

Power Market Design and Operation

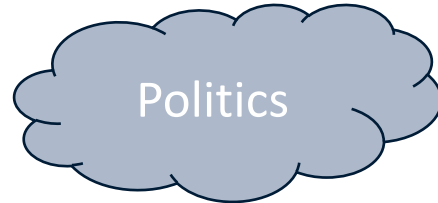
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A market reform is a process and not a project

- ... And it needs countries to be agile – support common market reform as well as individual strategies

National market reform (what is it?)



System Operator



Market Operator



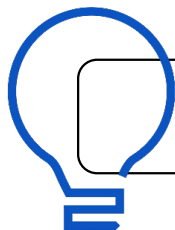
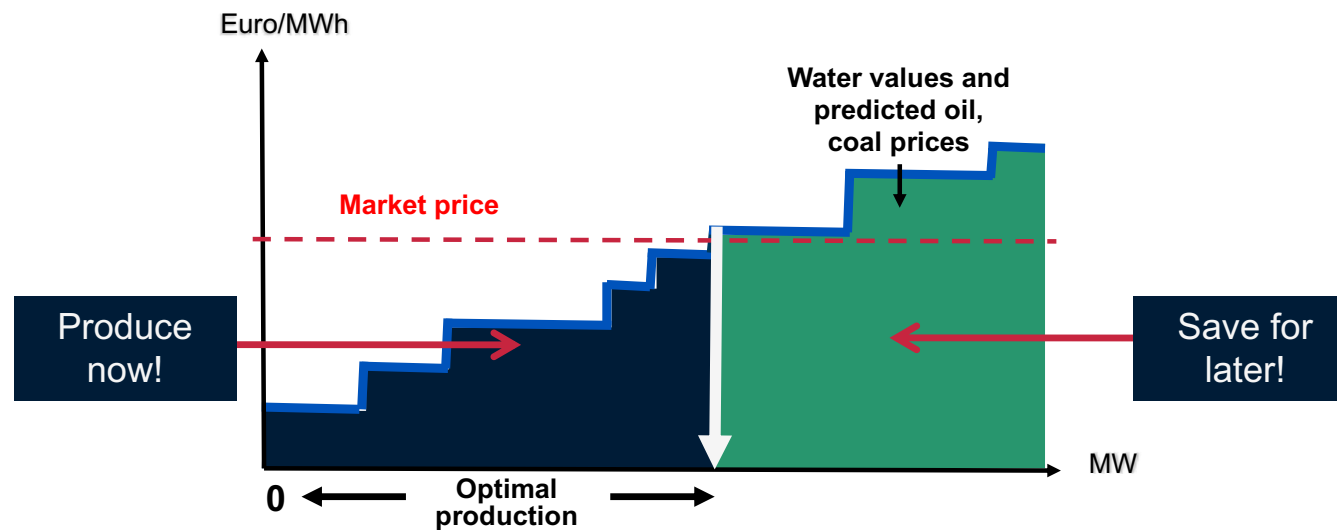
Bilateral trading (unregulated...)



In a competitive wholesale market – What are we trying to achieve?

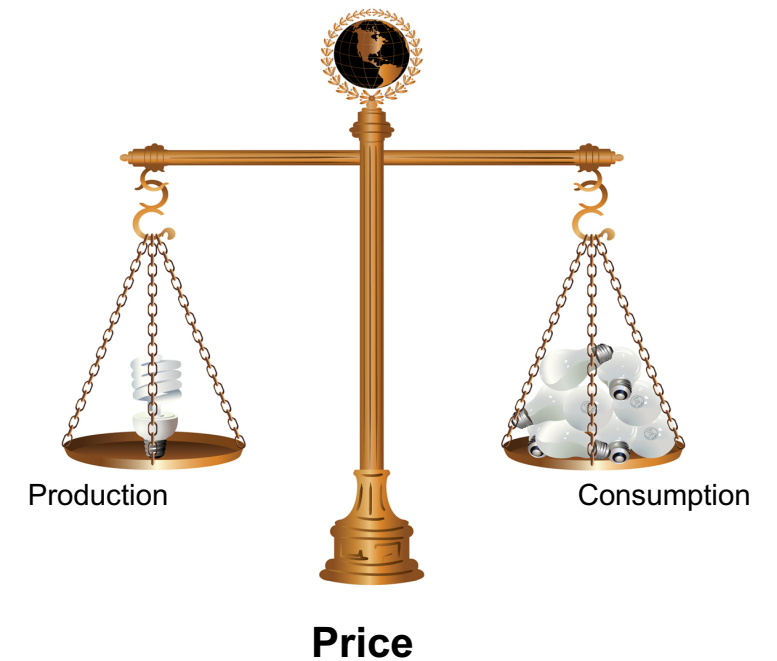
At a high level it is easy...

To Produce or not to Produce



The fuel value is the opportunity cost of producing now compared with producing in the future?

Market Principle



The power market: A happy marriage between economists and engineers - There is always a balance to be found....

...between competitive market with few limitations and a constrained real-time operation of the power system

The economist wants:

- Liquid markets
- Large trading area with no/few physical constraints
- Standardised products
- Large number of competing buyers and sellers
- No differentiation between the different buyers and sellers



The engineers wants:

- Market representation of the underlying physical power system
- Representative trading areas with physical constraints
- Customized products for the physical needs
- Deep knowledge of the sellers and buyers capabilities

The power market concept needs to take this in account in all market timeframes

A Market Driven by Planning

- The electricity market is driven by planning where the total assets and commitments must be balanced for every hour.
 - A buyer needs to estimate how much energy needed to meet customer demand for the next delivery day and the price to pay for this electricity volume.
 - The seller as the owner of power plants needs to decide how much he can deliver and at what price.
 - This has to be done based on the current market and electricity situation with a view to the company's short- and long-term strategy.

How to meet the new market requirements

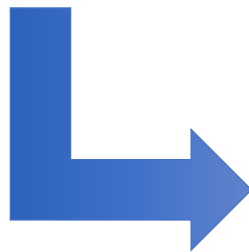
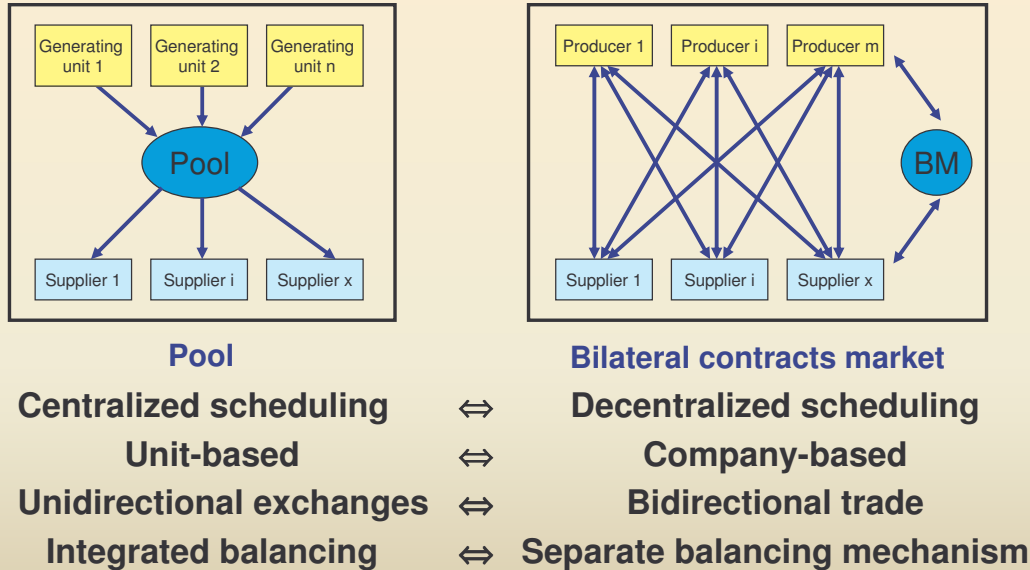
... But this is not the only path...

Characteristics	Monopoly	Single Buyer	Wholesale Competition	Retail Competition
Definition	Monopoly at all levels	Competition in Generation	Competition in Generation	Competition in Generation
Competing Generators	No	Yes	Yes	Yes
Choice for retailers	No	No	Yes	Yes
Choice for consumers	No	No	No	Yes

Increasing trend from monopoly towards fully competitive markets presents new requirements

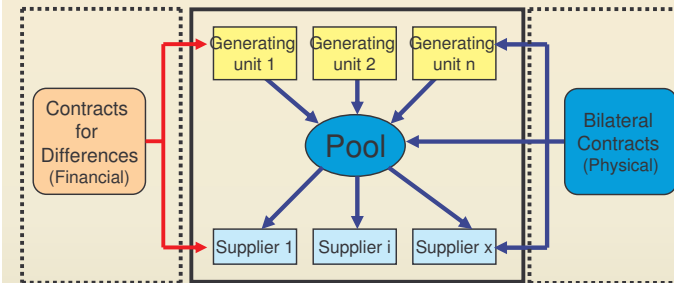
Historical evolution of market models

Pool vs. Bilateral Contracts Market



Convergence of Market Models

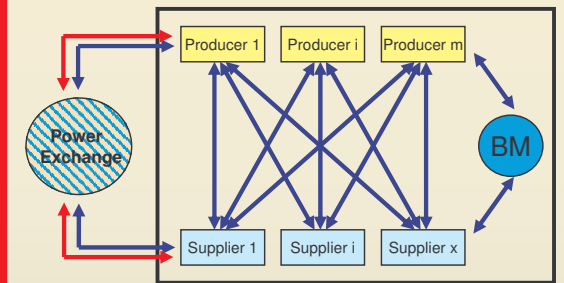
Pool market



Enable hedging

- Option 1: CfD (financial)
- Option 2: Allow bilateral trading


Bilateral contracts market



Gain benefits of centralised market

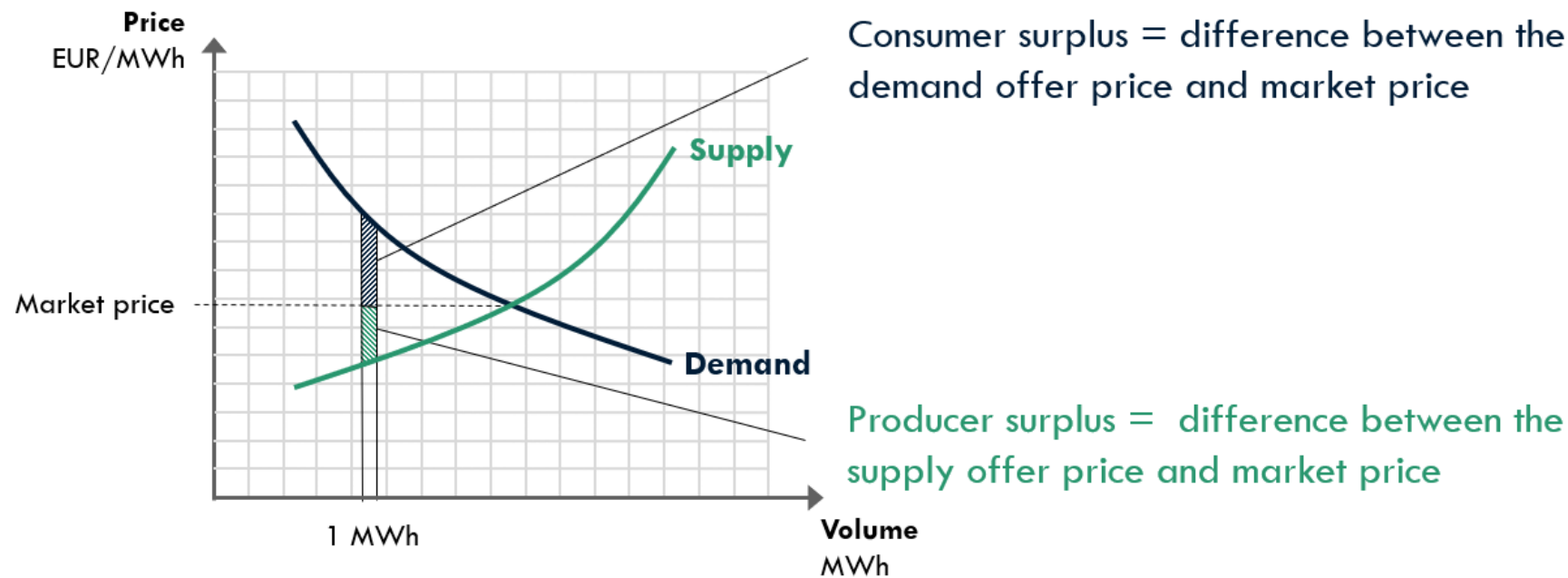
- Voluntary organised market (physical and/or financial)

In allocating roles between central bodies and market participants, market designs are often referred to as 'centralised' or 'de-centralised'

	Features associated with 'Centralisation'	Trend 	Features associated with 'De-Centralisation'
Physical	TSO constructs dispatch schedule and issues dispatch instructions to fulfil it	Central dispatch vs self dispatch	Parties self-dispatch, with TSO performing residual dispatch to adjust market positions
	TSO makes unit commitment decisions to turn plant on and off	Central commitment vs self commitment	Parties take own unit commitment (start/stop) decisions for their units
	Nodal pricing within an ISO area !!!	Locational vs non-locational	Zonal or national pricing over a very wide geographical area
Markets	Single marketplace option (for particular time frame)	Single vs multiple market (algorithm)	Multiple competing marketplace options (for particular time frame)
	Designated marketplaces are mandatory or exclusive marketplaces for physical trade	Exclusive vs non-exclusive	Flexibility to choose between different markets (most/all timeframes)
	Gross market (principally to settle positive volumes)	Gross or net market	Net (residual) market (principally to settle delta volumes)
	Designated trading windows with dead zones	Discrete vs continuous trading	Continuous trading opportunities without interruption
	Trades priced at common auction clearing price	Pay-as-clear vs pay-as-bid	Trade by trade specific pricing

Maximizing social economic welfare – the basis for all markets

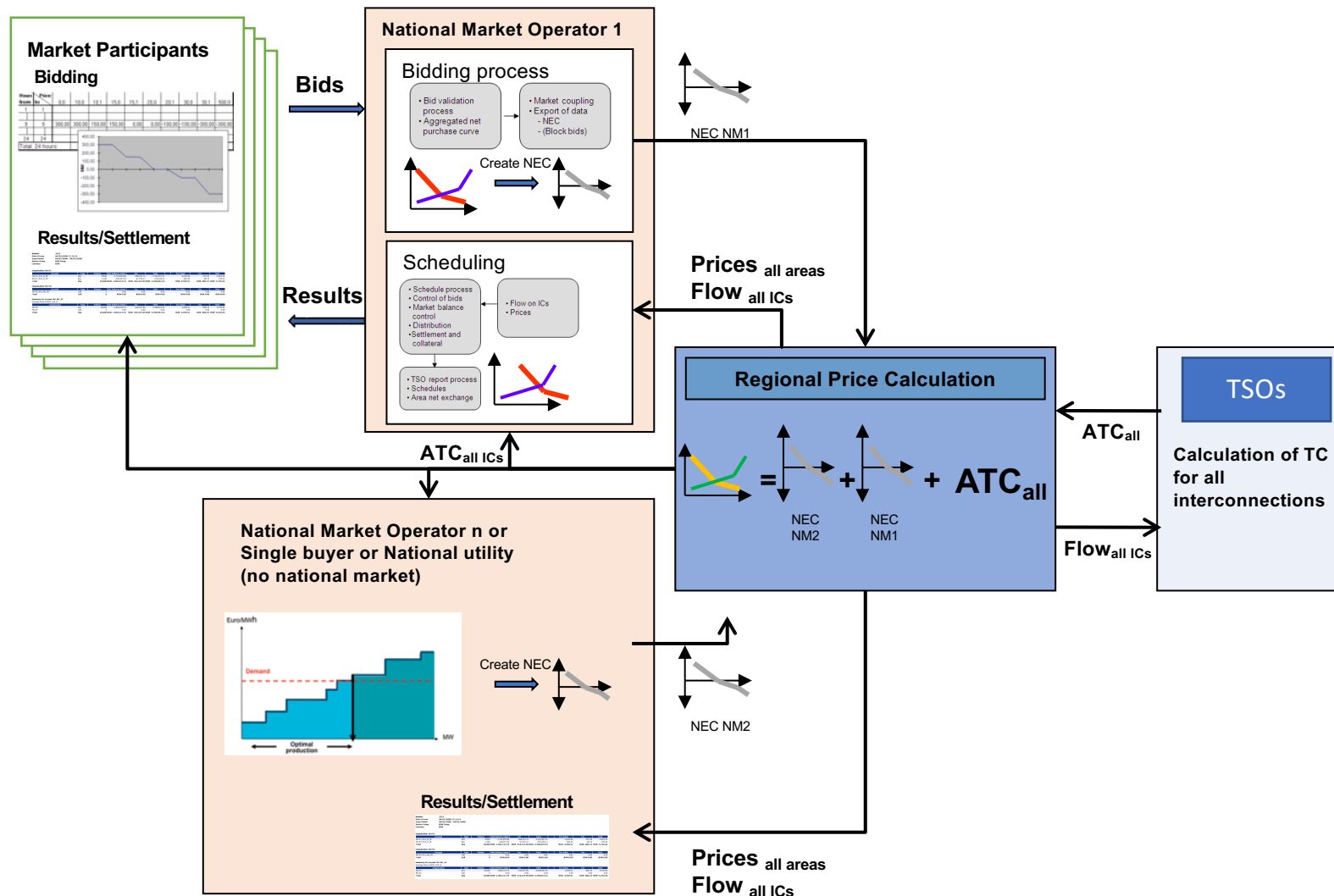
- Area between the buy and sell curves represent the total economic surplus of buyers and sellers for each hour. In addition, transmission network limitations can create congestion rent.



Optimising the seller and buyer surplus (while taking into account potential limitations in both orders and the transmission infrastructure) results in the maximum overall economic welfare.

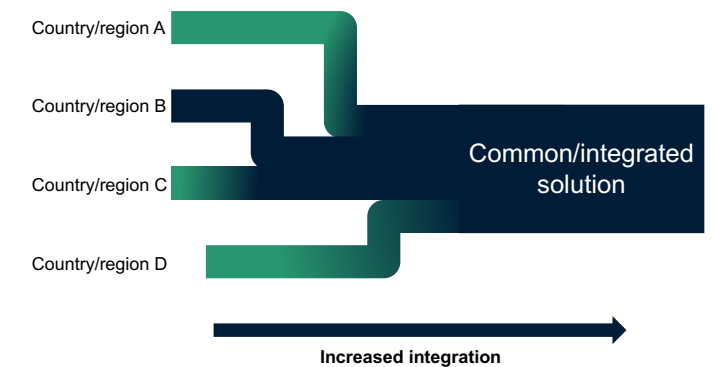
Regional markets – the need for a flexible approach

Allowing for regional cooperation, but maintaining national control of the assets



Flexibility is needed in:

- **Market design** – allowing future evolution of markets
- **Market Rules** – easy access to markets to new players
- **Market Platforms** – managing changes in the market framework
- **Legacy contracts** – respecting these
- **Market opening** – not a big bang where all join at the same time

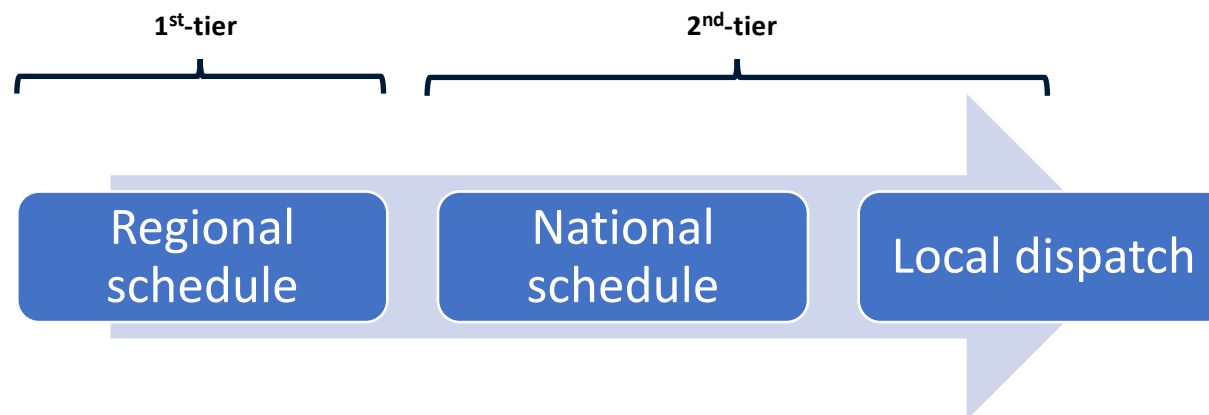


The regional market – two-tier dispatch

The primary purpose and criteria for the design of a regional power market is **optimal resource allocation and by this increase efficiency, enhance integration of renewable generation and reduce the overall cost of generation, including increasing the security of supply.**

To achieved this the concept is based on,

- Creating economic merit orders while taking transmission constraints into account
- Short-term optimizing of the power system and formation of a dispatch schedule from a regional perspective down to the local dispatch
- “Regional market”, connecting countries in a stepwise manner
- The regional trading provides (all or) parts of the interconnector flows between the countries
- The trades in the regional market is considered in the local dispatch together with the national schedule



You need a Market reform team – to guarantee a holistic design

- **Defining the necessary qualification of the team.** The minimum requirements include: political skills to ensure the political support is maintained, legal and regulatory experience (ideally both internationally and nationally) to discuss and develop the governance model; economic and market expertise to design the transitory and future market design; as well as detailed technical knowledge of the current South African power sector from both generation, transmission and distribution point of view. International experiences indicate that this team should be 4-6 people.
- **Defining the mandate and tasks of the team.** The mandate shall cover who is the sponsor of this team politically, what are the required reporting, mandate and budget to procure the required consulting services. What is imperative is that this team will lead the overall market reform and thereby be the guarantor that the various projects meet the overall objectives. This would mean that the team will be established for **several years** to follow the market reform and its project implementations.



The stepwise market implementation

- **Main targets:**

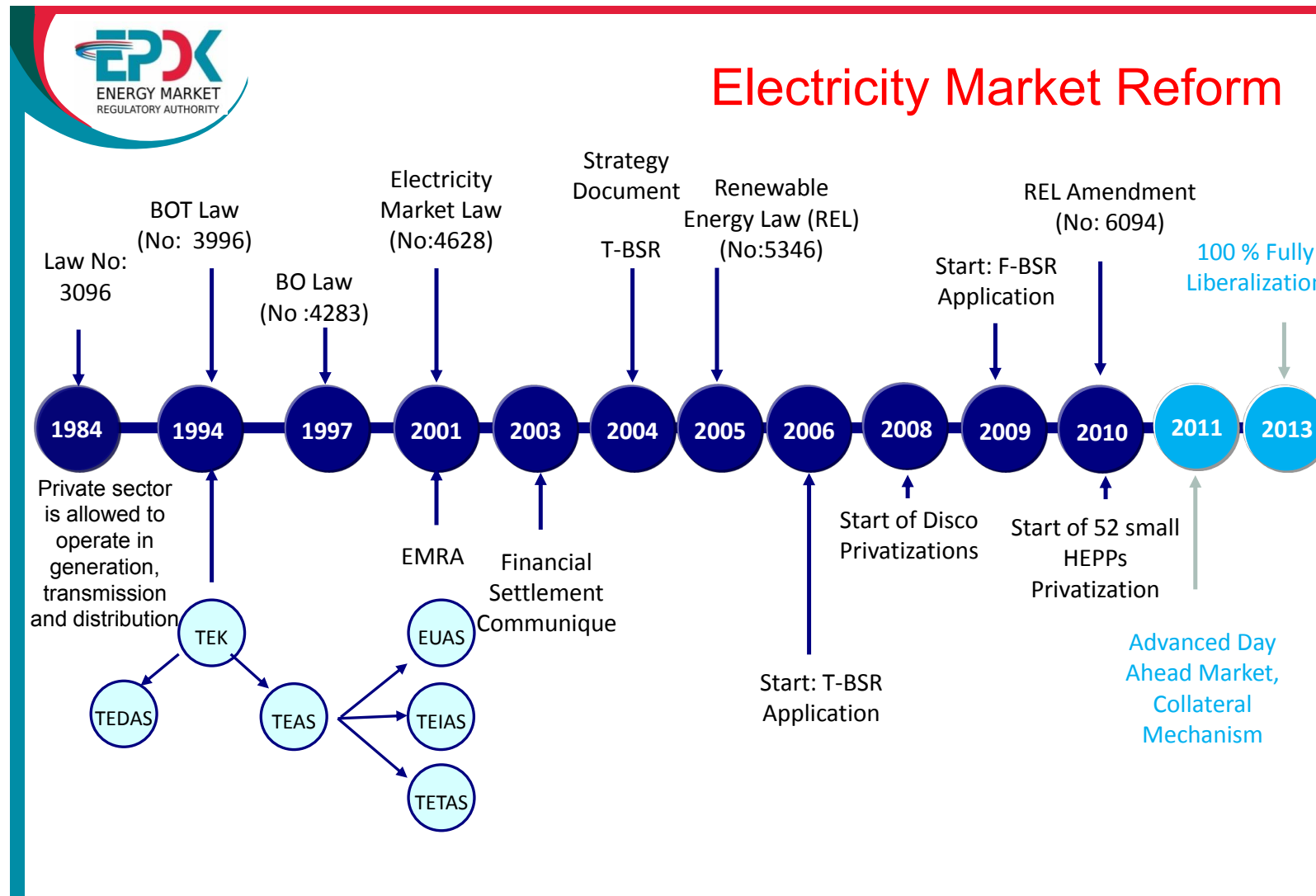
1. **Economic-driven price signals**
2. **Regain trust in the system**
3. **Support the energy transition and the technology disruption**

- moving towards ***unbundled, cost-reflective tariffs*** to better reflect electricity services
- .. while increasing ***security of supply*** and ***reduce load shedding***



You need a long term strategy to succeed

- An example from Turkey



SPV supporting the transitions in Market reforms – Based on Contract for Difference regime(s)

What is the measure?

- Replacement of existing Power Purchase Agreements (PPAs) and Universal Service Supply (USS) arrangements with Contracts for Difference (CfD's)
- Implementing RES support while supporting the market
- Might be a solution for potential stranded assets
- Generally - a vehicle for all “non-market based solutions” and also a transitory vehicle
- A well-known tool to manage both transitions as well as longer-lasting support schemes.

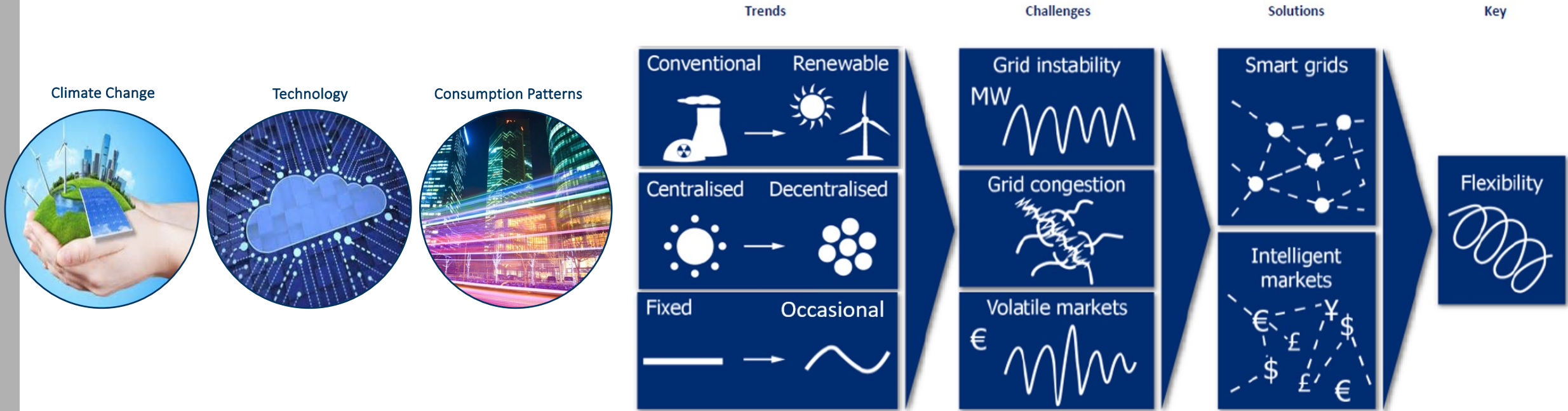
Why?

- Protection of end-consumers from overpriced electricity.
- Increased market liquidity.
- Transparency of true underlying price of electricity.
- Reduced exposure to market volatility for the party receiving the CfD than would otherwise be the case.
- No financial detriment caused by switch from PPAs to CfDs.

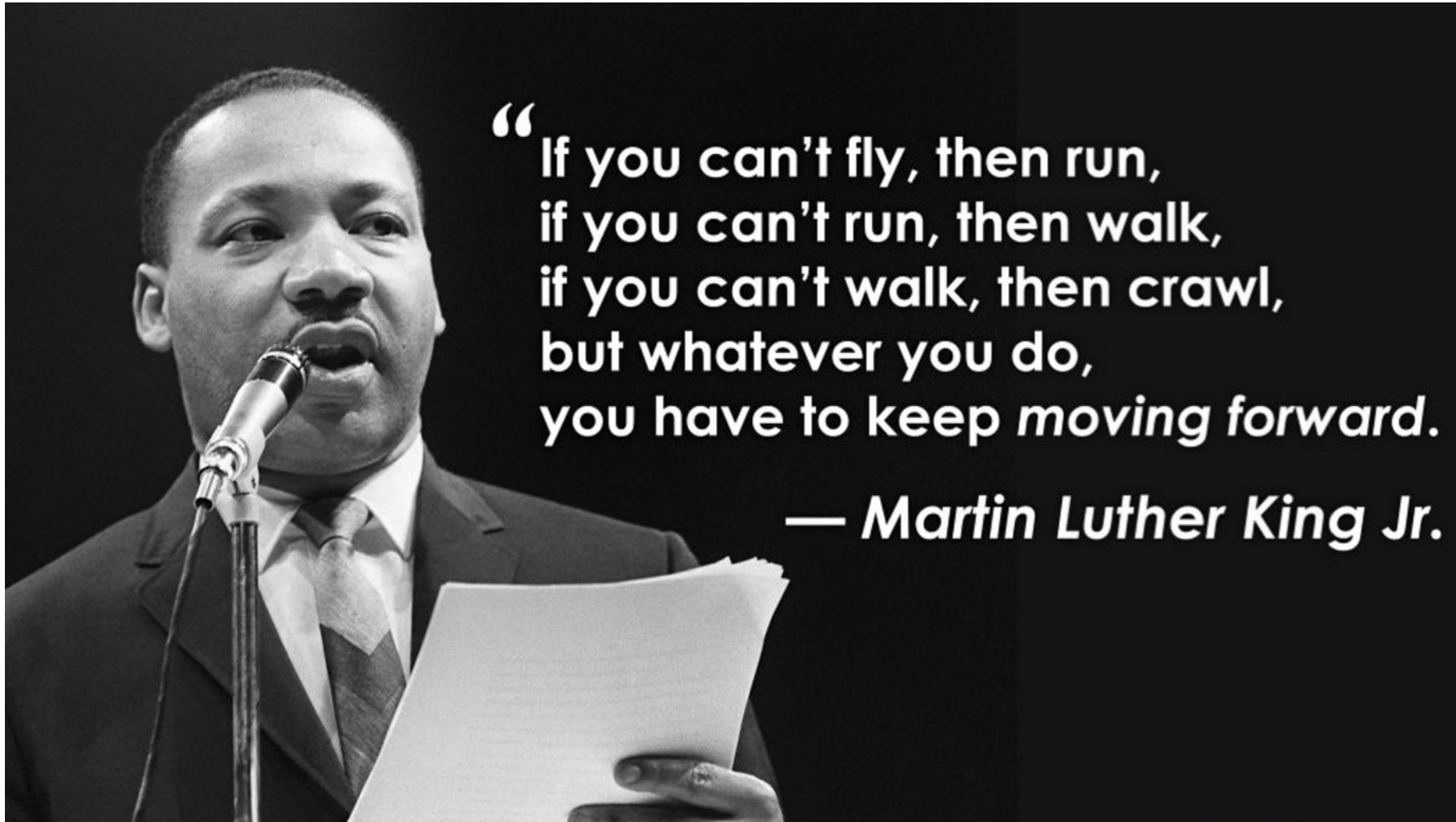
Which parties can be affected?

- Market participants previously on a bilateral power purchase agreement (PPA)
- Market participants with a Public Service Obligation for Universal Service Supply (USS)
- All market participants who have independently entered into a private PPA

Global drivers for change – flexibility is the solution

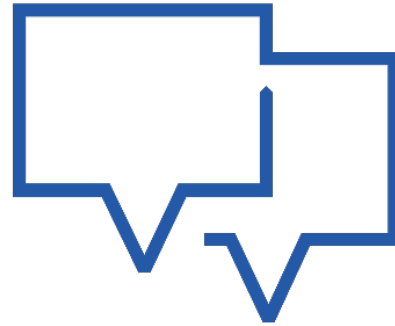


Words of wisdom: (my favorite market reform quote):



“If you can't fly, then run,
if you can't run, then walk,
if you can't walk, then crawl,
but whatever you do,
you have to keep *moving forward*.”

— *Martin Luther King Jr.*



Discussion
&
Questions



Profile – Hans-Arild Bredesen


Hans-Arild has 25+ years of experience from international projects in the energy sector

Consultant

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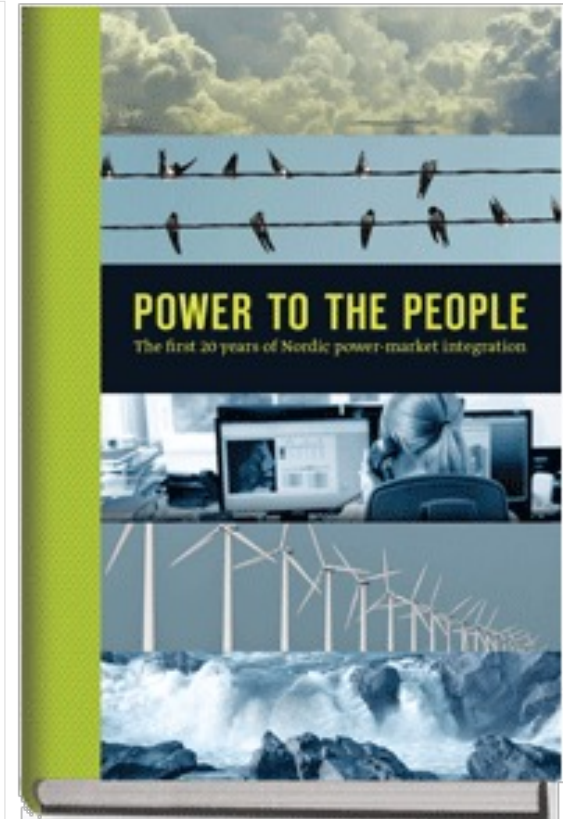


Education and Experience

- BSc in Computer Science from Høgskolen I Østfold, Norway
- Involved in the electricity deregulation process since 1992.
- Technical project manager for the market systems at Nord Pool
- Former CEO of Nord Pool Consulting
- Product manager for wholesale energy market participant systems for the Nordic market.
- Wide international experience from key roles in the development of strategies for trading, scheduling and settlement systems for PXs and TSOs in Nordics, EU, California, Ireland, China, India, Central and Southeast Asia, Southern and Eastern Africa plus South-east Europe (both regional and Vietnam and Philippines).
- Board member of NODES – the European marketplace for local flexibility.
- Author of the book “Power to the People”

Selected Project References

- **Southern African national market reforms**
South Africa: development of a Market Code, market structure
Namibia: Supporting Nampower developing the MSB
Zambia: Market structure, design and rules for the Open Access
- **Southern African Power Pool (SAPP)**
 Supporting SAPP since 2006 with market rules and regulations, design and implementation of their regional market.
- **Eastern African Power Pool (EAPP)**
 Responsible for the recommended market design and capacity building as well as regulatory development.
- **Implementing a Wholesale Market Opening for SEE (South-East Europe)**
 Creating a regional market design, develop an action plan and support in the implementation of a wholesale market in SEE.
 Various market design and implementation projects for **Romania, Turkey, Albania, Bulgaria, Croatia, Georgia, Moldova and Ukraine**
- **Setting up a national power exchange for India (2006)**
 Development of market rules and regulations, design of the market concept for a national Power Exchange in India.
- **Designing the Chinese national market**
 Supporting NEA with market design and market rules for a national market in China including a lot of capacity building
- **ASEAN/GMS regional market initiatives**
 Supporting ADB and UN ESCAP in various initiatives for development of a regional market (incl IEA report)



Regional markets – will it provide affordable prices?

ACER has recently done an in-depth study of the impact of the EIM in light of the events the last period

Case: Cross-border trade delivers substantial benefits and mitigates price volatility

To estimate the benefits from cross-border electricity trading in Europe in 2021, ACER asked the European NEMOs to conduct an analysis for 2021. It compared actual 2021 market results ('historical' scenario) with a scenario where all cross-border capacities were set to zero (the 'zero scenario', implying no electricity trade across Member State borders)⁹. The difference in welfare benefit between the historical and the zero scenario (see Figure 11) is a proxy for the yearly welfare benefits currently obtained from cross-border trade in day-ahead markets. The benefits of cross-border electricity trading amounted to around 34 billion Euros in 2021 (source: ACER based on NEMOs). More than one third of these benefits correspond to the last quarter of 2021, when power prices were at their highest.

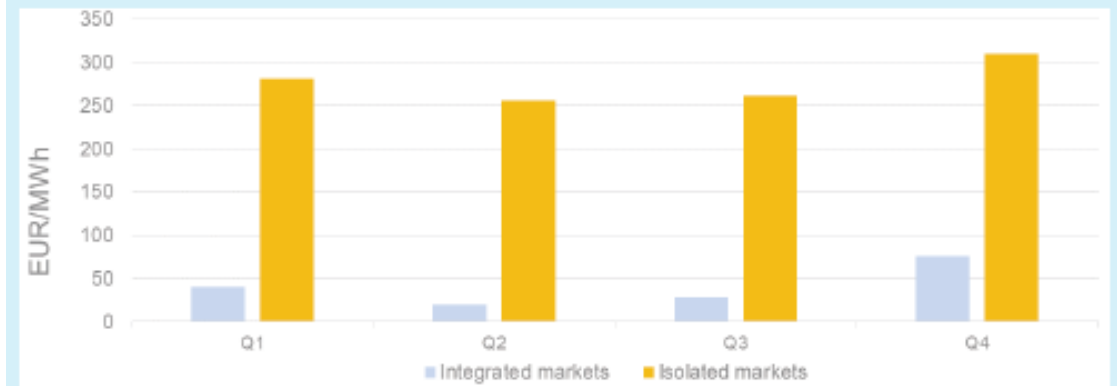
Figure 11: Estimated monthly welfare benefits (Billion EUR) from cross-border electricity trade in 2021



Source: ACER based on NEMOs' simulations.

In addition to the considerable savings associated with the current level of market integration, the analysis shows that this integration also reduces significantly price volatility. Figure 12 displays the differences in average price volatility between the two scenarios. It shows that price volatility would have been considerably higher (around seven times as high) if national markets were isolated.

Figure 12: Price volatility (EUR/MWh) in integrated and isolated electricity markets in the EU in 2021



Source: ACER based on NEMOs simulations.

Volatility was estimated by using the standard deviation of day-ahead wholesale prices. The standard deviation was calculated per bidding zone for the whole year, then averaged out across the EU.

*“Overall, in 2021, cross-border trade delivered an estimated **34 billion Euros** of benefits while helping to smoothen price volatility.”*