A power system for a carbon neutral Europe

entsoe VISION

Webinar 3

A Market Design fit for a Carbon Neutral European Economy

Zoltan Gyulay

Head of Market Section, ENTSO-E

DAY 3, 12 OCTOBER #VisionEvent22

A power system for a carbon neutral Europe

INTRODUCTORY REMARKS

Kjell A. Barmsnes

Chair of the Market Committee, ENTSO-E

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ENTSO-E Vision for the future of the European Power System

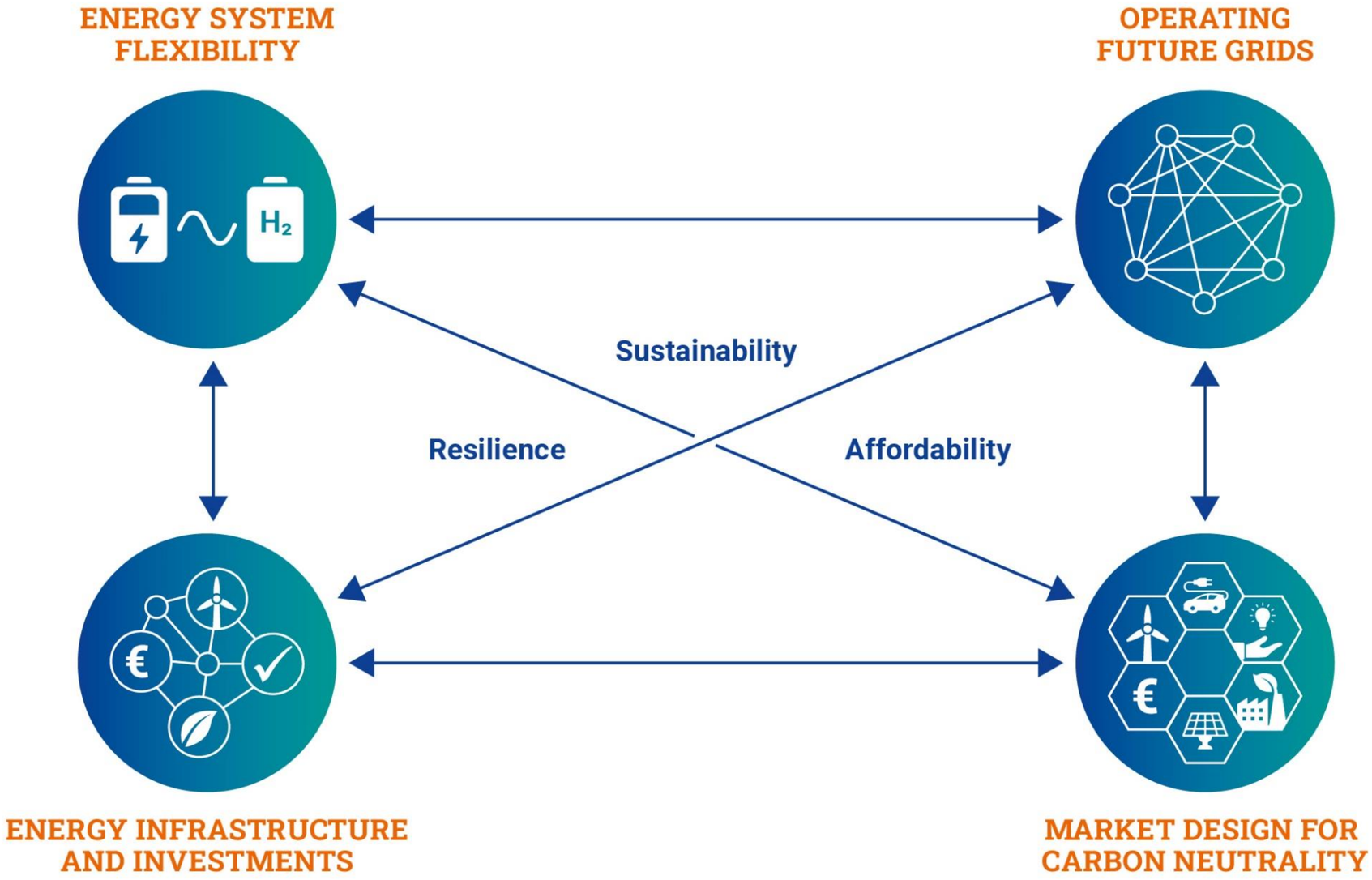
Guiding principle

- A shared political goal of a fully **carbon-neutral European economy**

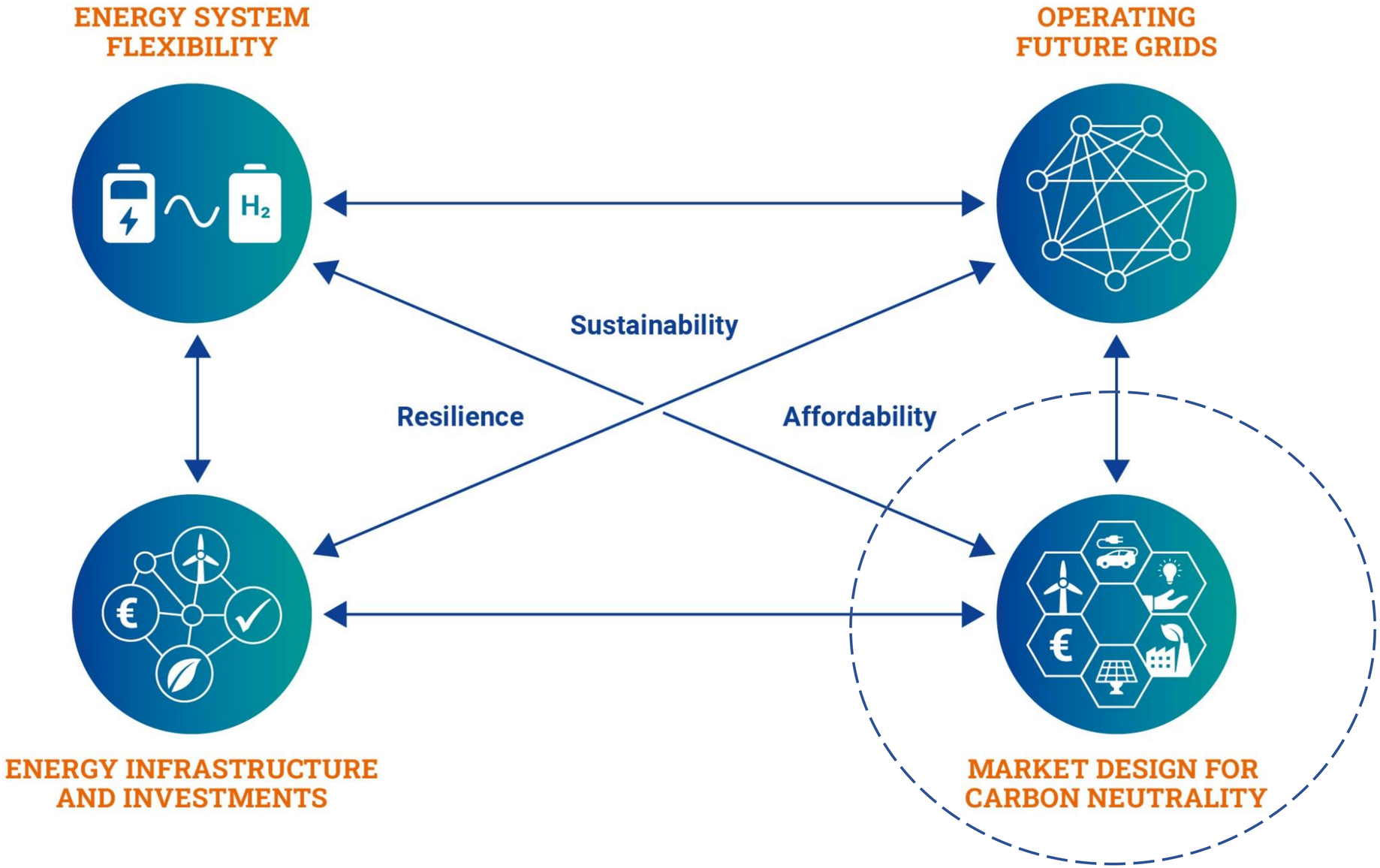
Our Vision

- A **comprehensive analysis** of what is necessary to achieve an European power system fit for a carbon-neutral Europe
- As a contribution to the debate on the **European Energy Transition** and on **Electricity Market Design**
- Including **TSOs shared intelligence** on trends, scenarios, challenges, technology & innovation

A Vision based on 4 Key “Building Blocks”



A Vision based on 4 Key “Building Blocks”



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KEYNOTE SPEECH

Mathilde Lallemand Dupuy

Policy Officer, Internal Energy Market, DG ENER, European Commission

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The EU objectives

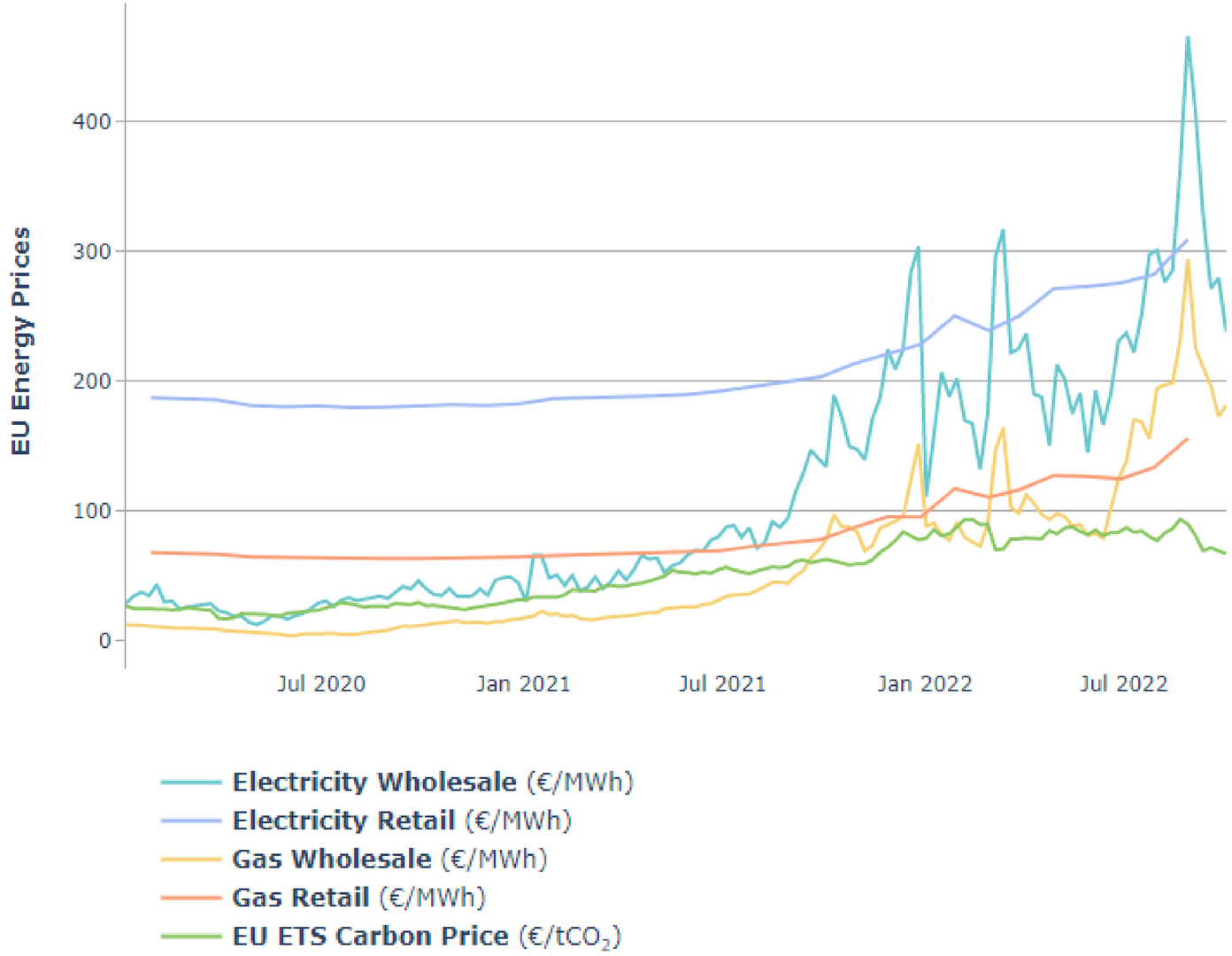
Security of supply

Affordability

Decarbonisation

European Commission

The reality of the crisis



Electricity markets don't work → vs. → Prices behave as expected given the current context

Volatility has to be avoided → vs. → Volatility has to be managed

European Commission

The urgent need to act: short and long-term not to be confused

RePowerEU Plan

Energy Prices Toolbox

13 Oct 2021

REPowerEU: Joint European Action for more affordable, secure and sustainable energy

8 March 2022

Non-paper: Security of supply and affordable energy prices: Options for immediate measures and preparing for next winter

23 March 2022

29 April 2022

Short-Term Energy Market Interventions and Long Term Improvements to the Electricity Market Design – a course for action

18 May 2022

Adoption of EU regulation on gas storage

June 2022

Adoption of emergency council regulation on reducing gas demand

August 2022

Commission proposes emergency council regulation to reduce bills

September 2022

Non-paper: options for gas price cap

28 September 2022

Proposal for improvements of the market design

European Commission

Fundamentals of the electricity market design

Market integration | **Competition and level playing field** | **Merit order and efficient dispatch** | **Price signals and incentives for investments** | **SoS and solidarity principle**

- Enhance **cross-border trade**: SoS and affordability
- Optimize use of **infrastructures**
- Enhance **locational price signals**
- Unlock **demand response and flexibility**
- Strengthen **forward markets**
- **Protect consumers** against high prices and excessive volatility

European Commission

Implementation and next steps towards an evolution of the market design

- Enhance **cross-border trade**
  - ➔ Market coupling further development, 70% rule, balancing platforms
- Optimize use of **infrastructures**
  - ➔ Optimization of the grid use, grid and system services, OPEX/CAPEX, boost innovation
- Enhance **locational price signals**
  - ➔ Proper bidding zone configuration
- Unlock **demand response and flexibility**
  - ➔ Electricity Directive implementation, Network Code on Demand Response, DSO-TSO
- Strengthen **forward markets**, to secure investments and stabilize the market price
  - ➔ Cross-border contracts/transmission rights, CfDs / capacity mechanisms,

European Commission

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Presentations by ENTSO-E Vision Project Members

Market Design for Net-Zero

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MARKET DESIGN FOR NET-ZERO

Marco Foresti

ENTSO-E Vision Project Team Member

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Market Design for a carbon-neutral energy system - Key Challenges

How can markets **ensure resource adequacy,** including long-duration flexibility?

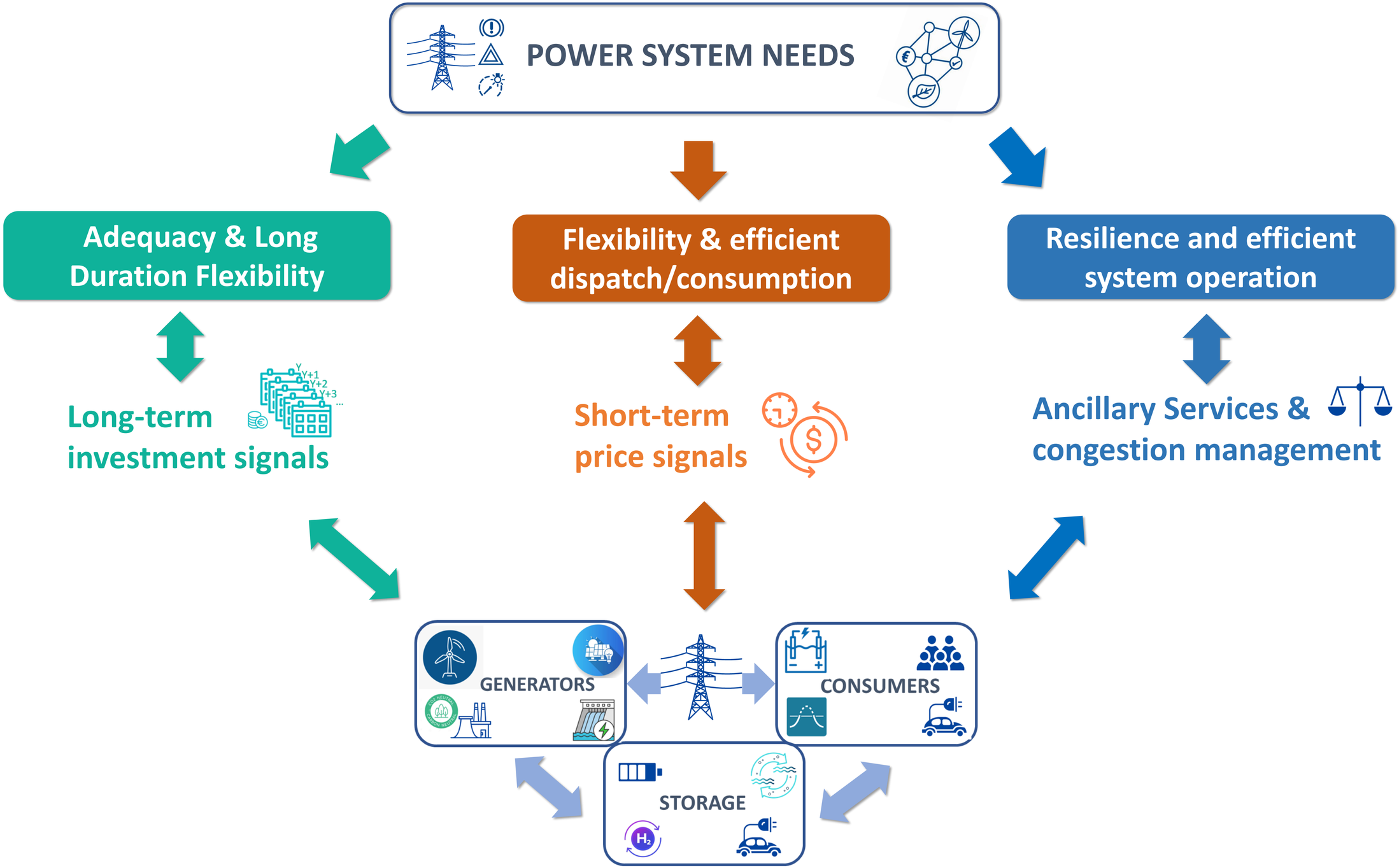
- How to finance massive RES development effectively and efficiently?
- Moving to a weather-dependent system, how can electricity markets remunerate the necessary long-term flexibility resources?

How to **incentivise** the necessary **short-duration flexibility & resilience** of the energy system?

- Which products and price signals are needed to value short-duration flexibility?
- How to reflect grid constraints and operational challenges in market design?
- How to facilitate sectoral integration and optimise market interfaces?

How can market design **address different consumers' needs and preferences**?

- How to facilitate emergence of new consumer services while aiming at simplicity, transparency and affordability?
- How to limit consumers exposure to extreme/sudden price increases while preserving incentives for demand response and energy efficiency?
- To what extent can demand response reduce the need for dispatchable generation in time of scarcity?


POWER SYSTEM NEEDS
Adequacy & Long Duration Flexibility
Flexibility & efficient dispatch/consumption
Resilience and efficient system operation
Long-term investment signals
Y
Y+1
Y+2
Y+3
Short-term price signals
Ancillary Services & congestion management
GENERATORS
CONSUMERS
STORAGE
H2

A market design fit for a carbon-neutral energy system

Rethinking Market Design

Today **market design is not fully fit for delivering a climate neutral energy system** and **needs to adapt** to upcoming challenges and opportunities.

Optimal value allocation

Electricity **market design** should **allocate value to what is most needed for the energy system** (adequacy, flexibility, resilience) in each timeframe and at each location.

Stronger long term price signals for RES & LD flex

Strengthen long-term price signals and **provide stable regulatory framework** to reduce capital costs to **accelerate investments** in both RES & complementary long-duration flexibility resources.

Efficient ST markets for dispatch & flex

Efficient short term price signal remain essential. To increase short duration **energy system flexibility**, **wholesale and balancing markets** need to be made **fit for the future generation mix** and new market actors**, optimising the integrated energy system of systems.**

Efficient use of grid capabilities

To facilitate **system resilience** and **efficient use of infrastructure**, market design should better **reflect grid constraints and operational challenges** via new requirements, new ancillary services, locational price signals, and new congestion management approaches, coordinated with DSOs when needed.

Affordability & Consumer needs

To meet the different **needs and preferences of consumers**, market design should facilitate **consumers engagement** and the provision of **new services**, while aiming at **simplicity of use, transparency and affordability**, and duly **protecting** specific categories of **consumers**.

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MARKET DESIGN FOR NET-ZERO

Gerard Doorman

ENTSO-E Vision Project Team Member

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Market Design - RES Investments & Long-Duration Flexibility

Stronger LT investment signals

Carbon pricing will be a cornerstone of new investment framework **but probably not enough for RES investments** unless markets develop reliable **long term pricing signals** (PPAs, liquid 10y+ forwards, etc.)

RES supports

Need of **effective and non distortive RES supports** (e.g. investment supports, capability-based CfDs, auctions for combined RES-storage assets, etc.) to make investments bankable (limiting risks & financial costs for developers) while **taking into account overall system costs**

Dispatchable generation

Weather dependency of future energy system, increasingly relying on electricity, highlights the **importance of resource adequacy and the value of capacity** through **investments in back-up & dispatchable carbon-free generation.**

Capacity Mechanisms

The **uncertainty on the evolution of energy prices, low acceptance of price spikes** and **risk of regulatory interventions**, impacts capital costs: some form for **Capacity Remuneration Mechanisms (CRMs) are likely to be needed in a carbon-neutral energy system.**

Long duration Flexibility

Scalable, affordable, efficient and largely deployable "medium**/long-duration" flexibility sources** (e.g. H2, hydro) **may reduce and even offset need for CRMs in the long-run**, but **technology breakthroughs are a necessary precondition.** To do so, **TSOs need to identify, define and transparently communicate LT system needs.**

Market Design - Enhancing resilience & energy system flexibility

ST signals for flexibility

Spot & balancing markets and price signals will remain **essential to optimise dispatch and incentivise flexibility.** Integrated, liquid, and competitive markets with robust price formation complemented by effective market monitoring will be at the core of the future system.

New products & processes

Existing **products and market rules need to evolve to be fit for future generation and market actor mix** (e.g min bid size, Gate Closure Times, Imbalance Settlement Period, procurement timeframes). New ancillary services and market based congestion management approaches are needed to **incentivise all flexibility providers to support system needs**. Remove barriers to market access and enable value stacking.

Grid constraints

To facilitate system resilience and efficient infrastructure use, **market design should properly reflect grid constraints & operational challenges**. Stronger locational signals improve accuracy of price signals provided to market participants, aligning signals with system needs & costs.

Seamless market interfaces

Seamless & optimised interfaces are needed to facilitate **Sector Integration**: **accurate electricity price signals in time & space** will be key to drive investments, dispatch, and consumption decisions.

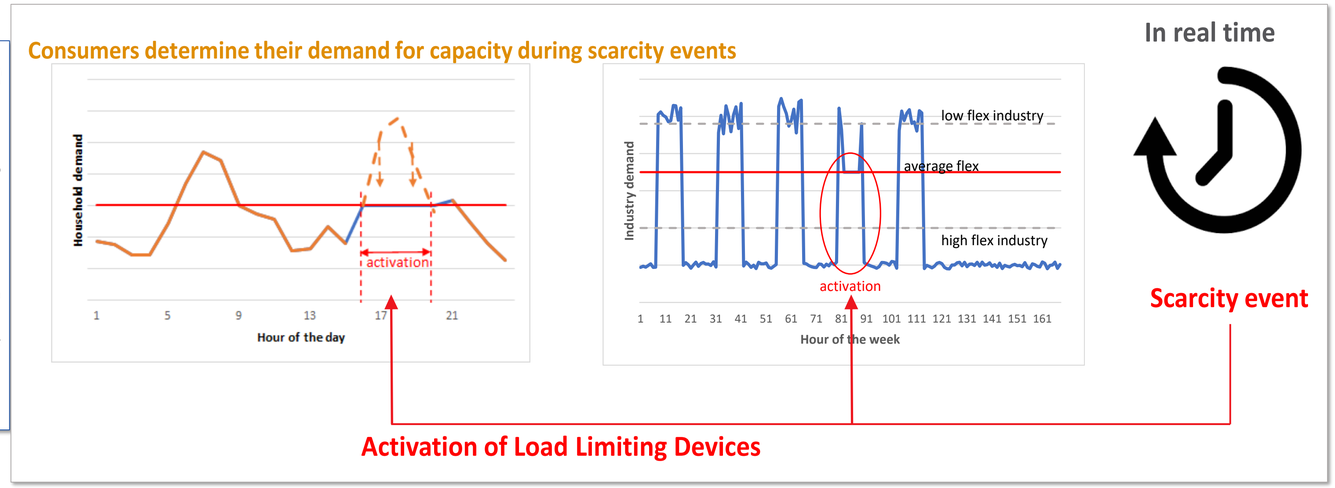
X-Sector Level-playing field

Unbiased price signals across sectors are essential to enable **optimal development of the energy system**. **Taxes, levies and network charges** need to consider their effects on the whole energy system as well as environmental externalities.

Affordability, consumers' needs and facilitating engagement

A future market design should allow **rewarding more flexible consumers** who are capable and willing to limit their demand during system-wide or more local scarcity conditions, for instance **via capacity subscriptions**.

This would **reduce energy prices in times of scarcity** and the overall costs to ensure resource adequacy, thus ultimately benefitting also less flexible or engaged customers



Future markets will need to serve **different types of consumers** and the **different value they associate with electricity** (level of guaranteed supply, carbon content, geographical origin, risk exposure) **and with related services** (trading possibilities, automation services, etc.). Consumers engagement and access for new service providers should be facilitated, while **simplicity, transparency and affordability** will still be the main needs for many consumers.

As wholesale prices volatility is likely to increase, **it is essential to partially shield specific categories of consumers from unlimited exposure to extreme or sudden retail prices increases,** while preserving the incentives for DSR, storage and energy efficiency. “Affordability options" or contracts with fixed price and fixed volumes are worth being investigated. Increase consumers risk awareness and target public support to most vulnerable/exposed consumers in times of crises.

Recommendations for upcoming market design reform & Concrete design proposals

ENTSO-E Vision: Recommendations for Market Design Reform

Rethinking Market Design

- **Accelerate RES development,** necessary grid infrastructure & timely development of long duration flexibility.
- Need of **more flexible & adaptable regulation** for specific circumstances. Avoid over-regulation for all times and countries, allowing targeted suspensions/exemptions for emergency & crisis situations.
- **Preserve IEM** and market fundamentals to ensure dispatch of most efficient resources.

Stronger LT investment signals for RES & flex

- **Capability based CfDs** provide revenue stability for carbon neutral generation, limit extra-revenues in times of high prices, and ensure correct bidding incentives to optimise dispatch
- Easier **introduction / application of Capacity Remuneration Mechanisms (CRMs)** to ensure resource adequacy**;** adapt CRM design to energy transition needs by considering Reliability Options and locational attributes

Efficient use of grid capabilities

- Introduce **stronger locational signals** via market granularity, tariffs or support schemes to optimise grid use and lower end-user costs; no one-size fits all: most suitable options depend on regional/national specificities

Efficient ST markets for dispatch & flex

- Unlock **Demand Response** through dynamic price signals and removal of non-price-based barriers
- Preserve **undistorted short term price signals** for efficient dispatch and flexibility use
- Review **Ancillary Services procurement timeframes and products** to ensure grid stability cost-effectively and appropriately remunerate technologies and providers (including for non-frequency Ancillary Services)

Affordability & Consumers' needs

- **Protect consumers while maintaining incentives for demand response & energy savings via fit for purpose retail pricing** suspend automatic price limits increase mechanism (introducing temporary relief valve); targeted support to consumers (esp. vulnerable households & exposed industries/businesses)

ENTSO-E Vision: concrete market design proposals

- Priority Structural measures
- Other options
- Crisis management measures

Affordability & Consumer protection

- Affordability options
- Fixed prices / fixed volumes contracts
- Suspend Automatic Price Limit Increase Mechanism
- Direct Consumers support
- Energy Savings Measures / Campaigns

Demand response

- Remove technical/administrative barriers to DR & allow reaction to dynamic price signals

Investment signals

- Capacity subscriptions
- PPAs
- Capability based 2-way CfDs
- Combined RES-Storage auctions
- Capacity Mechanisms 2.0
- Improved grid tariff structures
- Innovation-oriented Regulatory Framework

Efficient use of grid capabilities

- Strengthen locational signals

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MARKET DESIGN FOR NET-ZERO

Christoph Neumann

ENTSO-E Vision Project Team Member

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Capability-based 2-way Contracts for Differences

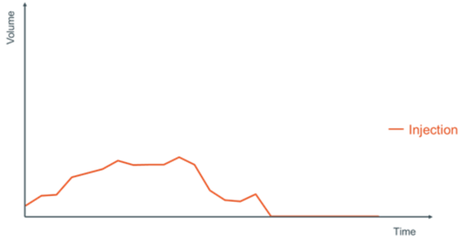
Definition

Capability-based CfDs are designed to settle the 2-way CfD payment on the *maximum possible* injection rather than on the *actual* injection

Traditional (2-sided) CfD

Payment based on injection:

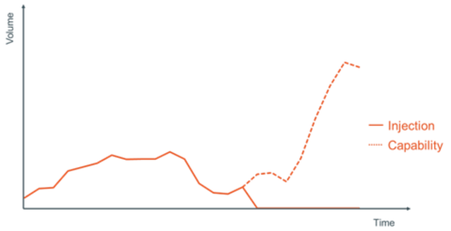
$$premium[€/MWh] = p_{strike} - p_{ref}$$
$$payback\ [€] = premium * P_{injected}$$



Capability-based (2-sided) CfD

Payment based on capability:

$$premium[€/MWh] = p_{strike} - p_{ref}$$
$$payback\ [€] = premium * Capability$$



Key design considerations

- ✓ Decoupling of injection and subsidy **removes the risk of possible market distortions** deriving from potential perverse bidding incentives linked to DA, ID and balancing market prices
- ✓ No need of mitigation measures (e.g no-payment with negative prices), increasing the mechanism complexity
- ✓ De-risk volume component for the windfarm, relating to e.g bidding zone configuration or possible congestion
- ✓ Retains proportionate subsidy where **windfall profits can be captured**

ENTSO-E recommendation

Capability-based 2 way CfDs give 1) **strong long term price signal** and **stable framework** (set by the duration of the CfD); 2) a**void market distortions**; and 3) Incentivize investors to build additional RES capacities while **guaranteeing capture of potential windfall profits**.

Capacity mechanisms 2.0

Stronger long term price signals for RES & LD flex

Efficient use of grid capabilities

definition

Capacity Remuneration Mechanisms (CRMs), including strategic reserves are **likely to be necessary to ensure adequacy** due to: 1) increasing uncertainty on operating hours of conventional generation; 2) frequency, magnitude and acceptability of scarcity prices; 3) any other form of political/regulatory intervention.

Key design considerations

- ✓ Design of CRM should ensure **non-discriminatory access** to all capacity providers (inc. RES, DSR and storage) and **fair remuneration** in line with adequate contribution of a specific resource;
- ✓ Its design should consistent with need to **accelerate the decarbonization** of the power system;
- ✓ Stronger **regional coordination** is required in case of wide-spread introduction of CRMs;
- ✓ Design features such as **reliability options, capacity subscriptions** and **locational attributes** are relevant to limit windfall profits and secure capacity at the right geographical localisation consistently with grid capabilities and system needs.

ENTSO-E recommendations

- Capacity mechanisms are likely to become a structural **part of future market design**, seen that increasing volatility and regulatory uncertainty restrains market parties to invest in new capacities only based on wholesale prices.
- Consider Reliability Options or Capacity Subscriptions and the inclusion of locational attributes to limit windfall profits, and to strengthen locational signals.
- Future legislative framework could facilitate easier/quicker introduction/activation of CRMs (e.g. CEP regulation, State Aid Guidelines)

Strengthen locational signals

Efficient use of grid capabilities

Definition

Stronger locational signals allow a **more efficient use of existing grid capabilities**. They improve the accuracy of incentives provided to market parties, making investment and dispatch more aligned with grid constraints and real-time system state. This limits the gap between market outcome and physics, and related system costs ultimately cost born by consumers.

Key design considerations

- ✓ **Finer spatial market granularity** (bidding zones, dispatch hubs or nodal pricing) allows more accurate reflection of network physics & more efficient usage of available infrastructure, reduce need & cost of remedial actions (redispatching)
- ✓ Locational signals can also be introduced in **RES support schemes, grid tariffs and capacity mechanisms**, providing incentives for generation & demand, including energy intensive facilities as electrolysers
- ✓ **Countries specificities** (grid topology, generation mix, demand profiles, market context, policy priorities) may require different approaches

ENTSO-E recommendations

- **Multiple options should be investigated to strengthen locational signals**: from spatial wholesale market granularity (bidding zone redefinition, dispatch hubs, or nodal pricing) to locational elements in RES support schemes, grid tariffs, capacity mechanisms.
- **No one-size-fits all solution**: EU regulation could facilitate, or at least allow, the test of alternative/innovative solutions in specific markets/regions while preserving the IEM.

Removal of non-priced-based barriers to demand response & response to dynamic price signals

Affordability & Consumers' needs

Efficient ST markets for dispatch & flex

Definition

- **Dynamic prices reflecting system conditions** gives market participants (incl. flexible consumers) a reference for dispatch and consumption optimization, incentives for storage, energy savings and energy efficiency, as well as decentralized trading and additional services.
- **Addressing barriers of entry to unlock all flexibility potential** in the system will facilitate large-scale implicit demand response.

Key design considerations

- ✓ **Limit consumer exposure to dynamic prices** by combining with retail pricing schemes (e.g., partial exposure to dynamic price, rest covered through fixed contracts; affordability options) and targeted consumer protection.
- ✓ Multiple possibilities to implement dynamic price mechanism, also in function of balancing approaches (e.g. reactive balancing)
- ✓ ENTSO-E identified a number of barriers to address to facilitate large-scale implicit demand response
  - Regulatory and administrative barriers
  - Technical barriers (full smart meter roll out and ISP based billing)
  - Behavioral barriers (awareness, economic incentive, simplicity of use)

ENTSO-E recommendations

End-consumer **active participation** to deliver implicit and explicit flexibility is an **essential part of future energy markets**. To do so, **regulatory and administrative framework must evolve** to allow emergence of additional value-added services, including **behind the meter**. In addition, **accurate price signals** must be provided to unlock all flexibility potential.

Policy Recommendations

Our Policy Recommendations

1. Strengthen **investment signals** for carbon-neutral energy and flexibility sources by facilitating the introduction of well-designed 2-way Contract for Differences and where necessary capacity remuneration mechanisms.

2. Increase accuracy of **short-term price signals** of day-ahead, intraday and balancing markets in space and time to optimise dispatch, flexibility and grid use.

3. Develop retail pricing solutions that facilitate **consumers engagement** and demand response while ensuring affordability and consumer protection.

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REACTIONS FROM KEY STAKEHOLDERS

Moderated by: Frauke Thies

Executive Director, Agora Energiewende

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CONCLUDING REMARKS

Kjell A. Barmsnes

Chair of Market Committee, ENTSO-E

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Our Vision – what the future will look like

In a fully carbon-neutral economy, **electricity** will be the main and most efficient energy carrier, and it will need to be coupled with other energy sectors. The system of the future will be based on 3 key elements, all **essential** for a sustainable, resilient and affordable power system:

- **Carbon Neutral Energy Sources**, providing the bulk of the power generation, and for the most part weather-dependent.
- **System Flexibility Resources**, to efficiently complement the variability of generation and consumption, and to address the increase in overall system complexity.
- The **Power Grid**, connecting generators, consumers and flexibility resources across Europe, and enabling a fully integrated European Energy Market.

The future power system in Europe will be:

- A **System of Systems**, which will need strong cooperation between transmission and distribution, and amongst different energy systems. All operators will be key enablers and facilitators to make this future energy system work.
- At the same time more **European** and more **Local**, with TSOs providing a critical interface between both dimensions.

Our Vision – how do we get there

A Power System for a Carbon Neutral Europe is within our reach

Four key elements will need to change to make this new reality possible:

- The development of significant system **flexibilities**, both short and long duration, that will need to be timed with the phase-out of fossil fuel generation.
- An **operation** of the system that will rise up to the challenge of this much more dynamic System of Systems, including the management of flexibilities, through innovation and cooperation.
- A regulatory framework, planning and permitting procedures that will facilitate the timely deployment of the necessary **investments**, and encourage efficiency and innovation.
- A **market design** that must evolve to allocate value where it will be most needed for the energy system, while reflecting different consumers needs and preferences.

The scale of change is such that **we need to act now**.
To transform this vision into reality as soon as possible, we will need a strong cooperation across the whole energy industry, and a permanent dialogue with consumers, stakeholders and public authorities

TSOs, through ENTSO-E, propose this work as a basis to start building this future together

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WRAP-UP

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Head of Market Section, ENTSO-E

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COME BACK AFTER THE BREAK!