



AMEU/SAIEE joint virtual webinar

“THE DIGITAL MUNICIPAL Dx ELECTRICITY UTILITY OF THE FUTURE”

25 August 2022

Session 6 (Theory/Case Study)
DX Electricity markets and trading
By / Hans-Arild Bredesen



What are we trying to achieve?

Combining the short term goals with a long term strategy is the most important



(c) <http://toten-troll.no>

A market reform is a process and not a project

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

National market reform (what is it?)

Politics



NERSA

System Operator



Market Operator

Transmission

Distribution

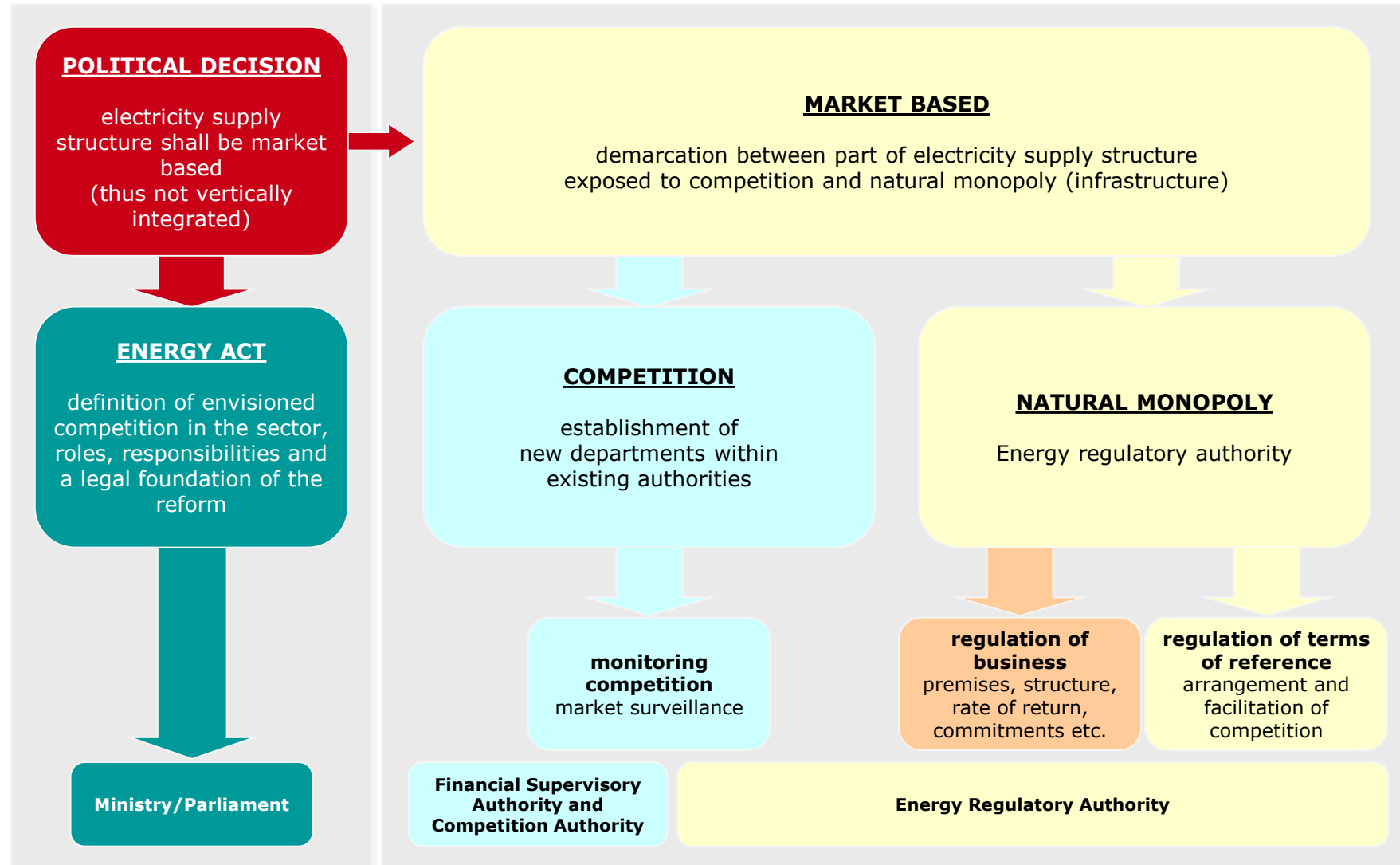
Generation

Retail



Bilateral trading (unregulated...)

Legal and regulatory framework for a market reform – Scope, laws provisions



How to meet the new market requirements

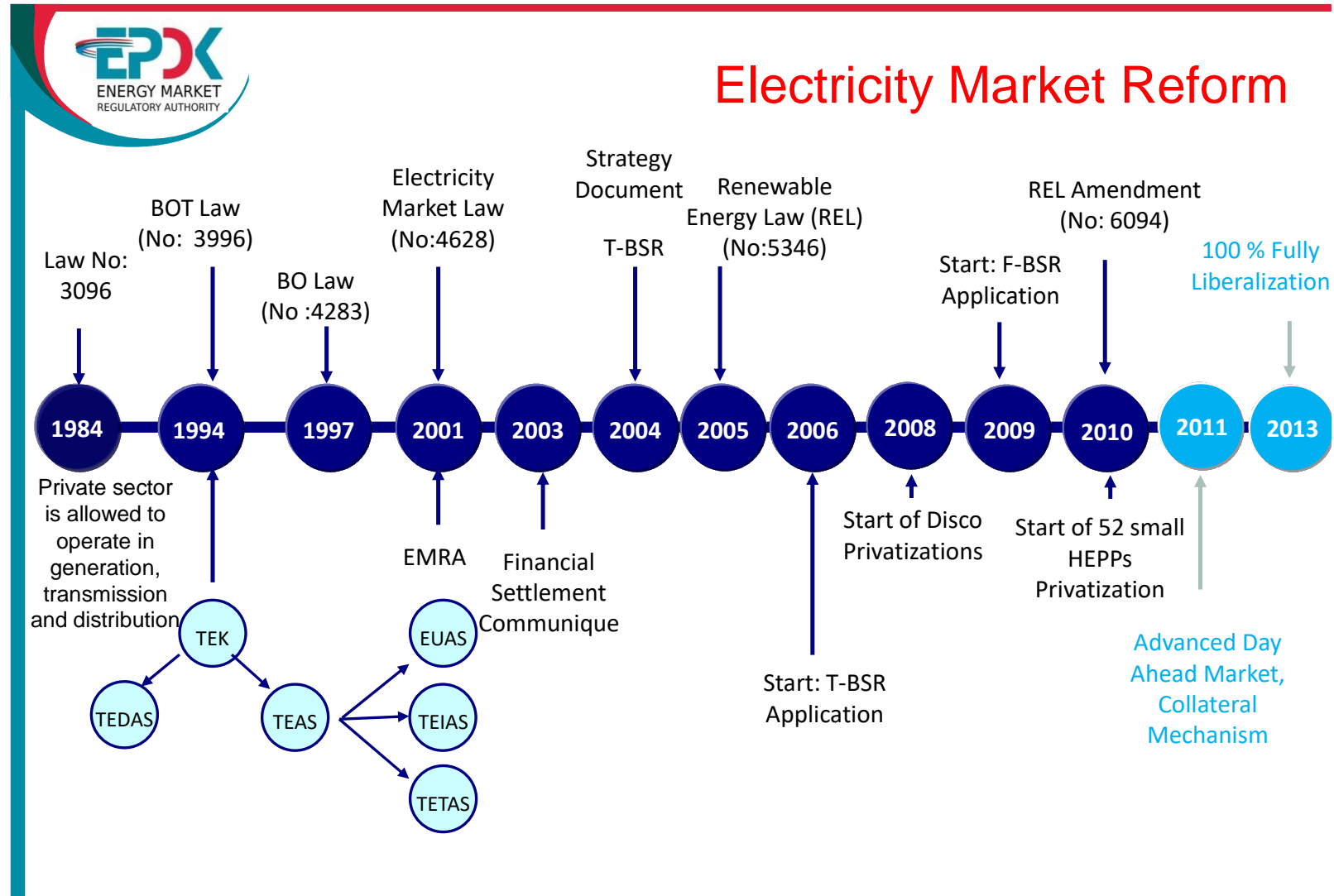
.... But this is not the only path...

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

You need a long term strategy to succeed

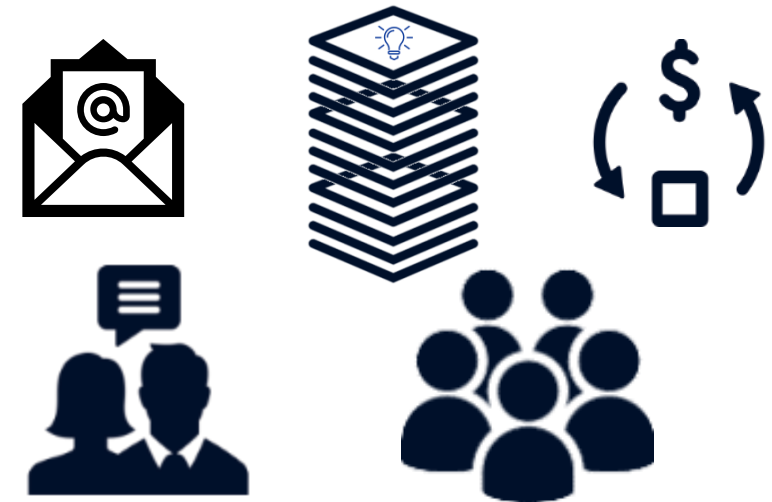
An example from Turkey



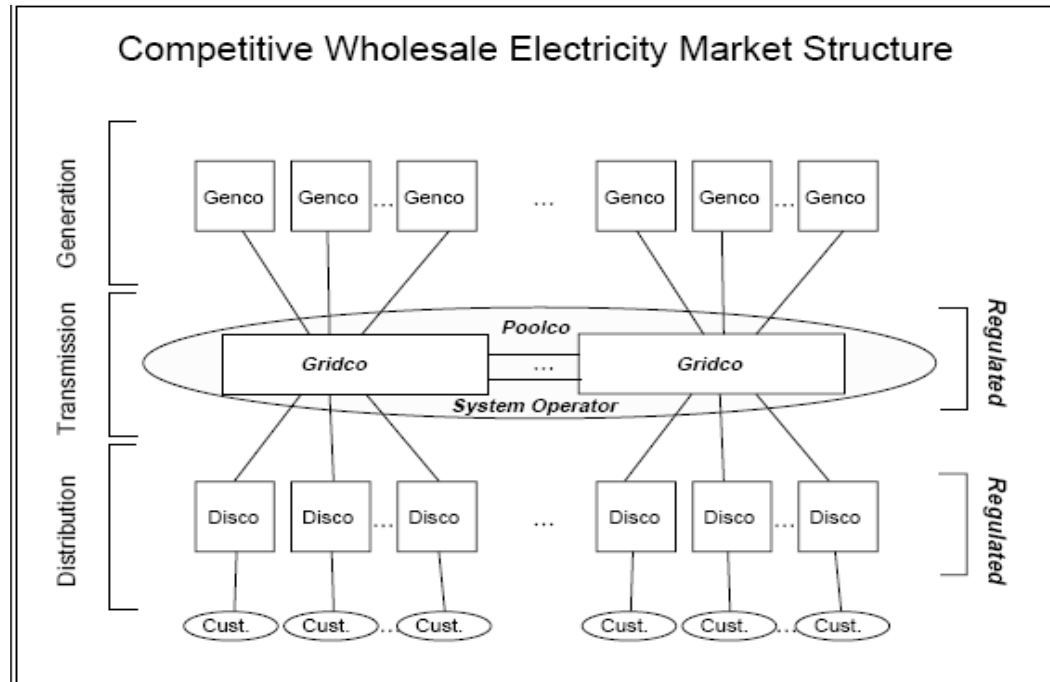
You need a Market reform team – to guarantee a holistic design

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.



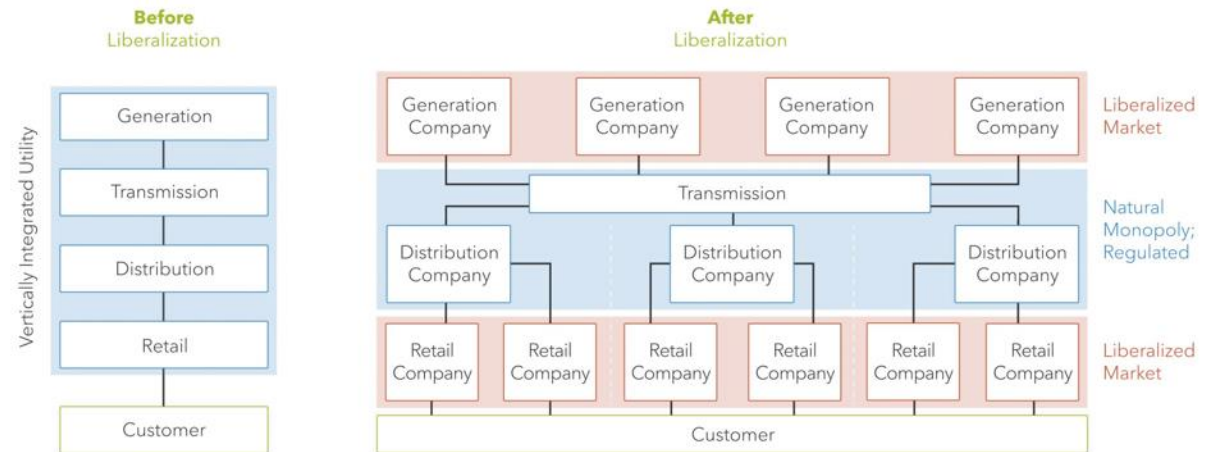
Generic best practice on Market Structure



Source: Hogan, 1998

The starting point

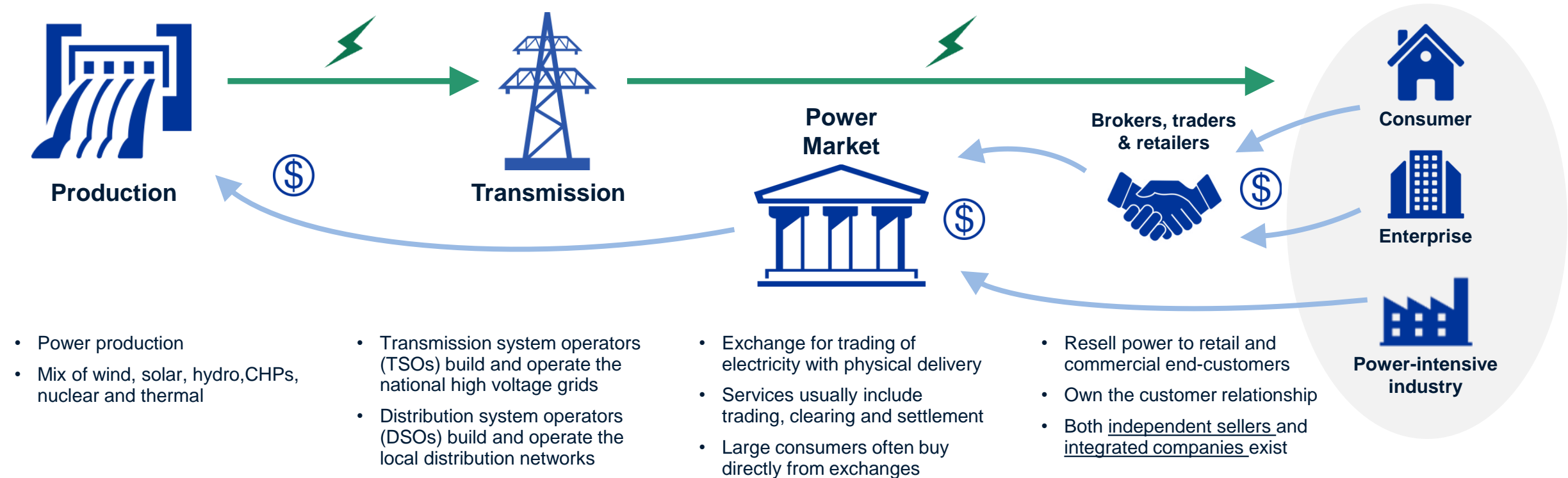
Liberalization of Energy Markets



The best practice

Overview of the electricity value chain

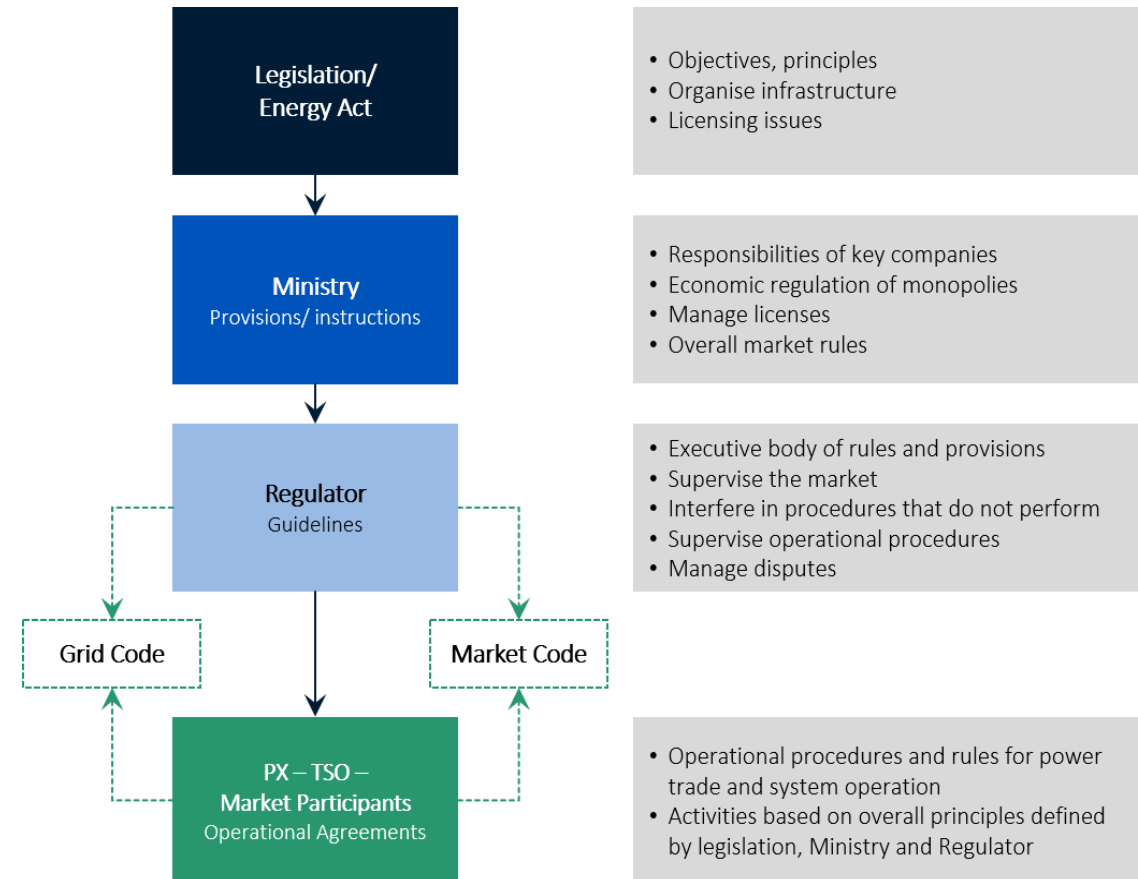
DSOs and retailers play an important role in the value chain



Unbundling needs Independent regulators and proper governance

The question of «independent Regulators»

- ▶ TSOs and DSOs ***must be regulated*** (not in competition on a given territory)
- ▶ Example: EU law asks for Regulators « independent from any other public or private entity »
- ▶ Necessary in Europe because of many state-owned utilities (conflict of interest for several governments)
 - The same for South Africa!



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 want:

- 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

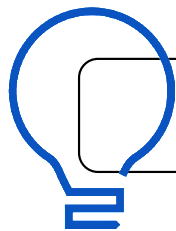
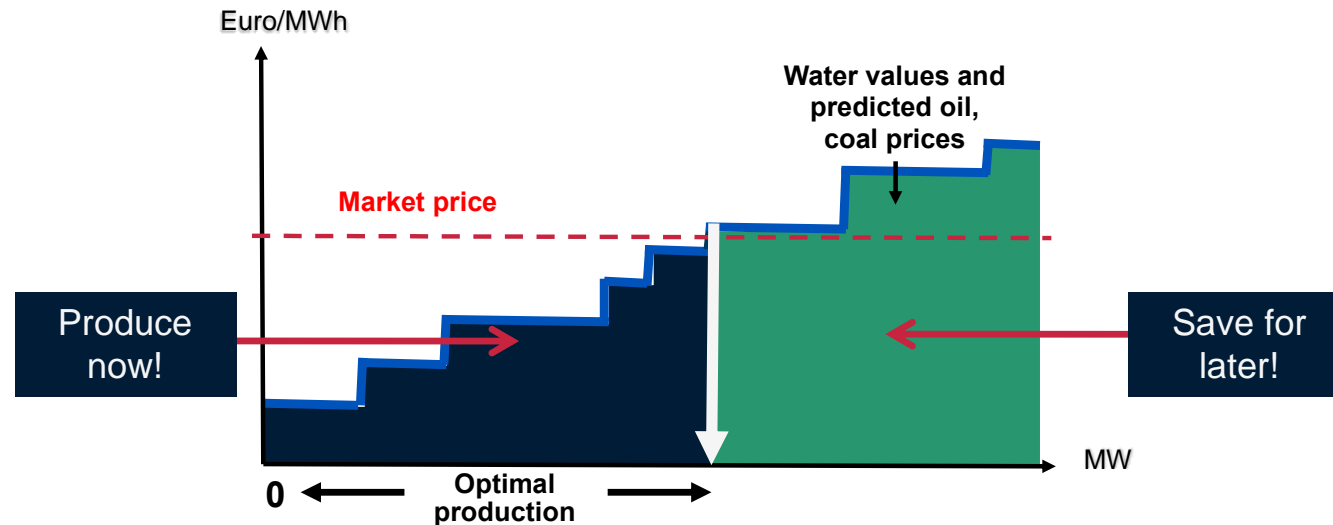
The power market concept needs to take this in account in all market timeframes

What are we trying to achieve in a market reform?

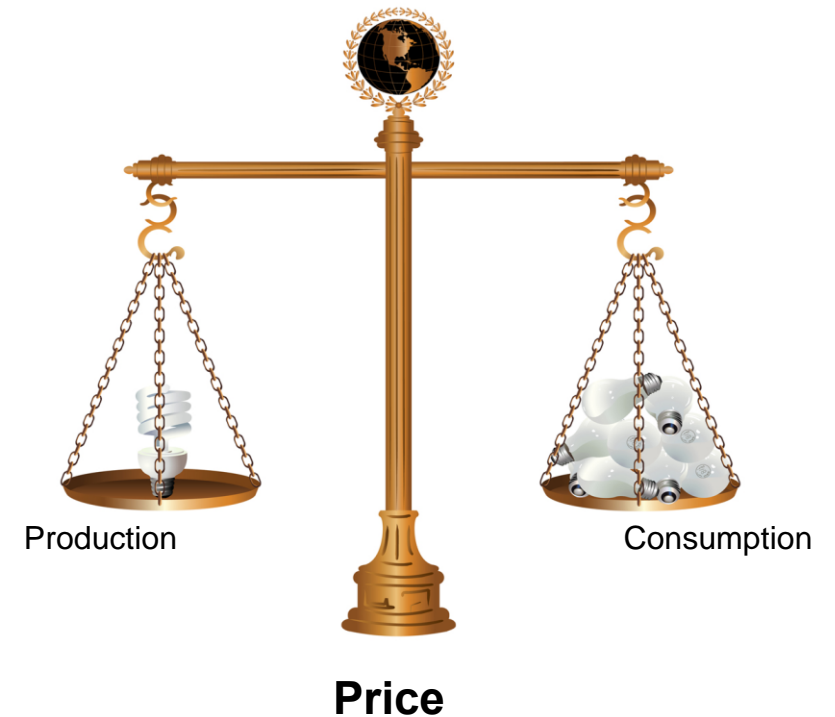
At a high level it is easy...

To Produce or not to Produce

Market Principle



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



The stepwise market implementation

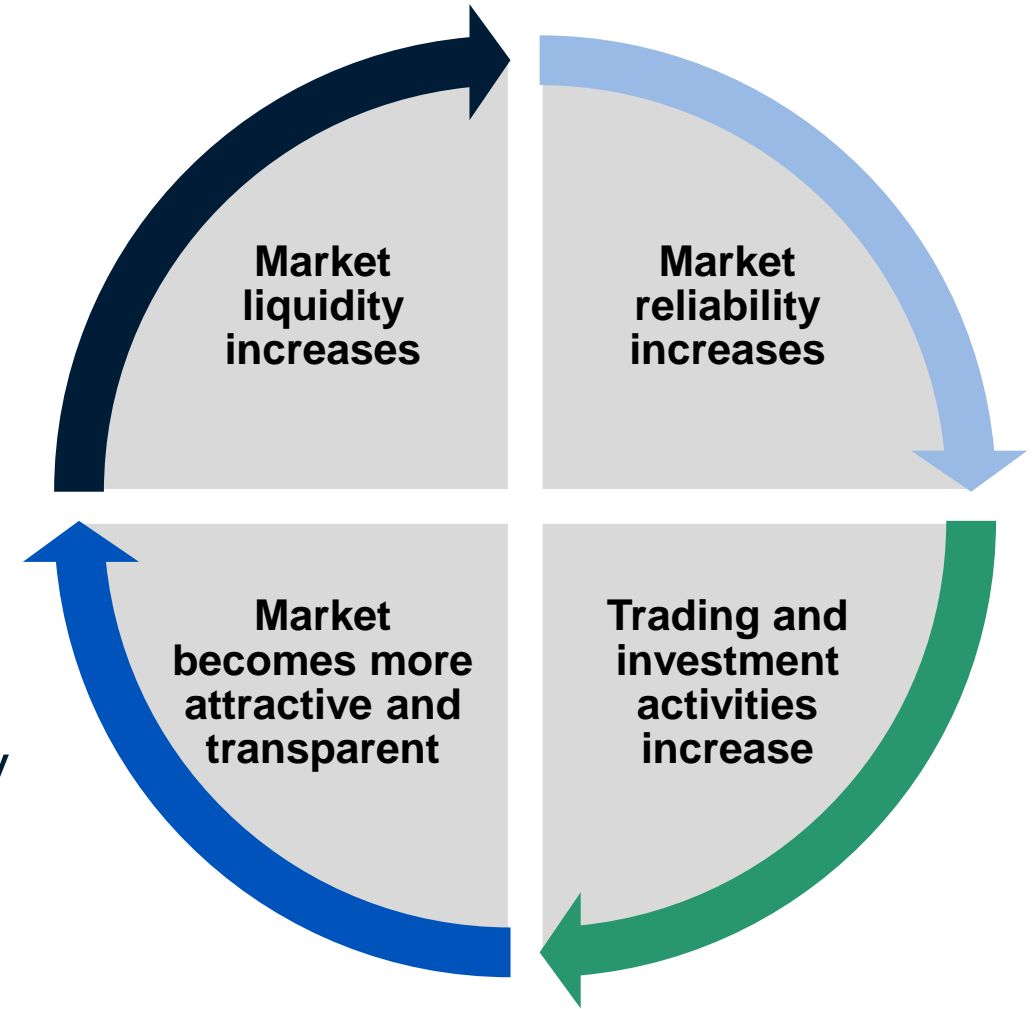
Virtuous circle of market liquidity and transparency

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***

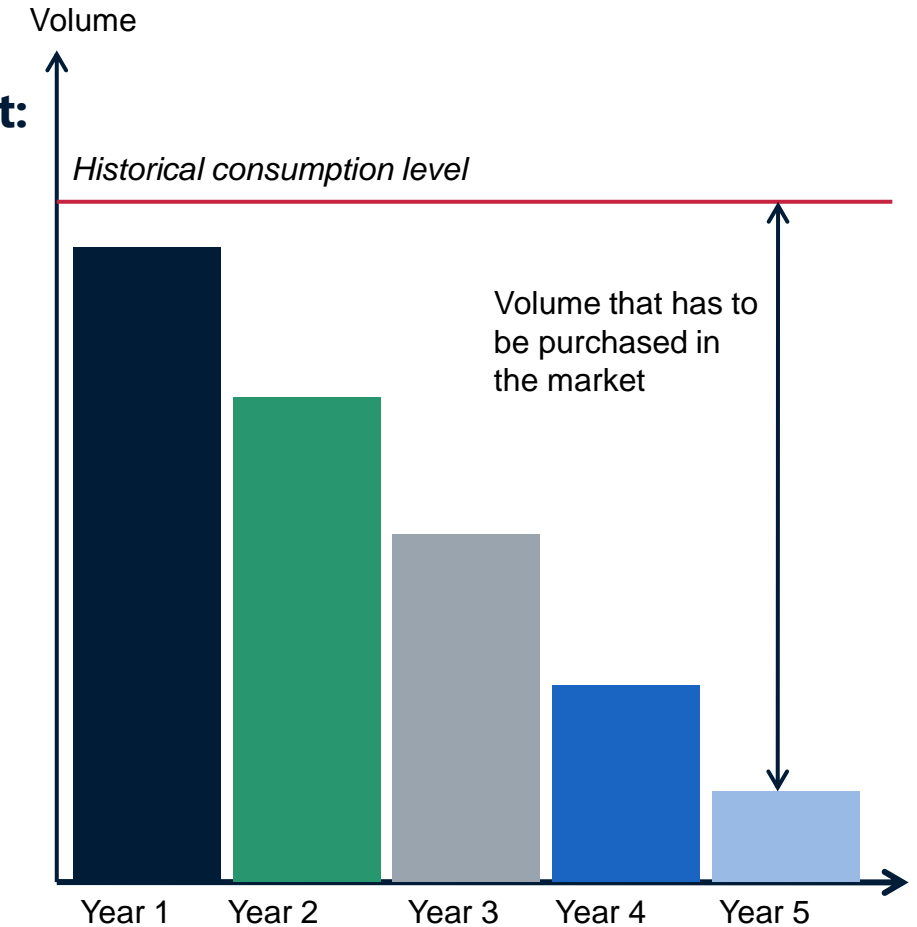


International best practices for a market reform

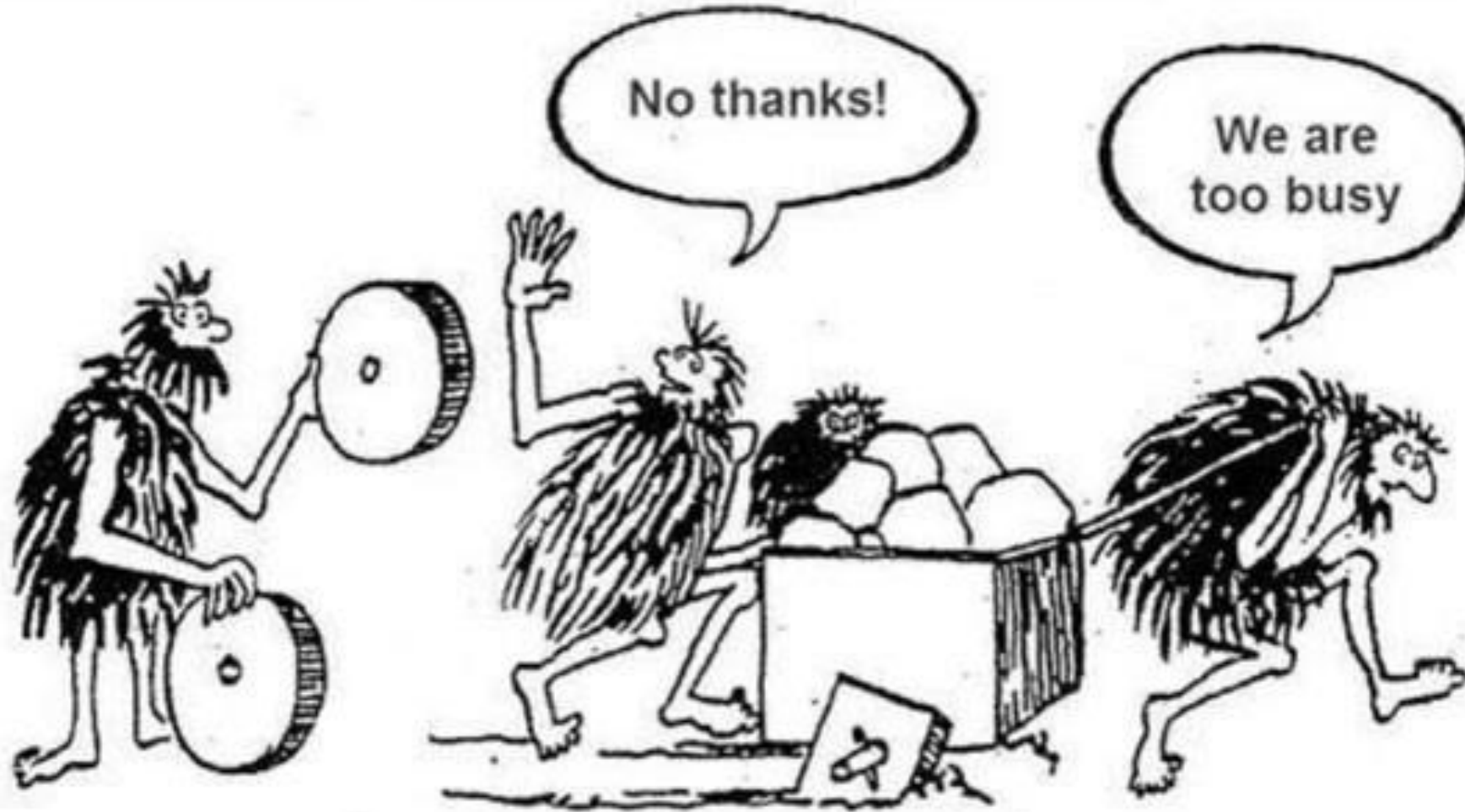
STEPWISE – is a key word

In all aspects of market reforms, stepwise is equally important:

- ▶ New market designs
- ▶ Market restructuring
- ▶ Market opening to new participants
- ▶ ... we don't want California all over again
- ▶ **What went wrong there?**
 - Nothing wrong with high-level design, but:
 - Big bang implementation
 - Nobody understood why, how and what
 - Mix of free and regulated market with really bad outcome



This is also true.... You have to take the time



A Market Driven by Planning

The electricity market is driven by planning where the total assets and commitments must be balanced for every hour.

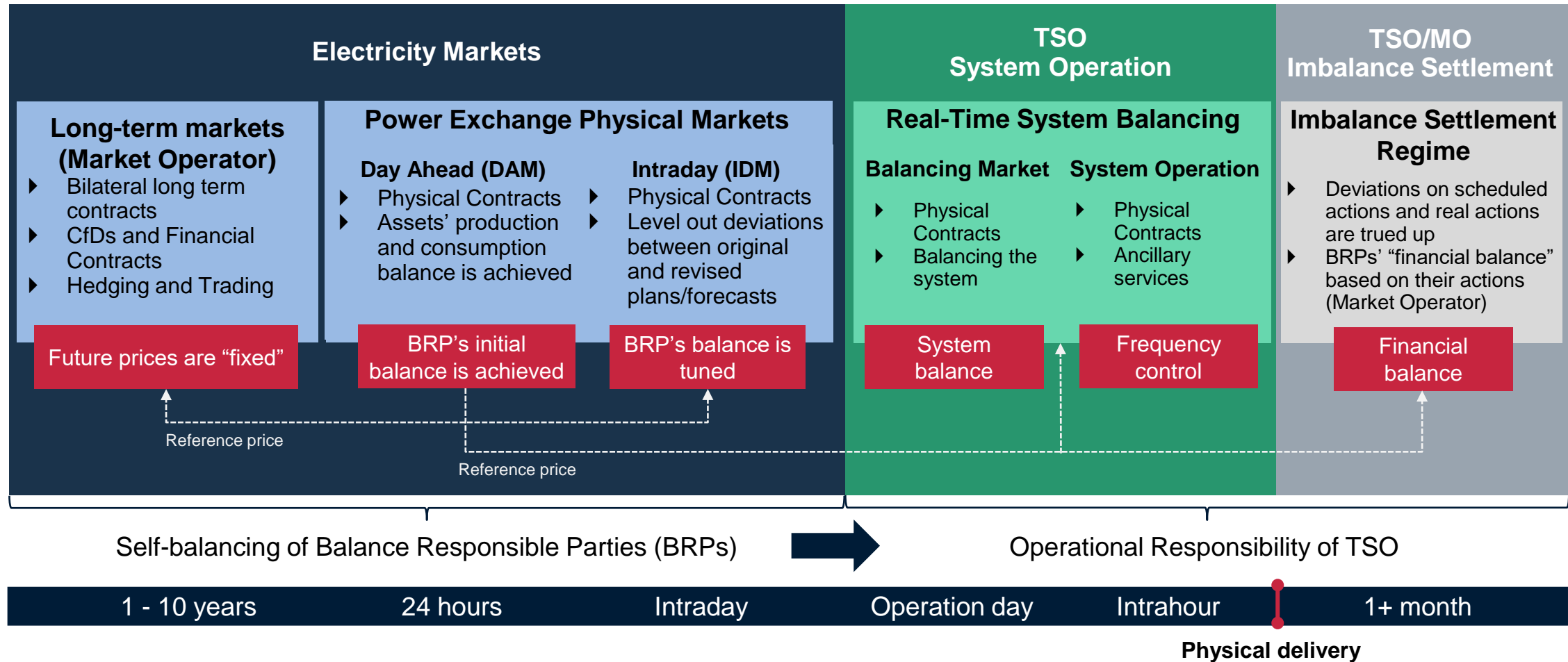
- A buyer needs to estimate how much energy needed to meet customer demand for the next delivery day and the price to pay for this electricity volume.
- The seller as the owner of power plants needs to decide how much he can deliver and at what price.
- This has to be done based on the current market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

The current South African power market design



There is an internal market within Eskom – but what will be the future?

The European target model contains several power market segments for different purposes – a holistic design



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.

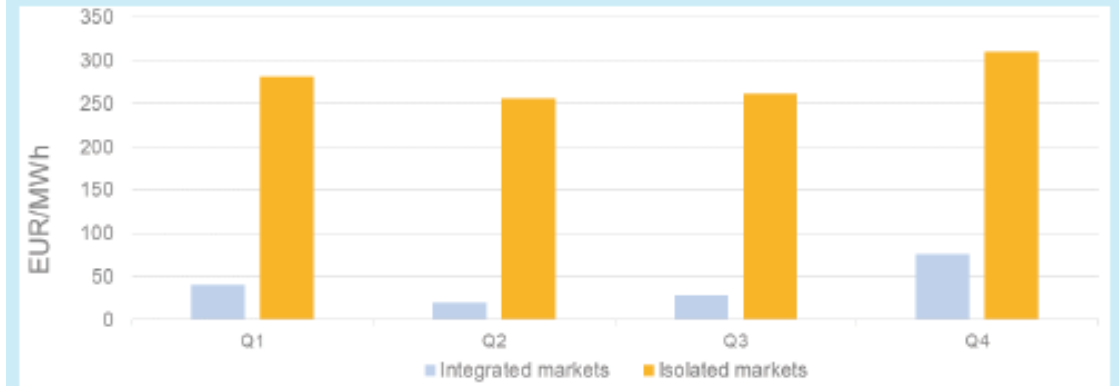
Figure 11: Estimated monthly welfare benefits (Billion EUR) from cross-border electricity trade in 2021



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.”*

And another issue – The Power system structure is changing 180°

Global Drivers



Bottom-up Revolution

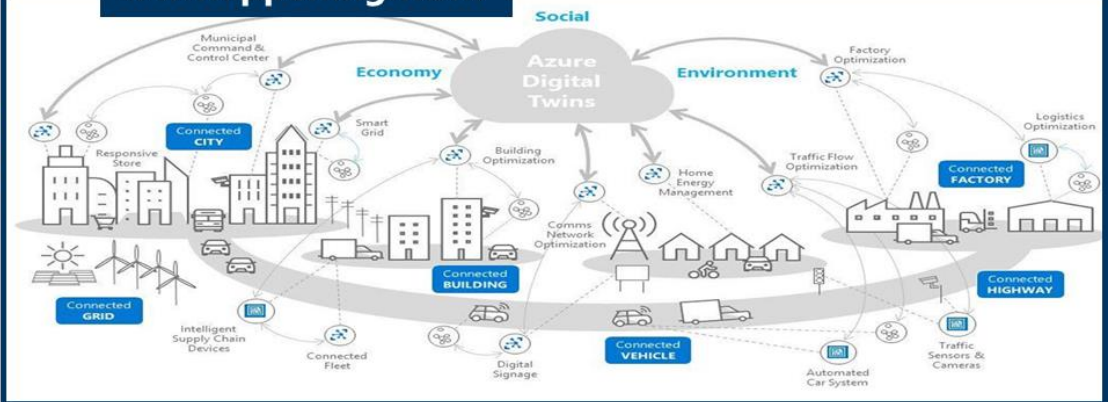
- From Central to Decentral
- From KWh to Services
- From Analogue to Digital
- From Fossil to Renewable
- From Manual to Machine Learning



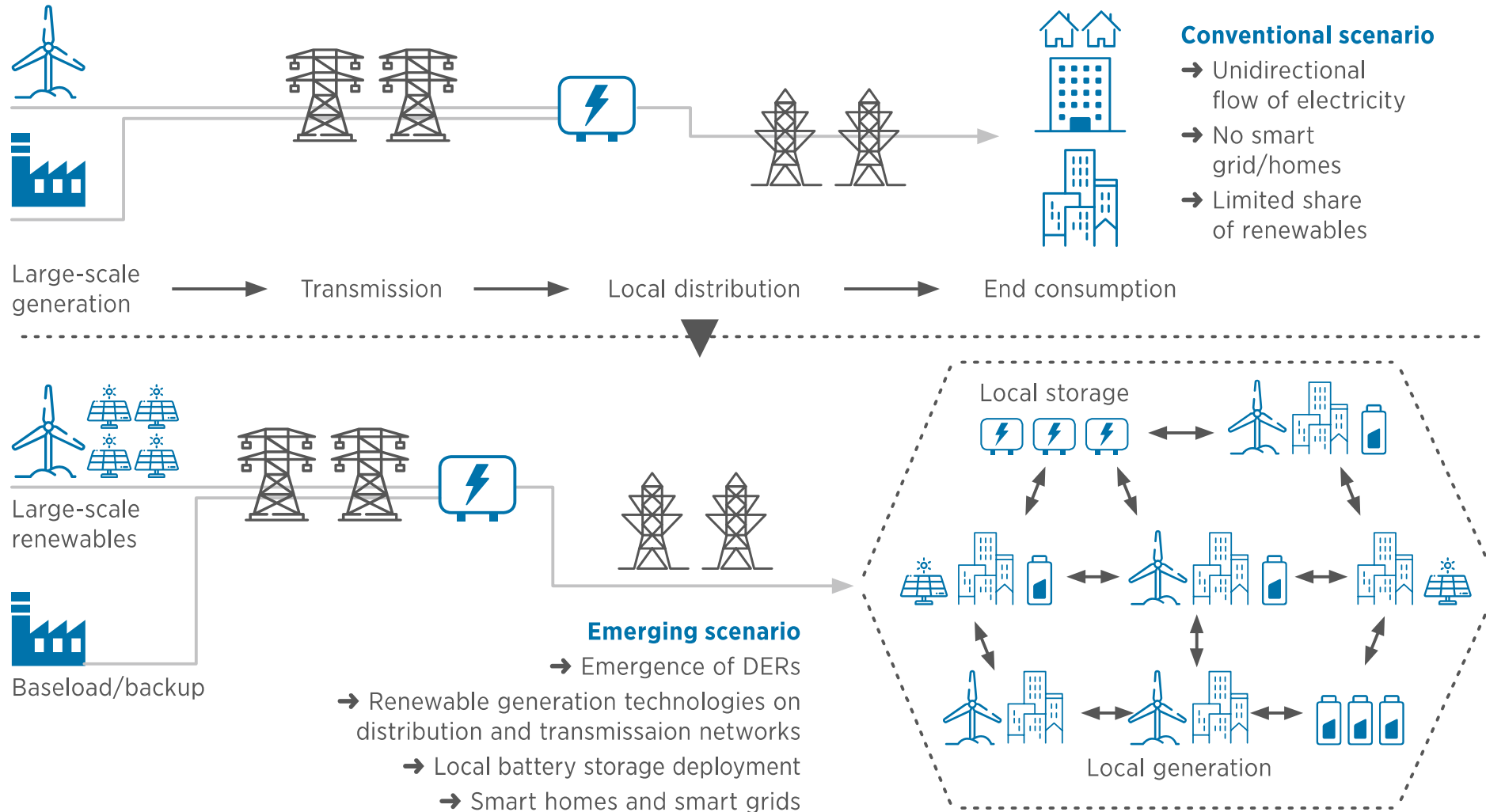
Policy Drivers



It is happening now!



The changing role of the DSO in the future



New approaches – Flexibility markets

Markets for local flexibility

- ▶ Have been discussed for many years – meet mostly technical and regulatory barriers
- ▶ CEP sets new requirements for DSOs
- ▶ Designed to better identify and resolve local (e.g. DSO) grid constraints
- ▶ Use greater spatial resolution and new approaches for market clearing
- ▶ Use capacity (€/MW) and energy (€/MWh) payments



Develops advanced AC OPF models for DSOs to better predict grid constraints



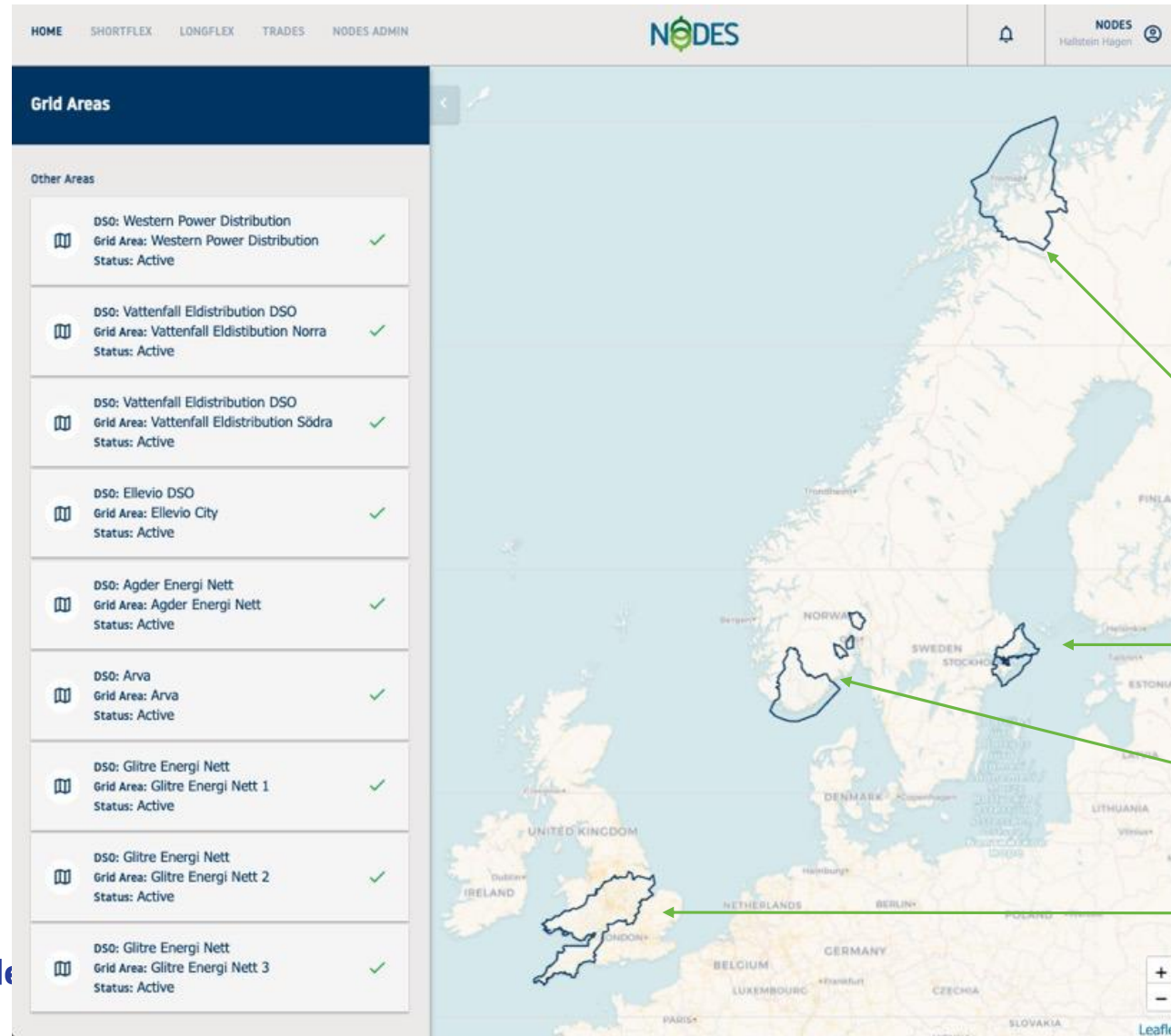
Develops market model exposing flexibility to all DSOs & TSOs utilizing existing intraday market platform

New approaches – Flexibility markets continued

Open issues

- ▶ What spatial granularity to choose
- ▶ How to integrate DSOs/TSOs and manage balance responsibility of aggregators
- ▶ How to address interaction between flexibility markets (locally) and adjacent (e.g. intraday) markets
- ▶ Lack of resources and competency (and incentives) at DSOs
- ▶ Requires more interaction between TSOs and DSOs – both nationally and (potentially) internationally
- ▶ Currently, flexibility markets are unregulated

New approaches – Flexibility markets examples



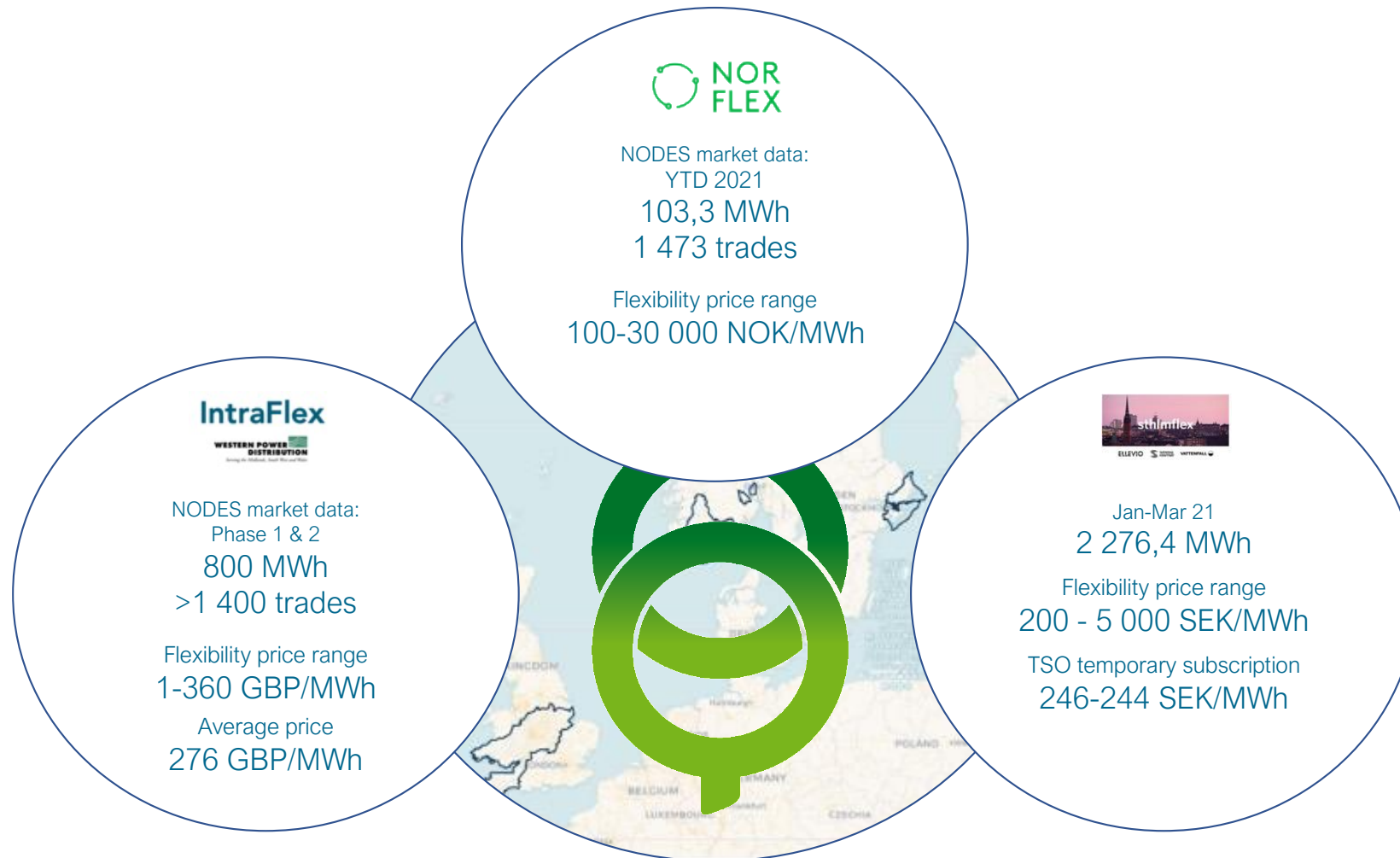
TSO-DSO coordination and activation of flexibility assets in the medium and low voltage grid



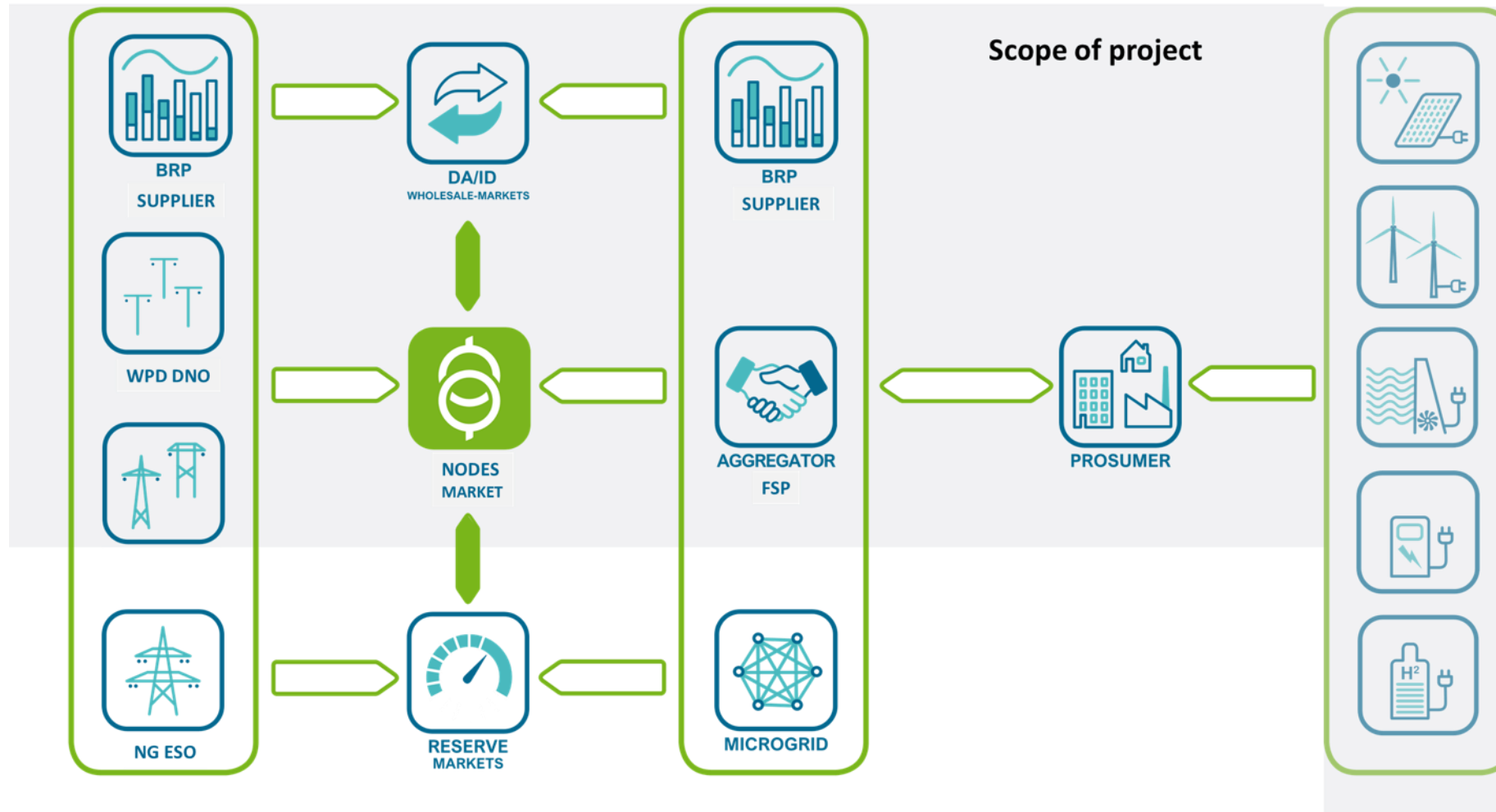
IntraFlex

WESTERN POWER DISTRIBUTION

New approaches – Flexibility markets examples



WPD – Intraflex – the scope of the market



New approaches – Retail markets

Digitization of retail markets

- ▶ Hourly (or lower resolution) metering allowing for more control and access to real-time data
- ▶ Smart load steering (e.g. smart charging) in low-priced hours during the night
- ▶ Retailer would charge/heat in PH04 and avoids using power in PH09
- ▶ Price signals somewhat diluted due to grid tariffs (no incentive compatibility)
- ▶ More active consumer role – the role of the prosumer

EUR/MWh

05-02-2021	Oslo
00 - 01	45,57
01 - 02	44,01
02 - 03	42,24
03 - 04	41,20
04 - 05	41,50
05 - 06	43,74
06 - 07	74,59
07 - 08	170,55
08 - 09	200,02
09 - 10	197,22
10 - 11	180,22
11 - 12	69,66
12 - 13	64,48
13 - 14	64,60
14 - 15	64,92
15 - 16	64,23
16 - 17	67,47
17 - 18	89,22
18 - 19	72,08
19 - 20	58,87
20 - 21	51,10
21 - 22	49,89
22 - 23	48,49
23 - 00	43,58



New approaches – Grid tariffs

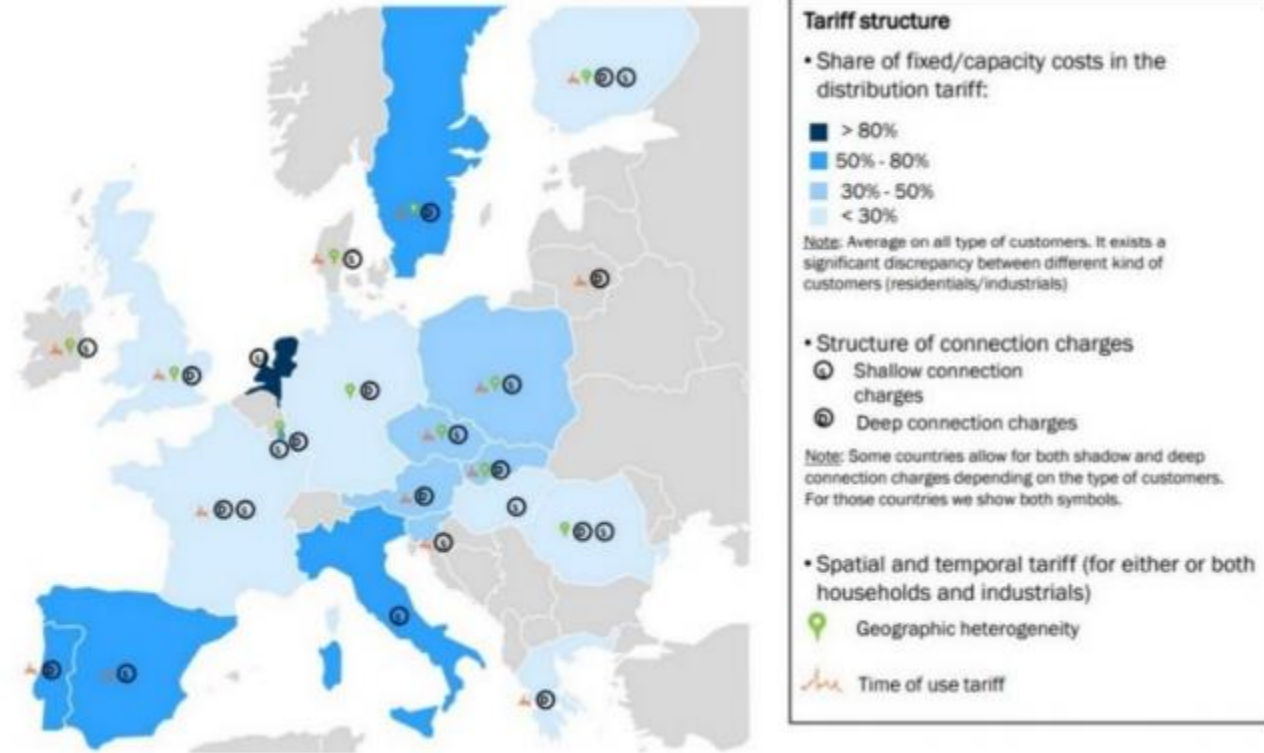
New methods for calculating income framework for DSOs proposed by NRAs

The DSOs need to be allowed to move away from a “copperplate” view of their role to a more active market-based procurement of flexibility instead of “just building hardware”

One solution being tried: Proposed higher fixed fee and lower variable fee (€/kWh)

Aim is to better reflect cost structure of grid companies (high CAPEX/low OPEX)

The whole key: getting access to (local) flexibility through market-based solutions incentivizing **all** potential providers through proper pricing regimes.



Cost recovery in Europe by Compass Lexecon (2016)

For local flex markets - The key is the DSO

The main requirements from DSO is to understand and adapt to this new world (and have regulatory support) for the details / implementation on national level:

DSO needs **incentives** to buy flexibility in the national regulations: TOTEX vs CAPEX

Market-based solutions – this is the “only” way to attract local flexibility – the providers of flexibility needs to see “the money” in providing these services

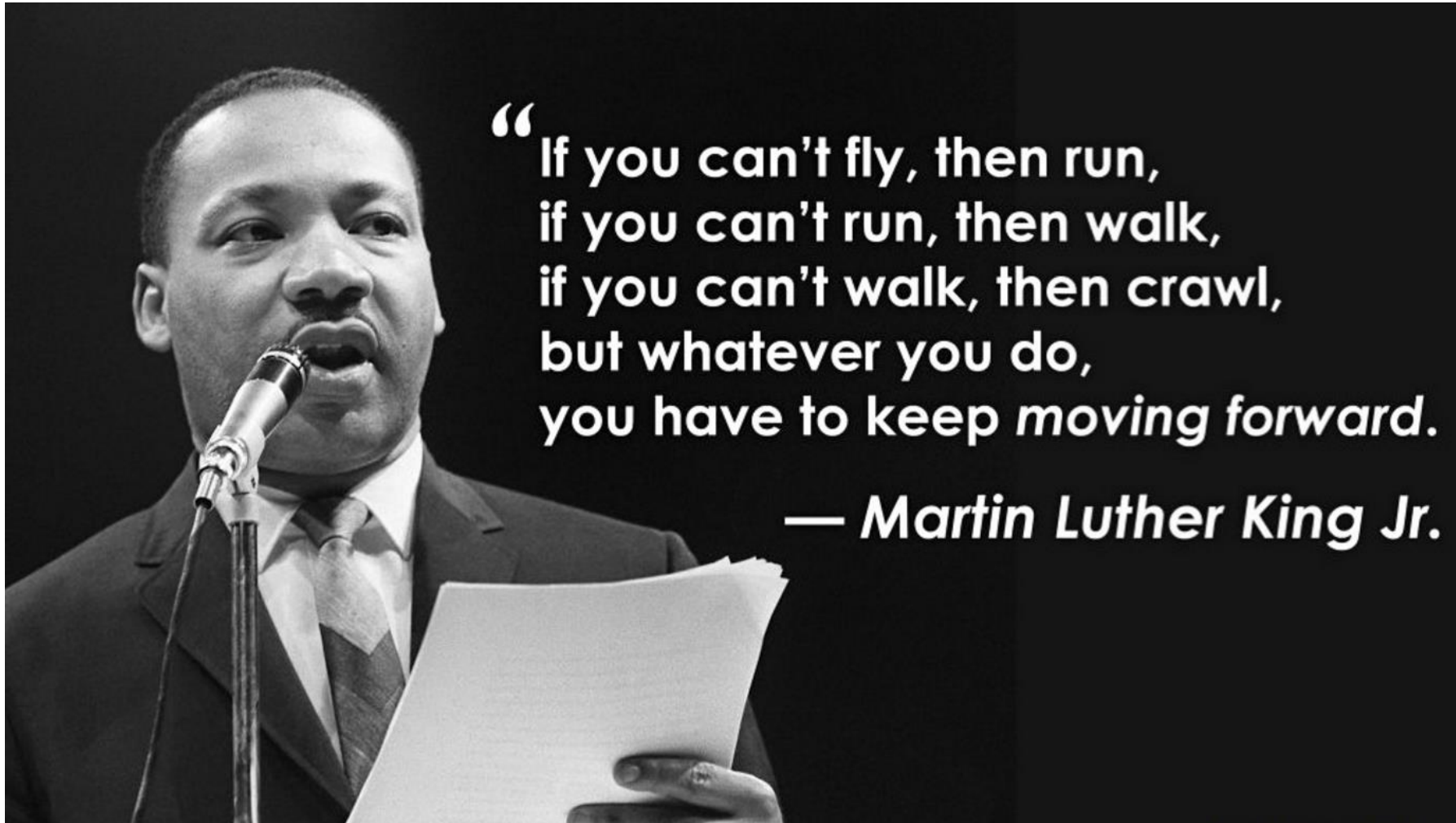
Interoperability to other markets (DA, ID, mFFR etc) – this is the way forward to also increase liquidity and also allow any imbalance to be solved by the correct party in the correct market

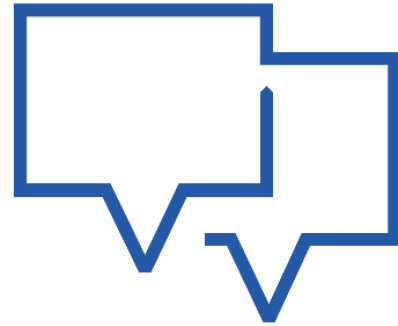
TSO-DSO coordination (green/red light) – currently some of the problems are emerging from no cooperation between the network operators – they need to work together!

Attributes for flexibility objects (grid location etc) – the location is important (and getting more and more important) – location is the key!

Flexibility register and aggregation – all parties needs to have access to common registries of the assets – but now at a lower level

Words of wisdom (my favorite market reform quote):





Thank you!

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: Supporting mainly Eskom with their transition into competitive entities + development of the new Market Code
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. Various business development and capacity building
- **Eastern African Power Pool (EAPP)**
Responsible for the recommended market design and capacity building.
- **Implementing a Wholesale Market Opening for SEE (South-East Europe)**
Creating a regional market design, develop an action plan and support ECRB, the NRAs and TSOs 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

