consumers: satisfy their energy needs at most economical price and in a reliable way
  - Suppliers: sell energy in (long-term) retail contracts, managing the wholesale price risks

- **Prices coordinate the behavior of all these market participants and therefore directly affect both the market efficiency and system security**
  - If prices reflect grid and energy balance, price signals are consistent
  - Behavior in line with system needs (expressed by price) is remunerated
  - Behavior against the system needs is discouraged
  - Gaming opportunities between the different market segments are eliminated

Get the prices right, so that they provide correct incentives for all grid users, leading to efficient use of resources (transmission, generation, flexibility) while respecting system security

„Old market” meets the prosumers

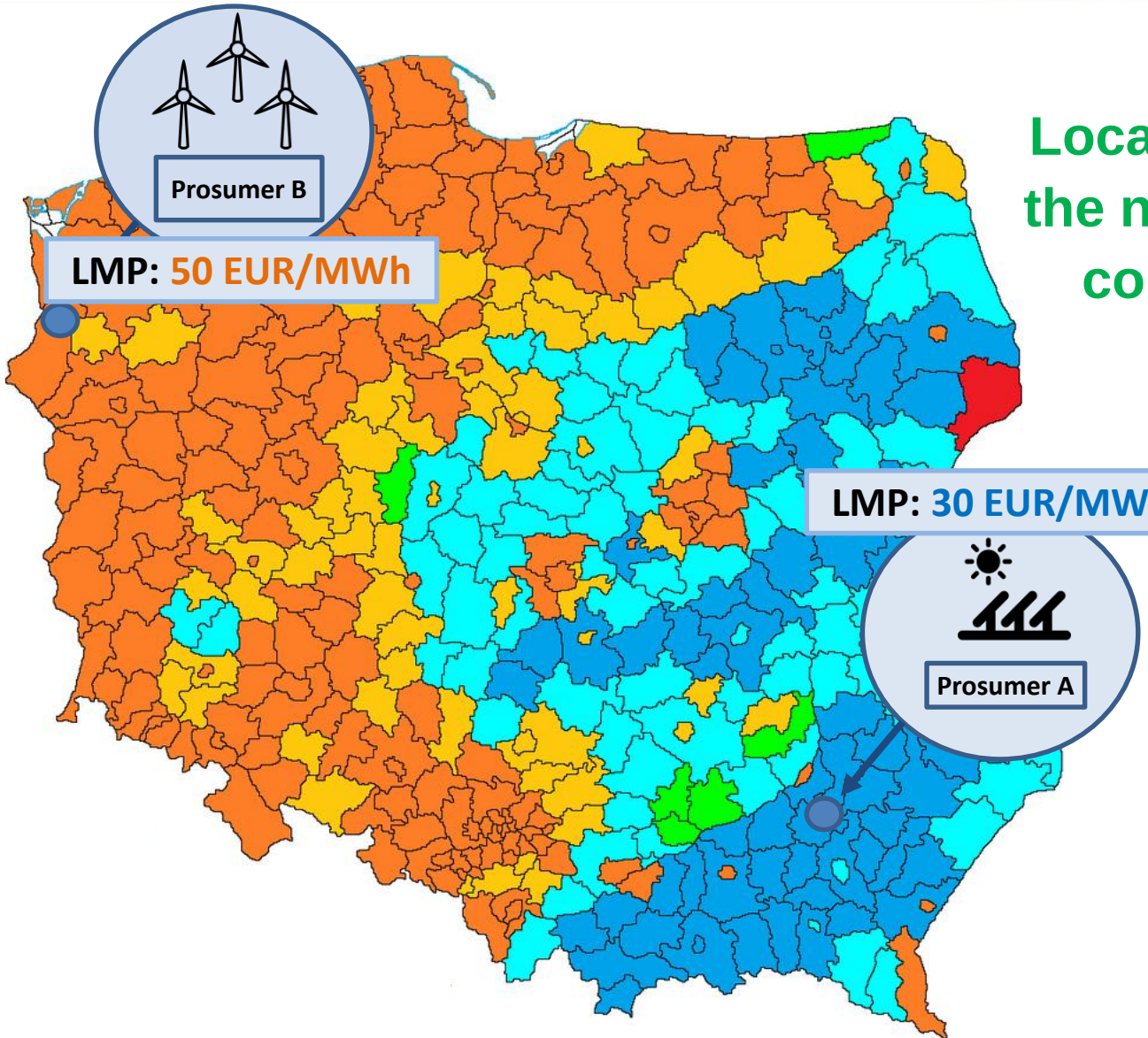


Cloud-based, AI-driven trade will lead to real-time flows across large areas, via DSO – TSO – DSO grids

Technical feasibility

Price-based coordination

Locational prices can coordinate behavior of prosumers and investors

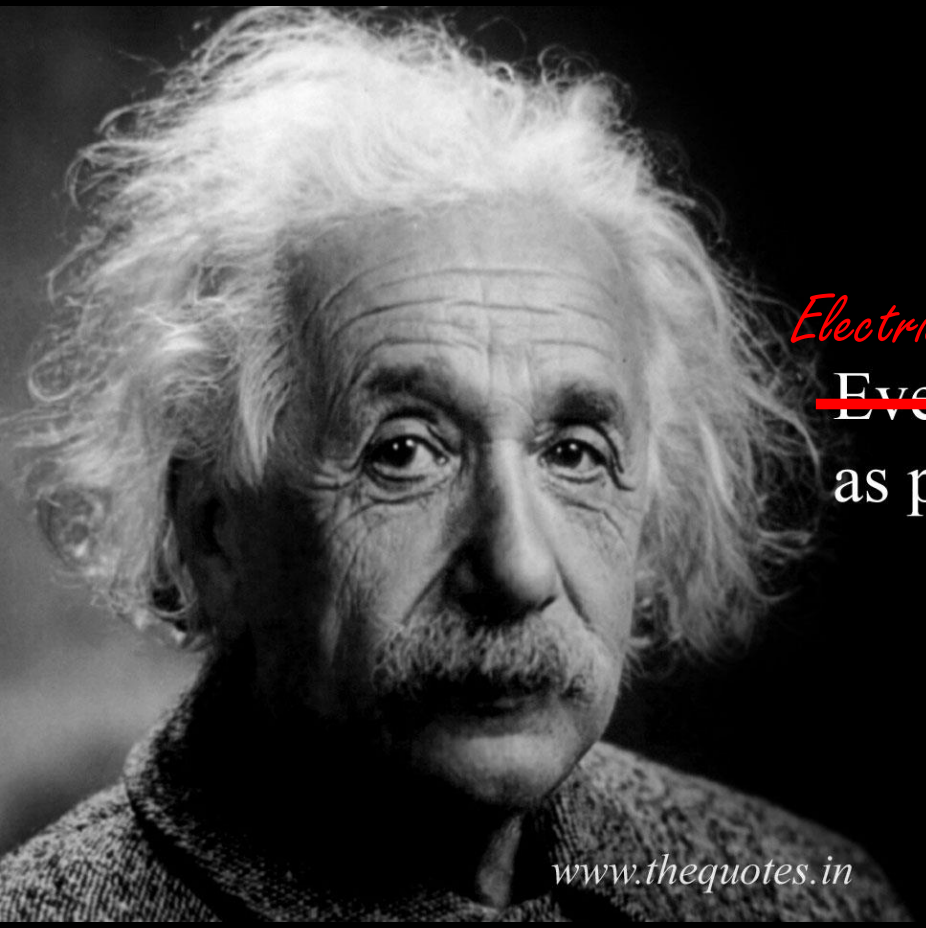


Locational prices reflect the needs of the system: consumers and grid

Technical feasibility ✓

Price-based coordination ✓

Nodal pricing (LMP) is the market design solution for managing future power system



Electricity Markets

~~Everything~~ should be made as simple as possible, but not simpler.

Albert Einstein

Thank you for your attention