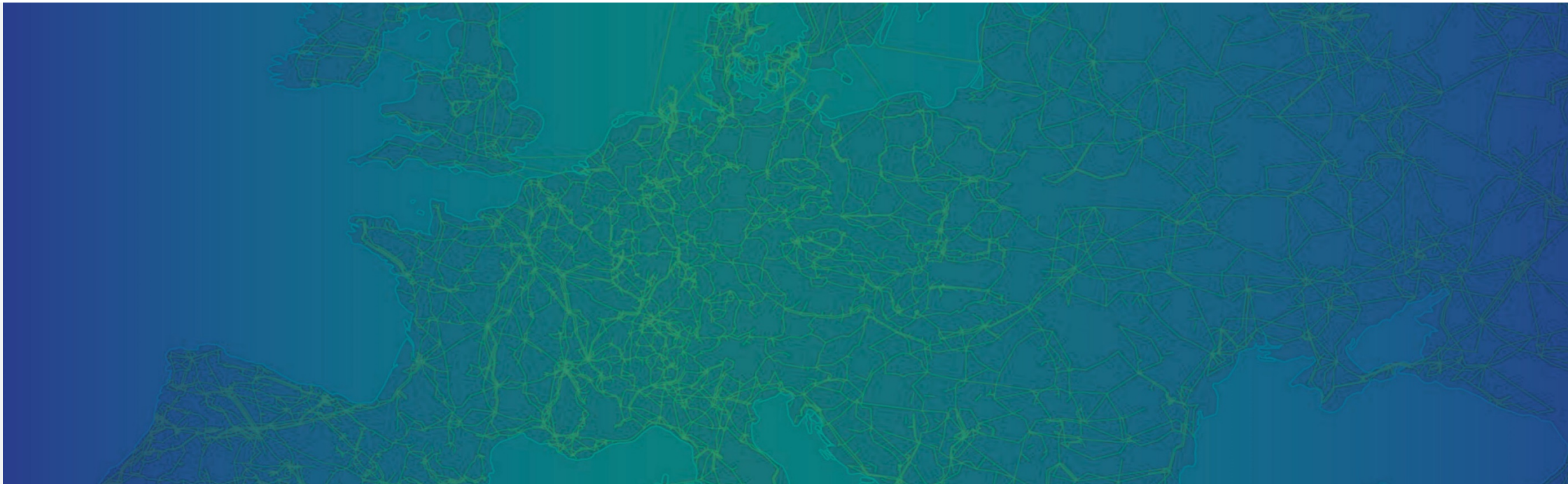
ENTSO-E Vision of the Future Power System

Market design options for the future



Webinar, 12 October 2020

entsoe

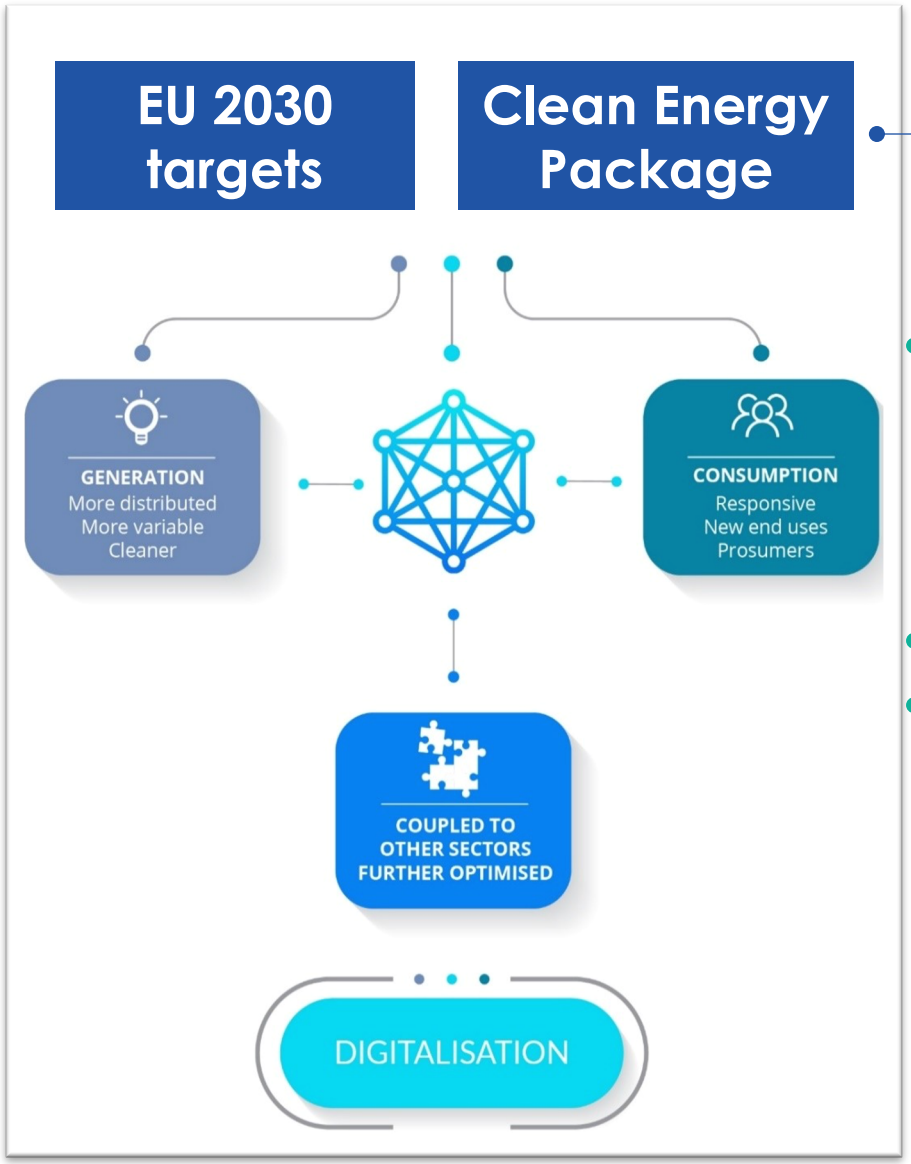
Reliable Sustainable Connected

Welcome & Introduction

Konrad Purchala

ENTSO-E Market Committee Chair

A Vision reconciling political objectives and technical reality



2030 Scenarios
a shared view of the future

System Operation **Market Design**

Working together towards a closer integration of system operation and markets

A robust and resilient expert-based 2030 vision
adapted to a **dynamic future**

Green Deal **Climate law**

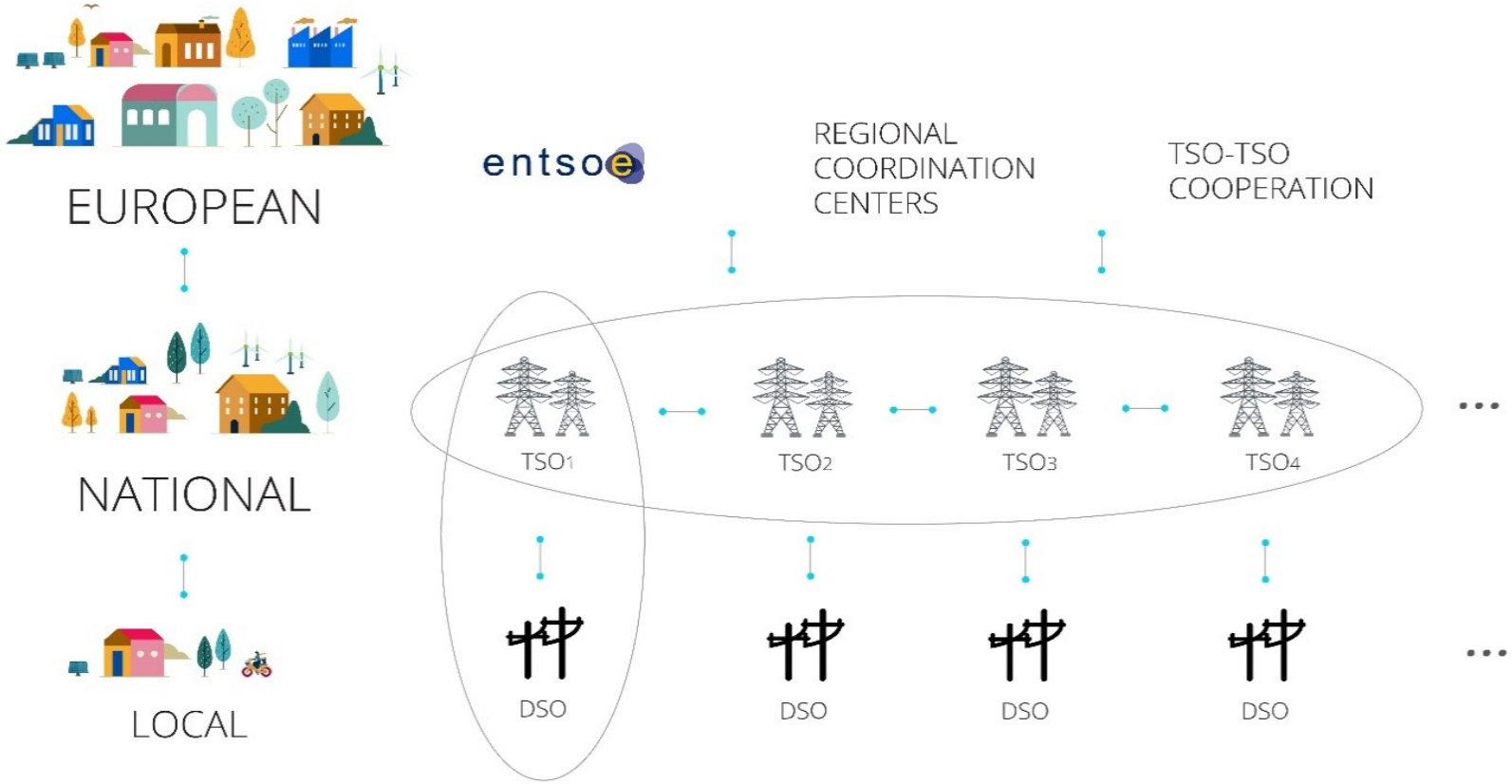
Drivers and challenges for markets & system operation towards 2030

- Increase transmission capacity to ensure **trading within and across BZs close to real time**
- **Distributed flexibilities** with close TSO & DSO cooperation and a customer centric approach
- **Energy Systems Integration,** beyond power
- Wind generation and interconnections in the seas: **Offshore Grids**
- **Power Electronics** towards hybrid AC / DC systems
- **Mastering operational challenges –** resilience, forecast, automation, artificial intelligence

Market design can help reducing the gap between market outcomes & physics

entsoe

Building a ‘System of Systems’

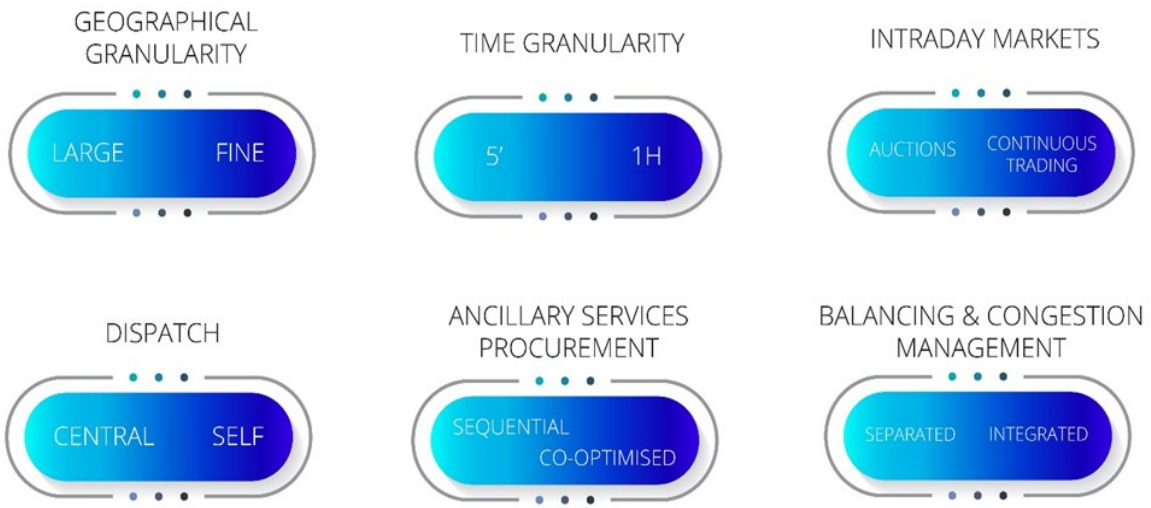


- Geographical scales
- Multilateral interfaces
- Interoperability
- System operators = key facilitators
- Governance involving stakeholders
- Putting consumers at the heart of the Energy Transition

entsoe

Market Design 2030 options & recommendations

No one-size-fits-all: Options*



** Examples of market design options for short term markets and congestion management*

Recommendations

- No need of radical market design change, focus on CEP implementation first
- Include stronger locational signals and increase the locational visibility of resources
- Enhance short-term markets to allow market participants to trade closer to real-time
- Fit-for-purpose solutions & dynamic regulation may be needed to avoid constraining innovation
- Key objective: supporting decarbonization while ensure preserving the IEM benefits

entsoe

Context and **objective of today's webinar**

- Building on **ENTSO-E Vision for 2030**, we have analised a number of **market design options** which in our view would **support the power system in the energy transition**
- The purpose of the webinar is to **present some of these ideas** and market design options for the future, which should **not be considered as ENTSO-E positions**
- We'd like to have a **first feedback from stakeholders** to understand w**hich options appear more interesting**, feasible, and worth further exploring and discussing
- As these options would deserve much more time to discuss than just 2h, consider this event just a teaser…
- In fact, we plan to issue by end of 2020/early 2021 a "**Market Design Discussion Paper**" elaborating further on these ideas and **seeking written stakeholders' feedback**
- Based on stakeholders' feedback today and on our discussion paper, we will organise (at least) another **market design webinar/workshop in Q2 2021**
- We're **not questioning the current regulatory framework nor CEP implementation**, but trying to look further ahead and anticipate future policy discussions
- The overall **objective is just to trigger a debate** on possible concrete options for 2030, we hope you'll find some useful food for thoughts!

Agenda

	Subject	Time	Presenters
1.	**Welcome and introduction**	10 min	Konrad Purchala
2.	**Market design challenges and possible solutions**	45 min	
2.1	- Wholesale markets		Bruno De Wachter
2.2	- Congestion management and spatial granularity		Gerard Doorman
2.3	- Resource adequacy and Investment signals		Marco Foresti
3.	**Reactions from Stakeholders** - ACER - EC - EFET - EURELECTRIC - Europex - IFIEC - Smarten - WindEurope	40 min	Oral reactions from stakeholders' representatives
4.	**Open Floor for Q&A discussion**	20 min	
5.	**Conclusions & next steps**	5 min	Zoltan Gyulay

entsoe

Housekeeping Rules

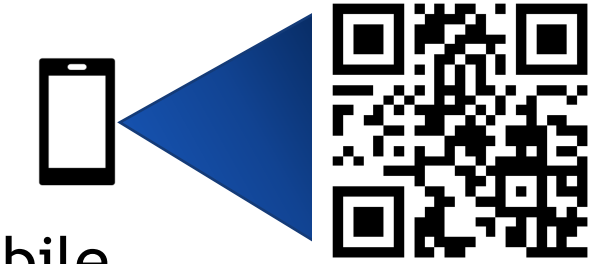
Video and audio

- Video and audio is allowed only for Speakers or Panellists
- Speakers or Panellists will be asked to switch video and audio OFF when not talking

Participants Questions and **Live Polling** via **slido**

- Participants can place their questions directly through slido and **not** through GoToWebinar. Please also vote for most interesting questions posted.
- Indicate your name and company/institution when posting your question
- Moderators will select 3-4 questions among the most voted and ask the relevant speakers or panellists to comment
- **4 Live polls** will also be launched via slido
- **Chat and raise the hand** feature will **not be used**

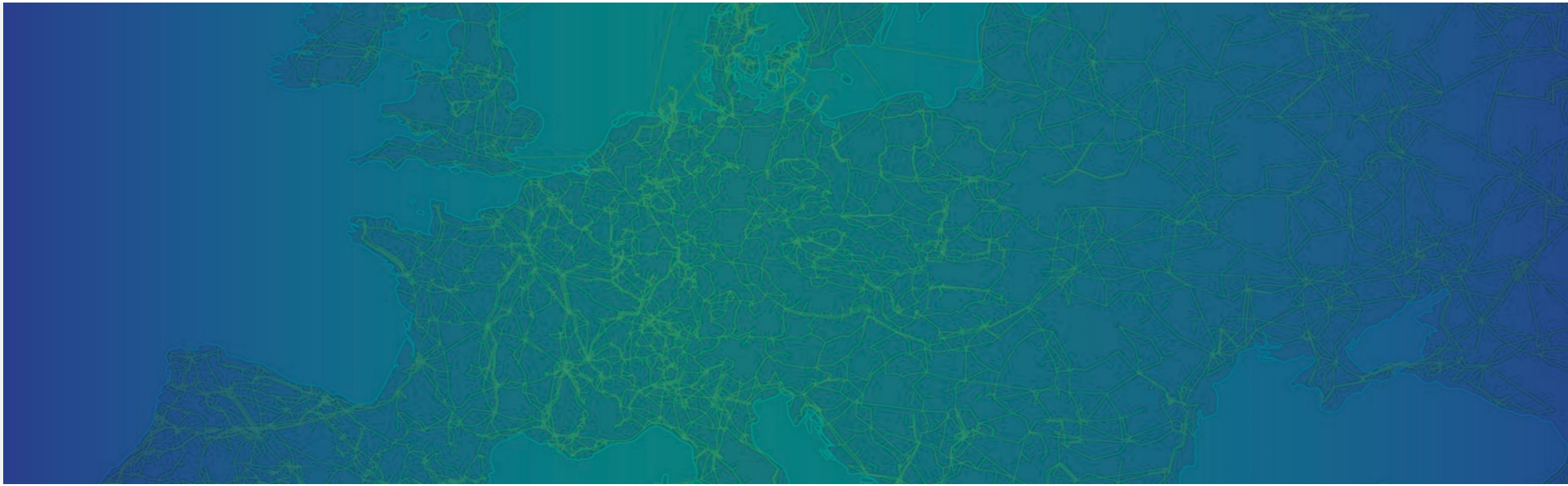
To join slido, go to www.sli.do and enter EWeek-2



...**OR scan** this QR code **now** with your mobile

ENTSO-E Vision of the Future Power System
Market design options for the future

Session II: Market Design Challenges and Possible Solutions



Webinar, 12 October 2020

entsoe
Reliable Sustainable Connected

Market design challenges and possible solutions
Wholesale markets

Bruno De Wachter

Working Group Market Design & Renewables

Day-Ahead & Intraday markets more fit for RES, DSR, storage

High penetrations of variable RES, demand response and storage lead to a more dynamic demand and supply trading. The increasing variability of production and consumption will increase the importance of trading closer to real-time. As the **Intraday market** will play a key-role in the future, its **auction organization and interaction with Day-Ahead markets** should be reconsidered.

Shorter products, smaller minimum bid size

Finer time granularity products incentivise market access of new resources (e.g. storage) by allowing to better capture the value of their flexibility.

Smaller minimum bid size and aggregation will facilitate market access of smaller and distributed energy resources (DER).

Digitalisation will facilitate the introduction of new products as well as the aggregation of DER.

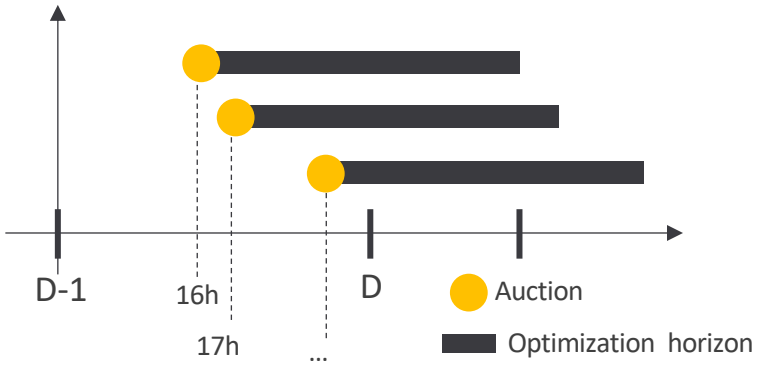
More Intraday auctions

Intraday auctions allow a clearer price formation, higher liquidity and a more efficient pricing of transmission capacity.

More frequent auctions, compatibly with implementation challenges, will allow market participants to better manage the challenges of variability of new energy resources, and allow a more active participation of RES, Demand Response (DR) and storage resources in the market.

Combining day-ahead and Intraday markets

Moving from a clear separation between the Day-ahead and the Intraday market by introducing a moving market window.



If sufficiently robust, ID markets can also be used as fallback solutions for DA markets

Adapt **balancing markets** to meet the energy transition challenges

European balancing platforms will facilitate balancing market integration and cross-border exchanges of resources by TSOs. Other market design changes will promote RES, storage and DSR participation, but implementation **challenges remain**.

Timeframes for reserves procurement

The CEP already requires TSOs to procure more balancing reserves within day (with some exceptions) as this can be beneficial for weather-dependent RES.
What about demand response and conventional generation?

TSOs also need longer term visibility and certainty about procured volumes.

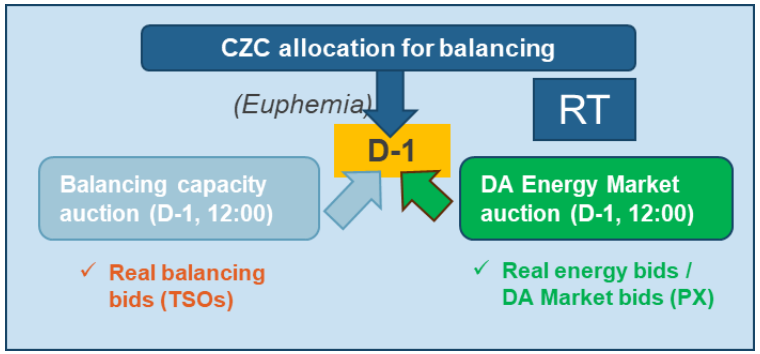
Incentives for RES participation to balancing

RES Support mechanisms should not distort Renewable Energy Sources participation to the balancing markets in order to offer enough flexibilities to the TSO to balance the system at each second.

Capacity-based support mechanisms could be a valid option in this respect.

Co-optimisation of energy and balancing reserves in Day-ahead

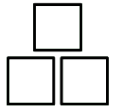
Making possible for stakeholders to let the market choose the best way to allocate flexibilities and interconnections capacities between energy and balancing reserve through co-optimisation.



Transmission capacity **forward markets**

The products and allocation of Long-Term Transmission Rights have not evolved at the same pace as other electricity related markets. **Enabling liquid and more complete products of forward trades** could be useful to better hedge transmission capacity risks in the future.

Product definition

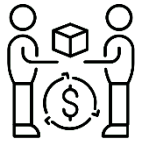


Currently, mostly yearly and monthly product are available.

Market Parties may need more detailed products as week/weekend, peak/off-peak, etc..

The possible introduction of block-bids should also be considered.

Secondary markets



For the time being, Market Parties can only resell their transmission capacity products at subsequent auctions.

An organised secondary market could allow Market Parties to efficiently hedge their position on a continuous basis.

Flow-Based allocation

Allocation of LT Capacity could be done on Flow-Based parameters (where relevant) and per bidding zone border.

LT Capacity auctioned per bidding zone border would be based on maximizing economic surplus.

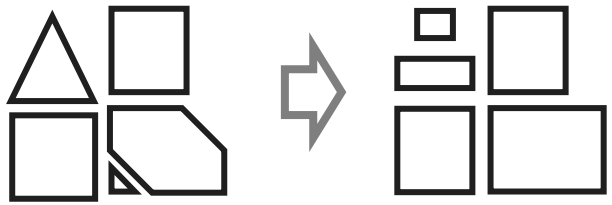
Several questions remain as hedging possibilities for market parties, transparency, re-allocation of revenues due to resales, new congestion income distribution methodology, level of capacity given by FB domain…

Algorithm challenges

Achieving one of the widest electricity market in the world is a challenging task that stresses optimization procedures and tools like Euphemia. **Prioritisation** may be needed **between complexity of products, prices, and spatio-temporal resolution** to achieve the 15 min DA and ID coupling.

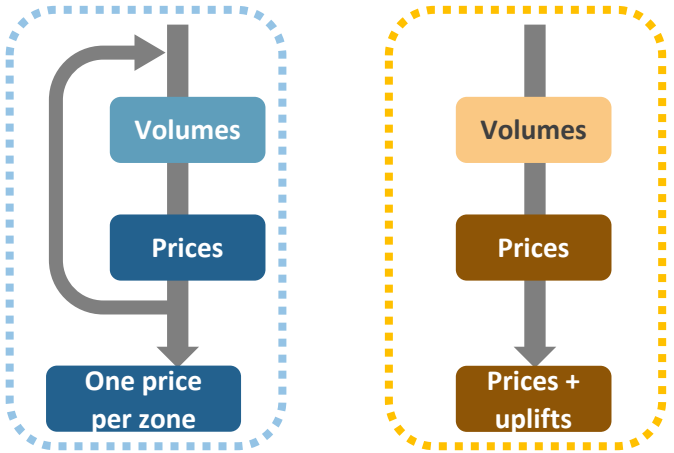
Products simplification

Some products appear to have a strong **impact on calculation** time regarding the obtention of results. It may be needed to **identify essential products** to deal with inter-temporal constraints in order to achieve other market challenges like the 15 min flow-based market coupling in CORE region.



Uniform vs uplifts payments

To improve algorithm speed and respect time constraints, it could be considered moving away from **the uniform pricing requirements, implementing uplifts.** Some questions are open like the sharing of those uplifts and regulation consequences.



Process optimisation

Combining hourly and **15 mins auctions** in order to simplify the optimisation problem and to adapt to different type of assets.

Allowing more time to the coupling and adapting processes, always ensuring system security.

Market design challenges and possible solutions
Congestion management and spatial granularity

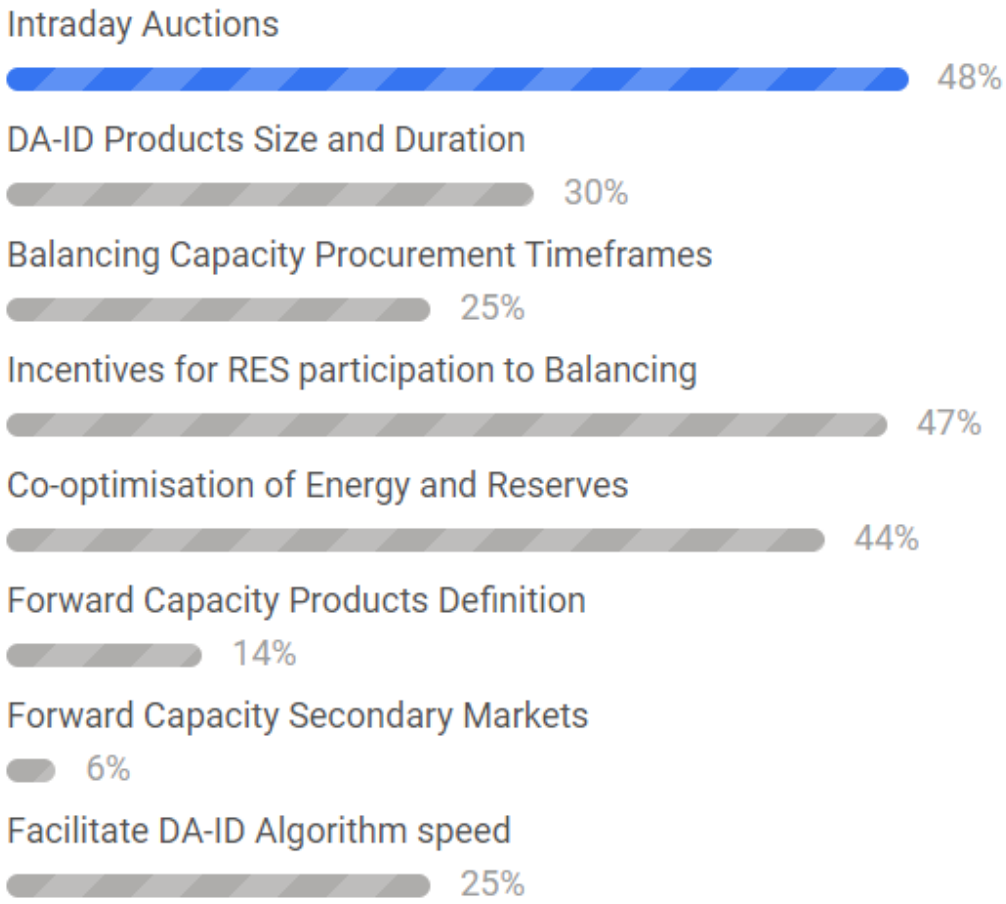
Gerard Doorman

Project Team Market Design 2030,
ENTSO-E

Live poll result from session 2.1.

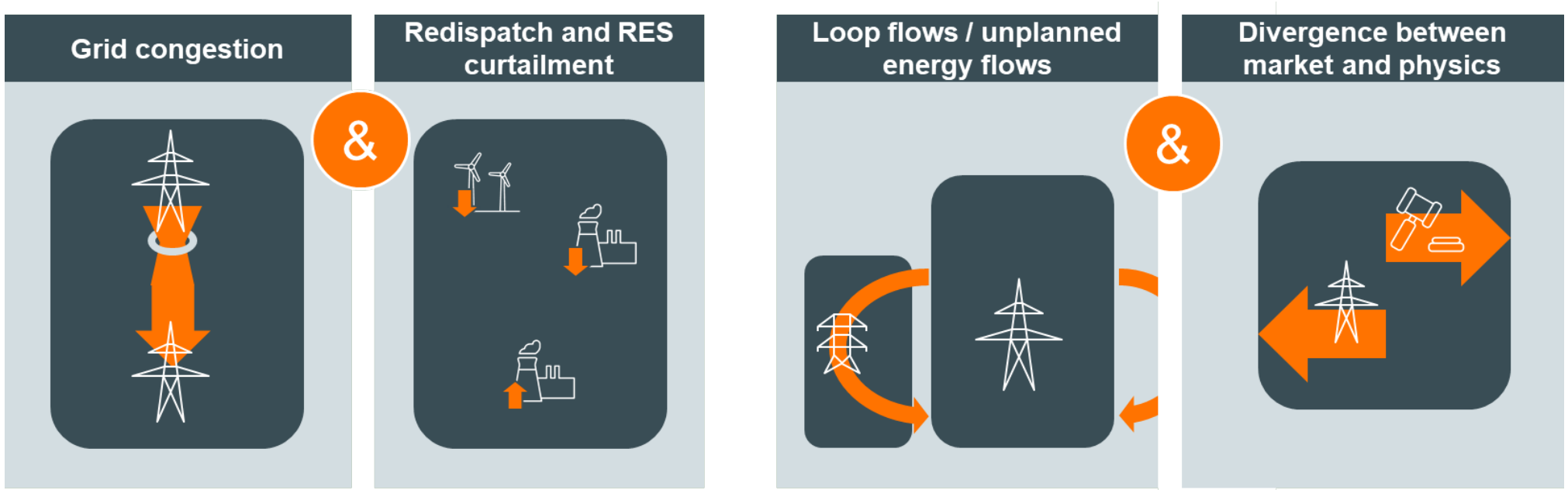
Which area of Wholesale Markets design requires design evolutions to ensure the fit-for-purpose markets in 2030 and beyond?

0 9 9



The challenges

- **Grid development is key** to ensure a green energy transition across Europe and to avoid costly structural congestions
- But grid development **is currently lagging** behind RES development
- **Higher and more volatile flows** in the power system
- **Market design needs improvements / adaptations** to cope with a rapidly changing power system

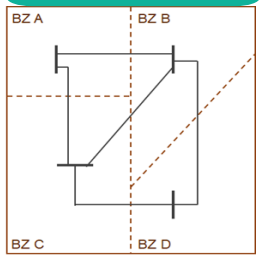


2030 Market Design Options for National/Regional markets

LOW CONGESTIONS — HIGH CONGESTIONS

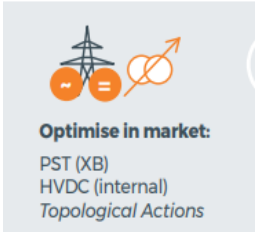
MINOR MARKET DESIGN CHANGES — SUBSTANTIAL MARKET DESIGN CHANGES

Zonal



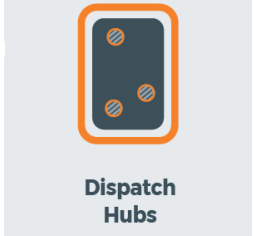
Fully implement today's model: well-defined BZs

Advanced Zonal



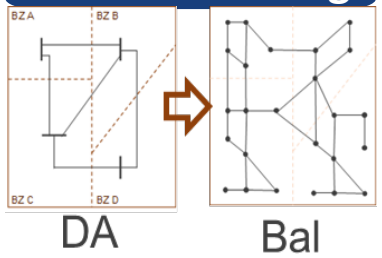
Improve Zonal Model: Optimise PST&HVDC + Topology Actions

Dispatch Hubs



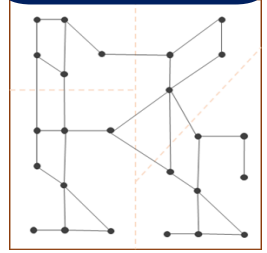
Enhance Zonal Model: integrate redispatch in market coupling

More Location-based Balancing



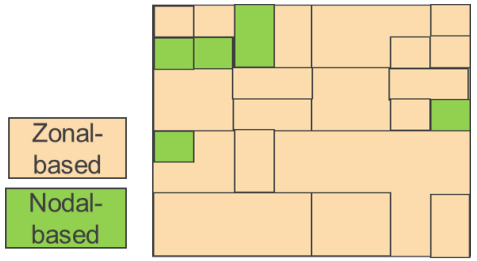
Adapt Markets with relevant information

Nodal



Redesign Markets

No one-size fits all *solution: ensure* ***coexistence & preserve the IEM if different models are implemented*** *nationally/regionally*



Improve Zonal capacity calculation/allocation: **Advanced Zonal**

Alongside transmission development, an efficient transmission capacity management is key in order to develop the full potential of the European power system and integrate more RES, DSR, storage and flexible resources to reach Green Deal targets.

Include PST/HVDC in the market coupling

In order to give more flexibility to the capacity calculation, PST taps and HVDC set points can be optimized through the market coupling

Initial studies show significant market benefits as more HVDC are introduced in the power system.

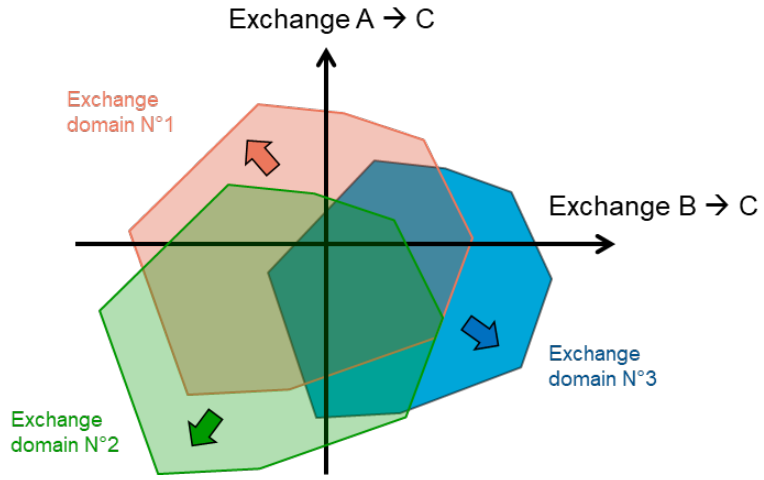
ALEGrO interconnector between Belgium and Germany will be implemented using these optimisation principles.

Include topological actions in the market coupling

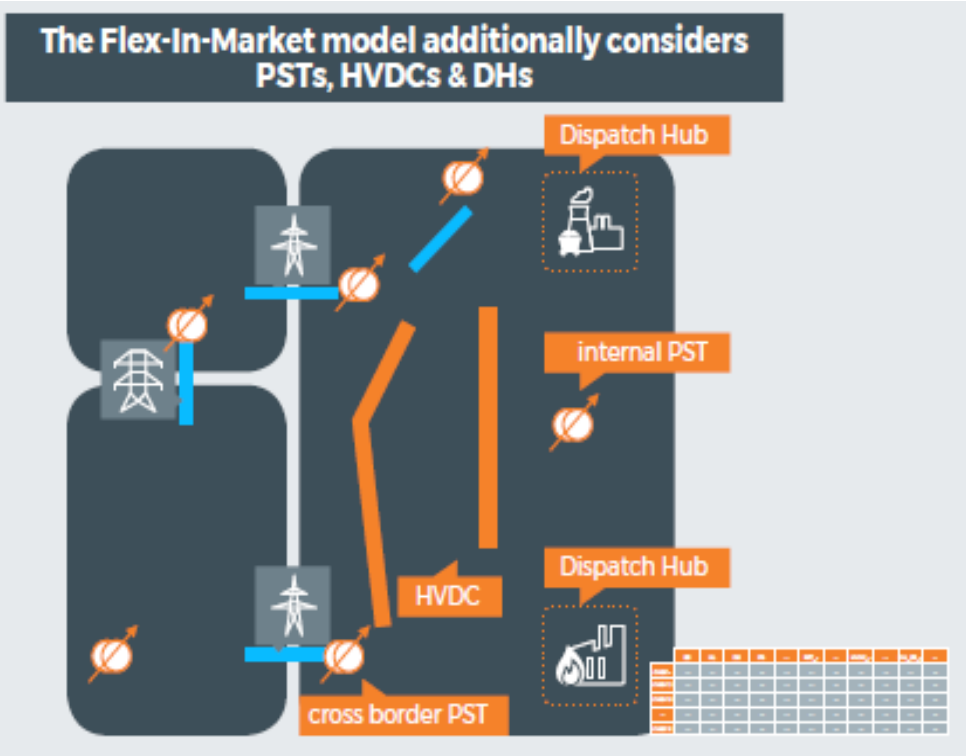
Today, only one predetermined topology is considered in the FB calculation.

Several domains could be offered to the market to deal with uncertainty and include topological flexibilities.

Regulation and pricing consequences needs to be carefully studied.



Enhance the Zonal flow-based model:
Dispatch hubs (DH) and Flex-in market design

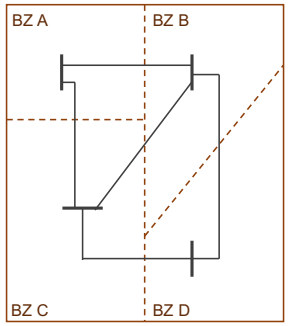


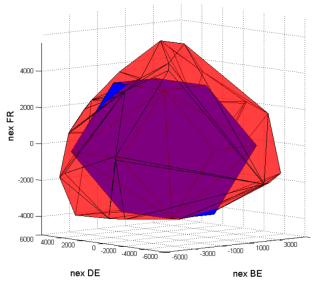
- Starting point is the current target model of Zonal Flow Based market coupling, including the optimisation of PSTs & HVDCs in the market.
- Redispatch potential (congestion relevant assets) is identified and placed in separate bidding zones (dispatch hubs) within an existing bidding zone
- The welfare optimization function will select costly remedial actions (redispatch) if these generate net welfare (more cross zonal trade)
- As a result the costs of these remedial actions are implicitly paid by the market

See also: *Integration of day-ahead market and redispatch to increase cross-border exchanges in the European electricity market, Ksenia Poplavskaya, et al., Applied Energy, Volume 278, 15 November 2020*

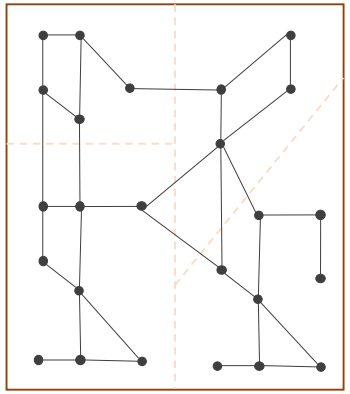
Adapt the market design to the relevant information:
Location based balancing

Day-ahead/Intra-Day → **Location-based balancing**





Zonal day-ahead and intra-day like today with Flow Based methodology for BZ interfaces and relevant enhancements



ensuring security of the system at all time

Nodal optimization: best handling of congestion, but pricing challenges

Flow Based: less accurate, possible alternative where relevant

- Effective operational control in real-time: **market outcome satisfies grid constraints**

- Consistent pricing with preceding markets
- Zonal price determined by European platform
- Pay-as-bid for extra-marginal activations

Redesign markets: **the Nodal model**

❑ **Implemented in US** and **New Zealand**

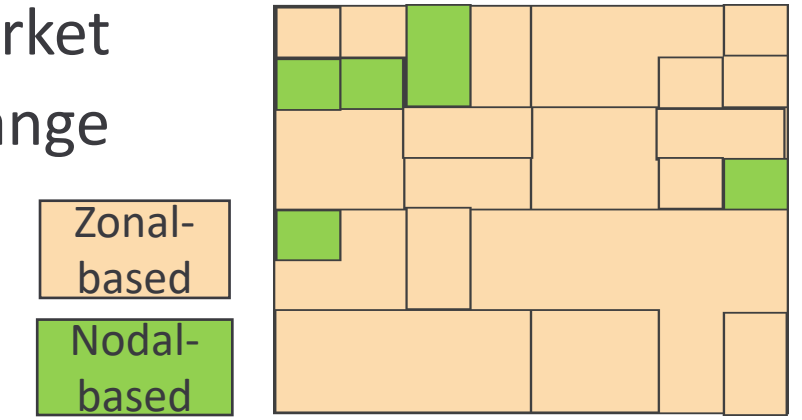
- Locational Marginal Prices (LMP), reflecting cost of generation, losses and congestion
- Co-optimization of energy and balancing reserves
- Central dispatch, unit-based bids representing technical constraints
- Real-time market optimizes system with short intervals (e.g. 5 minutes)
- Markets for Financial Transmission Rights to hedge locational price variations
- Uplifts to cope with non-profitable unit commitments

❑ **BUT** nodal is **not a feasible/desirable** option on a **European scale by 2030**:

- Public and political acceptability
- Implementation time and costs
- Technical challenges to include grid topological actions and hydro river systems
- Liquidity and cost of hedging
- Open challenges with large volumes of RES and DER

Coexistence of zonal and nodal-based markets

- Zonal market will remain the dominating European model
- However, congestions may be too challenging for the zonal approach in some countries
- One country or small group of countries may choose to implement nodal-based markets
- Efficient integration with the zonal market at large in all timeframes is key
- Tradeoff between efficiency of national market vs. (*potentially* reduced) efficiency of exchange



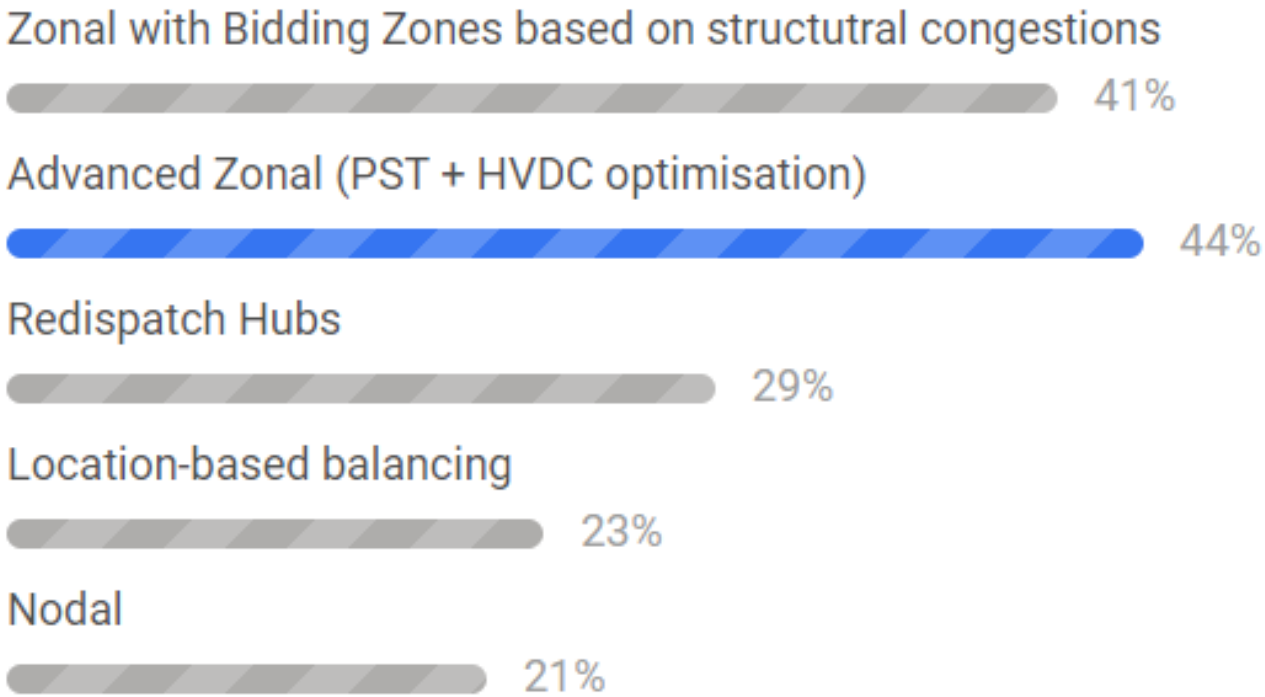
Main take-aways

- Efficiency of the internal energy market and decarbonization are the overarching objectives
- Current market models will need to evolve/change
- Locational aspects are gaining importance
- Not one solution that fits all – different countries may need different solutions
  - Make sure to retain and enhance the economic efficiency of the internal electricity market

Live poll result from session 2.2.

Which of the following market models would fit well with your country policy and level of congestions in 2030?

1 0 8



Market design challenges and possible solutions

Resource adequacy and Investment signals

Marco Foresti

Policy & Market Design Manager,
ENTSO-E Secretariat

Main market Design Options to ensure resource adequacy in 2030

We see **3 main market design options valid for 2030**, which will need to be adapted a changing policy, market, technology context. The increasing importance of RES, demand response and storage, will require market design improvements to ensure adequacy more efficiently.

Enhanced Energy Only Markets

In some markets EOM may deliver effective price signals to ensure the desired level of resource adequacy

Enhancements needed to:
- Incentivise new & flexible resources, remove price distortions;
- Ensure Sufficient demand response in times of scarcity;
- Develop Hedging products to cover increased volatility risks;

Targeted Capacity Mechanisms

Where enhanced EOM alone risk not to ensure resource adequacy in temporary or specific conditions, targeted capacity mechanisms should be implemented

Possible models:
- Strategic reserves;
- Tenders for new capacity

Open to new capacity providers such as DSR

*Inclusion of locational investment signals in the capacity mechanism could be considered

Market-wide Capacity Mechanisms

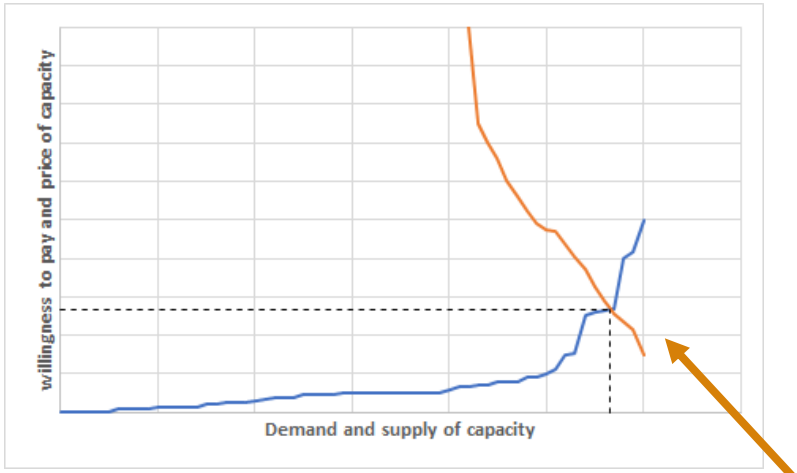
Where structural adequacy concerns cannot be solved neither by the EOM, nor by strategic reserves, market wide capacity mechanisms should be introduced

Possible models:
- Capacity Auctions;
- Capacity Obligations;
- Reliability Options
- Enhanced models (see next slides)

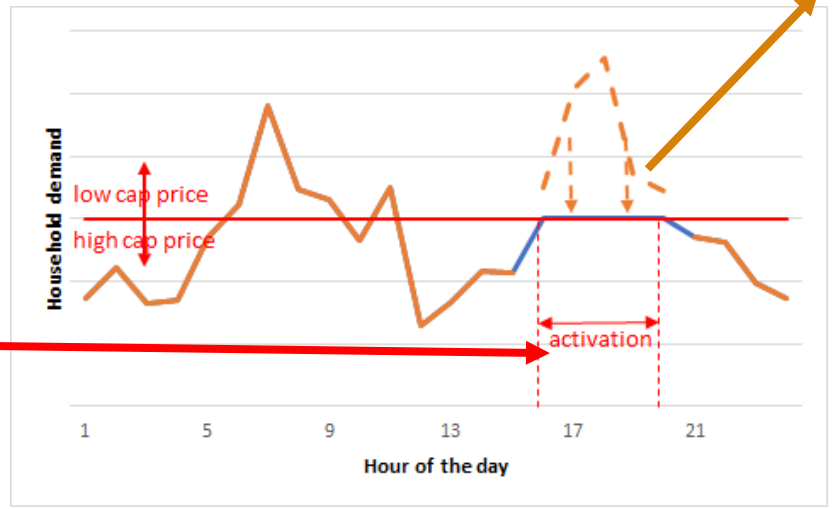
* Inclusion of locational investment signals in the capacity mechanism could be considered

Possible CMs enhancements: Capacity subscriptions

Year ahead, capacity market clears based on suppliers' offers and consumers' preference for uninterrupted supply



Consumers determine their demand for capacity during scarcity events, depending on the price of capacity



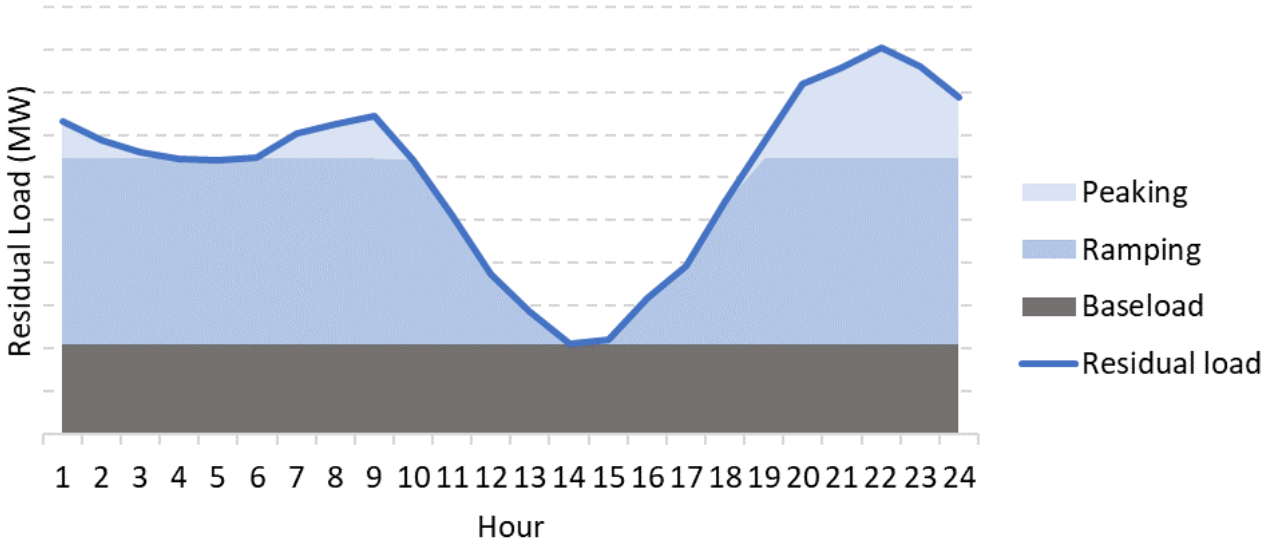
During scarcity events, the System operator activates in real time Load limiting devices

*For more info: Doorman and De Vries, Electricity market design based on consumer demand for capacity, FSR and Eurelectric Workshop on Design the electricity market(s) of the future, June 2017

Possible CMs enhancements: CMs with flexibility requirements

To address resource adequacy in a comprehensive manner, the demand for capacity of a given **capacity mechanism** could be **split in different components**, with specific **flexibility requirements** applied

- Baseload capacity: no specific flexibility requirement
- Ramping capacity: flexible resources able to ramp up/down in steeper hours of residual load curve
- Peaking capacity: residual flexible resources needed only at peak demand periods



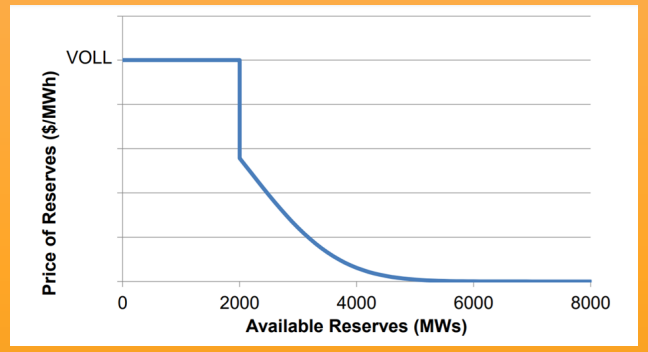
Scarcity Pricing

Is scarcity pricing a key element of wholesale markets to incentivise flexible resources and stimulate demand response? How to implement it?

Shortage Pricing Function

- Mentioned in the Electricity Balancing Guideline (Art.44) and in the CEP Electricity Regulation (Art. 20)…but not defined.
- When and how should it be implemented?

Operational Reserve Demand Curve



- Price adder when reserves volumes falls below a certain threshold
- Implemented in several US markets with (PJM, CAISO, NEISO) or without capacity mechanisms (ERCOT)

Objectives, pros & cons

- More frequent & predictable price spikes will favour flexible resources
- Will prices back-propagate to ID & DA market?
- Replacing or complementing CMs?
- Public/political acceptability?

RES financing and participation to CMs

Future market design should not only deliver resource adequacy but also ensure an efficient interaction with investment signals for RES, facilitating their integration and financing.

RES Support needs

- As wholesale prices decline and more RES come into the market, **more subsidies may be needed** despite the decreasing technology costs. This “cannibalization” effect might be offset by **new flexible demand** (e.g. batteries, EV's, P2x), shifting the demand curve to the right
- Which **support schemes better interact with energy markets** (eg. Capacity based supports)?
- How to incentivise the **emergence of PPAs**?
- Should support mechanisms include **locational elements** to better coordinate with grid capabilities?

RES & Capacity Mechanisms

- RES can contribute to adequacy, although at significant lower values that their installed capacity. Hence CRMs **must be open to RES participation**
- With what capacity can specific renewables participate in the CRM, i.e. **how should their capacity be taken into consideration? How to establish the derating factor?**
- How could RES that receive support be allowed to participate in a CRM? (e.g. Support schemes with revenue cap?)

Empowering Ancillary services

Ancillary Services will become more valuable to the system: the market should ensure provision of the required resources for the TSOs to manage the system efficiently, effectively and dynamically. If markets cannot provide the necessary services timely and efficiently, other means will be needed

Which services will the system need in 2030?*

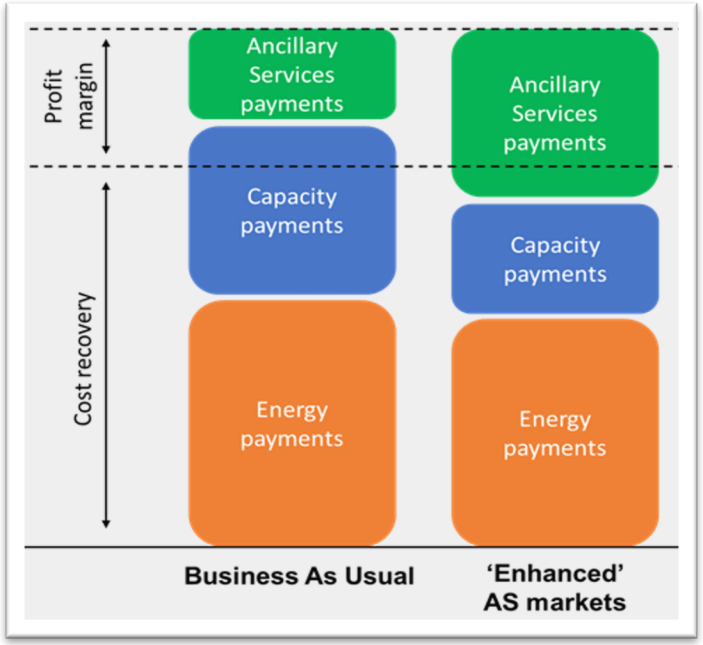
- Balancing
- Steady State Reactive Power
- Dynamic Reactive Response
- Ramping margins
- Synchronous Inertial Response
- Black start capability
- Fast post-fault active power recovery
- Island operation capability;
- Short-circuit current

How can TSOs ensure their system needs?

PROCURE	**AS Markets** balancing energy/capacity, reactive power, inertia, etc.
MAKE /OWN	**Network assets** capacitors, reactors, transformers, HVDC, etc.
ENFORCE /FORBID	**Service Requirements** or **Grid codes** e.g. voltage-dip resistance

A **combination of these approaches** taking into account regulatory framework and system **specificities**

Where/when system needs can be efficiently procured via **AS markets**, these can provide key **investment incentives,** esp. for new providers (e.g. DRS, storage)

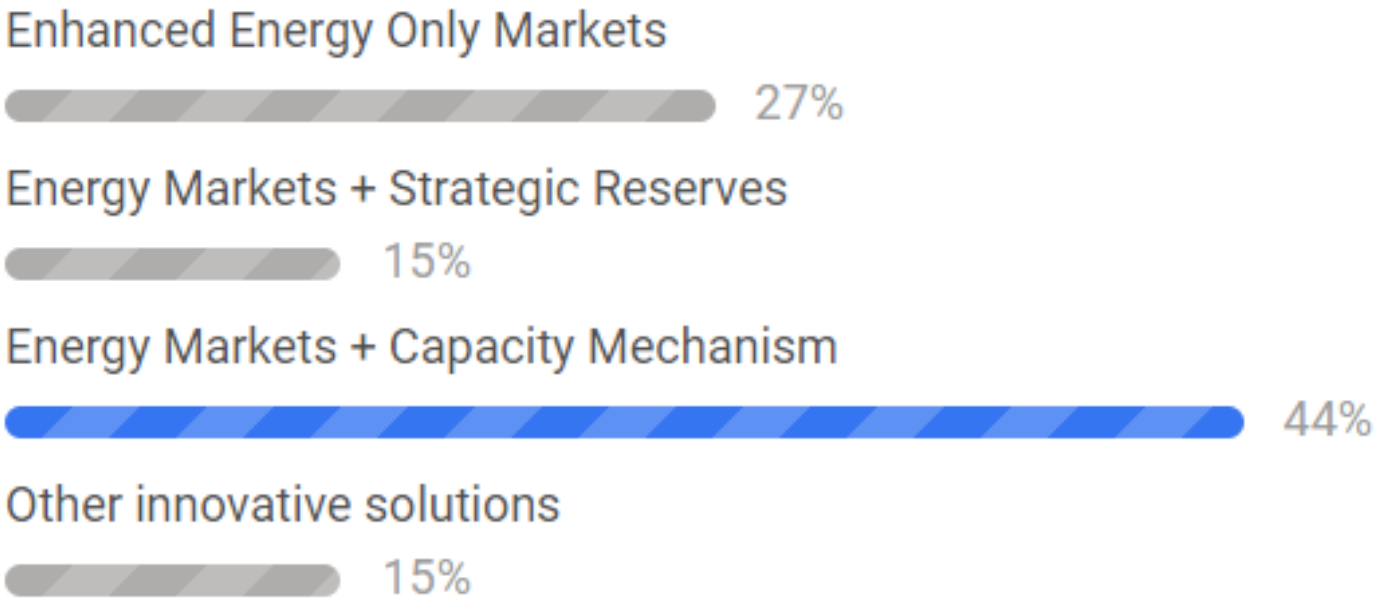


*See also ENTSO-E "Power System Needs", as part of TYNDP 2020

Live poll result from session 2.3.

Which of these models would be more efficient and effective to ensure adequacy in 2030 in your country?

1 1 0



Reactions from Stakeholders

ACER

François Beaude

ACER
European Union Agency for the Cooperation of Energy Regulators

Reactions from Stakeholders

European Commission (DG ENER)

Jan Papsch

Reactions from Stakeholders

EFET

Jérôme Le Page

Reactions from Stakeholders

EURELECTRIC

Alfred Hoffmann

Reactions from Stakeholders

Europex

Rickard Nilsson

Europex Association of European Energy Exchanges

Reactions from Stakeholders

IFIEC

Peter Claes

Reactions from Stakeholders

SmartEn

Andrés Pinto-Bello

Reactions from Stakeholders

WindEurope

Daniel Fraile

Conclusions & next steps

Zoltan Gyulay

ENTSO-E Head of Market Section