ENTSO-E
Conclusions from Stakeholder Engagement on 2030 Market Design

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ENTSO-E Mission Statement

Who we are

ENTSO-E, the European Network of Transmission System Operators for Electricity, is the **association for the cooperation of the European transmission system operators (TSOs)**. The 39 member TSOs, representing 35 countries, are responsible for the **secure and coordinated operation** of Europe's electricity system, the largest interconnected electrical grid in the world. In addition to its core, historical role in technical cooperation, ENTSO-E is also the common voice of TSOs.

ENTSO-E **brings together the unique expertise of TSOs for the benefit of European citizens** by keeping the lights on, enabling the energy transition, and promoting the completion and optimal functioning of the internal electricity market, including via the fulfilment of the mandates given to ENTSO-E based on EU legislation.

Our mission

ENTSO-E and its members, as the European TSO community, fulfil a common mission: Ensuring the **security of the interconnected power system in all time frames at pan-European level** and the **optimal functioning and development of the European interconnected electricity markets**, while enabling the integration of electricity generated from renewable energy sources and of emerging technologies.

Our vision

ENTSO-E plays a central role in enabling Europe to become the first **climate-neutral continent by 2050** by creating a system that is secure, sustainable and affordable, and that integrates the expected amount of renewable energy, thereby offering an essential contribution to the European Green Deal. This endeavour requires **sector integration** and close cooperation among all actors.

Europe is moving towards a sustainable, digitalised, integrated and electrified energy system with a combination of centralised and distributed resources.

ENTSO-E acts to ensure that this energy system **keeps consumers at its centre** and is operated and developed with **climate objectives** and **social welfare** in mind.

ENTSO-E is committed to use its unique expertise and system-wide view – supported by a responsibility to maintain the system's security – to deliver a comprehensive roadmap of how a climate-neutral Europe looks.

Our values

ENTSO-E acts in **solidarity** as a community of TSOs united by a shared **responsibility.**

As the professional association of independent and neutral regulated entities acting under a clear legal mandate, ENTSO-E serves the interests of society by **optimising social welfare** in its dimensions of safety, economy, environment, and performance.

ENTSO-E is committed to working with the highest technical rigour as well as developing sustainable and **innovative responses to prepare for the future** and overcoming the challenges of keeping the power system secure in a climate-neutral Europe. In all its activities, ENTSO-E acts with **transparency** and in a trustworthy dialogue with legislative and regulatory decision makers and stakeholders.

Our contributions

ENTSO-E supports the cooperation among its members at European and regional levels. Over the past decades, TSOs have undertaken initiatives to increase their cooperation in network planning, operation and market integration, thereby successfully contributing to meeting EU climate and energy targets.

To carry out its **legally mandated tasks**, ENTSO-E's key responsibilities include the following:

- Development and implementation of standards, network codes, platforms and tools to ensure secure system and market operation as well as integration of renewable energy;
- Assessment of the adequacy of the system in different timeframes;
- Coordination of the planning and development of infrastructures at the European level (Ten-Year Network Development Plans, TYNDPs);
- Coordination of research, development and innovation activities of TSOs;
- Development of platforms to enable the transparent sharing of data with market participants.

ENTSO-E supports its members in the **implementation and monitoring** of the agreed common rules.

ENTSO-E is the common voice of European TSOs and provides expert contributions and a constructive view to energy debates to support policymakers in making informed decisions.

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1 Introduction

As a follow-up to the work on the 2030 Vision[1], in April 2021, ENTSO-E published a discussion paper "Options for the design of electricity markets in 2030" and launched a related stakeholder consultation[2]. This consultation was the result of an extensive process which aimed to identify the potential evolutions in market design towards 2030. The consultation paper was split into three distinct topics – wholesale markets, congestion management & spatial granularity – as well as resource adequacy and investment signals.

Over 50 participants, including stakeholders from all parts of the industry, shared their views on more than 60 questions. A first summary of the consultation responses was presented during a webinar in June 2021, encouraging debate on certain selected topics[3]. A follow-up webinar on flexibility platforms, market-based redispatch and the consumers' perspective was held on 12 November 2021[4]. Both webinars attracted more than 200 participants from a wide range of stakeholders.

The purpose of this paper is to conclude the work on Market Design 2030 by summarising the stakeholder feedback on a select number of topics, whereby Transmission System Operators (TSOs) see a continued interest for discussion with all stakeholders from the energy sector. It should be acknowledged that not all questions were answered by all stakeholders, hence the stakeholders' positions presented during the webinar or summarised in this paper are based only on those explicitly expressed. As such, we believe that continued exchange with stakeholders is valuable to steer discussion on market design and inform policy makers. In addition, specific topics raised during the consultation are being addressed in the ongoing work for the future of the CACM Regulation (2015/1222).

Building on the reflections on the 2030 market design, ENTSO-E is currently extending its future thinking to elaborate on a 2050 Vision towards a fully climate-neutral European energy system. Our goal is to provide an overarching contribution to the debate on the Green Deal & EU Energy Transition, starting from our Ten-Year Network Development Plan (TYNDP) 2022 scenarios and including TSOs' common intelligence on trends, challenges, technology & innovation. In the course of 2022, ENTSO-E will engage stakeholders on the key elements of our emerging 2050 Vision, including on further market design challenges and possible solutions.

1 See https://vision2030.entsoe.eu/

2 The discussion paper, the consultation questions and stakeholders responses, as well as the related webinar can be found at: https://consultations.entsoe.eu/markets/options-for-the-design-of-european-electricity-mar/

3 The consultation document, together with the consultation responses, can be found at: https://consultations.entsoe.eu/markets/options-for-the-design-of-european-electricity-mar/

4 https://www.entsoe.eu/events/2021/11/12/stakeholder-webinar-2030-market-design-to-enhance-distributed-flexibility/

2 Wholesale markets

Market rules, products and processes need to be adapted to reflect the changing nature of participants from both the demand and supply side. To prepare the energy system for 2030, we must ensure the proper participation of consumers in the different markets and ensure the right incentives for all market parties. Moreover, we need to be able to tackle the technical challenges of market coupling.

2.1 RES and consumers' participation

Consumers' participation and demand side response (DSR) are key enablers to support the energy transition; this is also reflected in the current European energy policies (such as the Clean Energy Package). To unlock the full potential of DSR, it is important to identify and address any potential barriers of entry.

Stakeholders have identified a broad range of barriers preventing the participation of DSR in the wholesale markets. Similar barriers have been raised by different categories of stakeholders, and several potential solutions were proposed:

The main barriers to the uptake of DSR are the inflexible structure of tariffs, combined with the high share of taxes and fees that obscure market price variations. Limited access to all markets, cumbersome procedures or products, and a lack of standardisation of the legal framework were also mentioned by several respondents. Moreover, costs to unlock response often exceed the benefits for individual consumers because there is still sufficient other cheap flexibility in the system.

The introduction of more dynamic pricing and fees with the roll out of smart-meters and controllers, when combined with a settlement based on actual smart meter data, may facilitate increased DSR.

The necessity to ensure a level playing field in all markets from day ahead (DA) to capacity markets for all market parties, including large and small consumers.

Although the participation of DSR is being discussed at the pan-European level, stakeholders raised the importance of the national framework (e.g. tariff structures). Lastly, with regards to residential consumers, emerging service providers highlighted during the November webinar the importance of the simplicity of solutions, allowing consumers to optimise their consumption choices with little interaction and without negatively affecting their desired comfort levels.

Regarding Renewable Energy Sources (RES) participation in Balancing Markets, stakeholders have identified that the existing balancing products alongside the technical requirements and the RES support scheme constitute the main barriers for such participation. Regarding how support schemes promote participation in balancing services, investment support and two-sided contract for difference were highlighted as the least distortive support schemes.

When stakeholders were asked which type of RES support is more fit for purpose for the 2030 power system, the most cited option was that support schemes for RES should be phased-out in the 2030 timeframe, but two-sided Contract-for-Differences (CfDs) and Power Purchase Agreements (PPAs) were also mentioned as appropriate options.

2.2 Frequency of intraday implicit auctions

On the topic of intra-day (ID) auctions, ENTSO-E outlined our views on the advantages and disadvantages of increasing their frequency (beyond the three ID auctions which are to be implemented). The rationale for increasing the number of ID auctions mainly stems from the assumed increase in efficiency of capacity allocation and the potential to unlock more flexibility in the ID timeframe.

From the consultation responses, it became evident that there is little appetite for a higher frequency of ID auctions. Several arguments against ID auctions were put forward, complemented by several voices calling to maintain continuous trading. To ensure efficient ID auctions, a gate closure time close to real time and a capacity calculation process for each auction are needed.

Given the strong opinions expressed during the consultation, it might make sense to further assess the optimal frequency of ID auctions and the link with the continuous trading algorithm – especially considering the expected increase in the importance of the ID market. This evaluation should involve all stakeholders.

2.3 Alternative pricing methods

Alternative pricing methods in the DA algorithm are proposed to improve the overall performance of the algorithm. Especially with an eye on the increasing complexity of the DA market coupling, e.g. the introduction of 15’ products or an extension of the flow-based (FB) areas, significant progress will have to be made to ensure the scalability of the algorithm used for market coupling.

Some stakeholders recognise the necessity and the benefit of moving towards non-uniform pricing, but there is a strong call to further assess the impact and evaluate its efficiency. Questions concerning the volume of side-payments and market transparency remain open until now. ENTSO-E recognises that this topic is still very much in an R&D phase and calls for further exchanges between nominated electricity market operators (NEMOs), TSOs and stakeholders on this topic.

3 Congestion management & Spatial granularity

In the long-term, an efficient system development entails incentives for the effective spatial coordination of market activities, i.e. generation, demand, storage, conversion, with infrastructures. In the short-term, the key responsibility of the TSOs is to maintain a secure system operation, in particular by ensuring that the physical limitations of the electricity grid are not exceeded. This task can be performed in an economically efficient manner only if electricity trading is subject to certain constraints.

This chapter elaborates on the different market design options with respect to how different models consider grid boundaries when performing their economic dispatch of available resources.

How short-term markets could ensure the efficient management of an increasing amount of congestion to cope with increasing and more volatile electricity flows, in the ultimate interests of consumers and all market parties, will be a challenge of the next decades. Although this is only one of the many market design challenges, ENTSO-E believes that, in addition to the continued development of the grid infrastructure, efficiently using the scarce transmission resources is a key challenge, in which the TSOs play a fundamental role as market facilitators.

3.1 PST & HVDC in the market coupling

Phase Shifting Transformer (PST) and High Voltage Direct Current lines (HVDC) are types of network equipment which provide flexibilities to the network due to their capability to control power flows. This makes them extremely valuable for managing transmission capacities at very low variable costs compared to other options such as the redispatching of conventional resources and curtailment.

PST and internal/cross-borders HVDC can be incorporated into FB methodology and enhance European power exchanges. To ensure that TSOs have sufficient flexibility for maintaining a secure system operation in real-time, a fixed share of capacity/tap positions (e.g. 2/3 as today for PSTs) needs to be reserved for operational security. Hence, a balance should be struck between providing flexibility in the market and having sufficient means available to ensure operational security. Although the cost of the solution appears minimal compared to the benefits, it still requires regulatory, technical and IT implementation.

In the consultation, market participants agreed that this approach may increase social welfare but also mentioned that the increased complexity might impair calculation times during the market coupling. Further analysis is therefore recommended.

3.2 Dispatch Hubs

Another design option is to integrate additional degrees of freedom into the market coupling algorithm by introducing so-called Dispatch Hubs (DH). These are small zones consisting only of congestion relevant assets[5] within an existing bidding zone. All other market parties are still within the larger bidding zone, regardless of their location in the grid. Separate bids (coming from the TSO or the market) are provided for each individual DH. The market coupling will select costly remedial actions (e.g. redispatch) if these generate net welfare through more cross zonal trade. The network impact of such actions is considered by the market algorithm to define the net position and price within the DH. There is still one clearing price for the whole bidding zone, whereas each DH will have its own price. The advantage of this "implicit redispatch" is that its impact is already considered in the market clearing, enhancing the result, instead of being done subsequently in a separate process (additional redispatch like today will still be necessary but to a smaller extent).

Two distinct variants of DHs can be considered. DHs can contain "market" bids or "redispatch potential" bids. The main difference between both methods is whether it is the market parties that bid or else the TSO on behalf of the expected response from market parties. The mechanics for optimising DHs in the market are similar for both methods.

The use of DHs offers the opportunity to organise an efficient trade-off between the costs incurred by the redispatching to guarantee a certain level of cross border capacity and the additional market welfare. In this regard, they integrate part of the redispatching costs into the clearing prices of the DA market and henceforth reflect the merit-order effect of redispatching onto the DA price level (as opposed to a scheme where redispatching is separated from the market clearing).

In the consultation, a majority of those who responded were positive towards the further analysis of this option, with a first focus on better understanding the concept and its implications. Others were more skeptical and feared the increased complexity of the market clearing algorithm, reduced portfolio bidding and the fact that there would be more than one price within one bidding zone. A number of implementation challenges were put forward, mainly related to the increased complexity of the market coupling algorithm.

3.3 Location-based Balancing

In the future, a much higher and more dynamic utilisation of the grid, with more actions taken in shorter timeframes, is required to integrate energy from volatile and distributed resources to distributed load. Among others, this implies closer coordination, and possibly the integration, of balancing and congestion management, to improve system efficiency and increase the pooling of resources. Arguably, a market-clearing model that internalises all relevant grid constraints is most relevant close to real-time. At this stage, it is difficult to correct actions that violate the security constraints of the system. Although TSOs are allowed to declare bids unavailable for the upcoming balancing platforms, it is complex to perform ex-ante filtering depending on the congestion they may cause. Therefore, countries with significant intra-zonal congestion need to allow for ample "slack" in their internal flows to avoid the violation of constraints in a purely zonal balancing model.

The European zonal market design could include a more location-oriented balancing market that would interact with the planned zonal balancing platforms. Bids would be given for specific nodes, or possibly groups of nodes, and location would be considered by the TSO during activation whenever necessary to avoid the violation of grid constraints. Such an approach could be used by countries with material congestions within their bidding zone(s) in co-existence with other countries using the present model.

Such a model with location-based balancing remains essentially a zonal model, incorporating the advantages that location-based information brings. It is a hybrid model with some of the advantages of the nodal model, mainly in ensuring a feasible and efficient dispatch in real-time with only limited disadvantages, e.g. the potential reduced liquidity derived from the more complex aggregation of distributed flexibility providers.

In the consultation, roughly equal shares of the respondents were positive and negative towards this development. Of those who were negative, several mentioned that balancing and congestion management should not be mixed. Furthermore, adding locational information to bids in the balancing timeframe implicitly establishes an additional, local price signal that parallels the zonal price. In the event congestions are predictable, there are similar risks for increase–decrease gaming as during redispatch. Other comments indicated that structural congestion should be handled by creating bidding zones, that investment in the grid should alleviate congestion, or that it is not suited for the transmission grid but more for the distribution grid.

5 Generation or demand facilities which significantly impact congestion in the grid.

3.4 Nodal based models

With Locational Marginal Pricing (LMP) or nodal pricing, the price in each node of the grid reflects the marginal cost of serving an additional unit of load in that particular node, knowing the detailed network constraints. The market clearing is based on Security Constrained Economic Dispatch (SCED) and/or Security Constrained Unit Commitment (SCUC).

One of the main differences between LMP and zonal based approaches is that the physical characteristics of the grid (i.e. all relevant grid constraints) are included in the market clearing. In traditional zonal models, such characteristics must be dealt with "out of market" or in redispatch markets. With the nodal approach, it is not necessary to calculate zonal capacities, as the grid as well as the capacities of individual lines (and where relevant, transfer corridors) are directly represented in the market-clearing. For the same reason, redispatch after day-ahead market clearing is not necessary as grid constraints are taken into account by design.

Of those who responded on this topic, a good share were of the opinion that a nodal model is simply not useful for Europe. The major objections were complexity, reduced market liquidity, market power, barriers for entry and transaction costs. Another share of respondents agreed that it is not useful for the DA market, but could be relevant for balancing (cf. location based balancing), for bidding zone analysis or for transmission planning. The remaining share of respondents thought that nodal models could be useful for the European context, at least after 2030, mainly due to increased efficiency.

4 Resource Adequacy and investment signals

The transition to a climate-neutral energy system will require a profound transformation sustained by massive investments in capital-intensive technologies. The electricity system is already rapidly evolving from a system dominated by traditional fossil fuel generation towards a low-carbon system, dominated by renewables, with active participation of demand and an increasing role for storage technologies.

As this rapid transformation changes the market drivers for new investments, there are growing concerns among stakeholders that the current electricity markets as they were designed in the past may not provide sufficiently effective investment signals to ensure the resource adequacy of the future power system. In this context, ENTSO-E has analysed the possible market models and solutions for 2030 and sought stakeholders' feedback on them.

4.1 Main market design options to ensure resource adequacy

The increasing penetration of renewable generation technologies in the electricity markets has been accompanied in recent years by lower margins for conventional generation and an increased wholesale price volatility. These market dynamics are leading to concerns that the current design of electricity markets – at least in some countries – may not provide sufficiently effective investment signals for firm and back-up capacity to ensure the resource adequacy of the system in 2030. ENTSO-E has identified three potential market design models to ensure the adequacy of the low-carbon system of the future:

Enhanced Energy Only Markets (EEOM), a model where the level of resource adequacy is not set exogenously but as an outcome of the energy only market (EOM) itself, without additional payments for the provision of capacity (except for some ancillary services). ENTSO-E considers it necessary to enhance traditional EOMs by improving price signals for flexibility.

Strategic Reserves (SR), similarly to capacity markets, complement wholesale electricity but with a targeted remuneration of capacity: specific contracts for the provision of capacity are signed only with a limited number of resources, which are activated in extreme cases when the desired level of adequacy cannot be met by the EOM alone. Such capacity is typically provided by resources that would otherwise be decommissioned and unlike the case of capacity markets they are not allowed to participate in the energy markets.

Capacity Markets (CM), a market design where to complement wholesale electricity markets additional remuneration for capacity is considered necessary to ensure the adequacy of the system. Such remuneration typically provides revenues to capacity providers in exchange for their availability to generate (or to reduce consumption) when mostly needed by the system.

According to ENTSO-E consultation, stakeholders expressed no clear preference for a single proposed market model, whereas several of them acknowledged that more than one can be a valid solution for 2030. Moreover, a minority of stakeholders proposed long-term contracts (e.g. 10–15 years) for the provision of firm capacity as a fourth alternative to simulate new generation investments by reducing uncertainty and lowering the cost of capital.

Given the importance of the topic in the transition to a carbon-neutral energy system, ENTSO-E considers it necessary to continue to monitor market design evolutions and to reassess at a later stage the effectiveness of different options in ensuring the adequacy of the system. In fact, clearer patterns and/or innovative solutions might emerge as the system decarbonises and new technologies spread in the energy system, driven by either technology advances or policies.

4.2 Capacity subscription

One innovative model design of capacity markets is the "Capacity Subscription" market model. Under this model, consumers buy the amount of generation capacity they need during system scarcity periods. Also in this model, consumers are generally allowed to consume more than the subscribed capacity. However, in times of scarcity, the TSO can activate the "Load Limiting Devices", which are installed at the consumers' premises, to keep consumption at the contracted level.

Under this market model, scarcity price does not normally occur as consumers obtain the right to consume electricity at a contracted price at any time. At the same time, the demand for reliable capacity is made explicit and payments to generation companies are spread out over time.

A small majority of stakeholders sees capacity subscription as a promising option, while requiring considerable additional analysis to further assess its functioning and market implications. In particular, stakeholders recognise that the main advantage of this market model is the consumer-centric approach. However, there is scepticism among the stakeholders as to whether this model could actually provide sufficient investment signals. Other challenges of this market model include complexity for consumers and social acceptance. Finally, some stakeholders question whether the level of capacity subscription should be defined directly by consumers or instead by a third-party entity (at least for certain customers).

Following the feedback received from stakeholders and the potential positive implications of this market model, ENTSO-E recommends that policy makers and regulators implement pilot projects to further test this market design option, in particular regarding the interaction with the consumer and the approach (fully consumer-based or involvement of third parties) to determine the amount of generation capacity to be contracted. Furthermore, additional analysis and studies would be required to assess the effectiveness of this model to stimulate investment in new generating capacity.

4.3 Scarcity Pricing

According to Regulation (EU) 2019/943, scarcity pricing is a means to encourage market participants to react to market signals and to contribute to the removal of market distortions to ensure security of supply. Based on this, ENTSO-E has evaluated the possibility of scarcity pricing, in the form of a price adder to the imbalance price, to ensure the adequacy of the system. ENTSO-E acknowledges that although scarcity pricing could incentivise flexibility provision, the impact that scarcity pricing has on adequacy remains to be demonstrated. Moreover, ENTSO-E highlights some key aspects which must be considered before introducing scarcity pricing:

All market participants need to be exposed to the imbalance price.

Wholesale markets must ensure the backward propagation of the real-time imbalance price up to the forward markets.

The scarcity pricing solution can be implemented (in combination with, and not as a substitute of capacity mechanisms)[6].

Any (national) scarcity pricing solution should not hamper the effective functioning of cross-border (balancing) markets.

When asked which potential benefits or drawbacks stakeholders see with the implementation of scarcity pricing (as imbalance price adder or adder in the wholesale market), the common consensus is that scarcity pricing improves a price signal for flexibility; however, it is not sufficient to stimulate sufficient investments to ensure resource adequacy. Lastly, political acceptance of scarcity pricing might be challenging to achieve.

6 As recognised by the academic literature and currently implemented in some US markets such as PJM and MISO.

5 Conclusion

Considering the very wide range of stakeholders who participated in the public consultation as well as the number of individual contributions to the specific questions, ENTSO-E believes that the objective of triggering a comprehensive and constructive debate on the market design for 2030 has been achieved.

ENTSO-E analysis, complemented by the stakeholders' feedback, has allowed TSOs to assess numerous options for improving European electricity markets, including several innovative solutions. Moreover, extensive interaction with stakeholders has helped ENTSO-E and TSOs understand which priority areas the stakeholders consider worth requiring further analysis in the coming months.

As such, we believe that debating longer-term market evolutions with stakeholders is not only complementary to the short-term implementation of ENTSO-E's legal mandates but also necessary to ensure coherence with the longer-term objectives.

As an example, in the context of the CACM 2.0 discussions ("Future of the DA Algorithm"), a number of solutions proposed by ENTSO-E in our 2030 Market Design Paper (e.g. optimisation of topology actions, non-uniform prices, DHs) have been positively received by NRAs and other stakeholders. Initial qualitative assessments of their impact on the algorithm were made. As a next step, the implementation feasibility of some of these proposals is now being discussed within the Single Day Ahead Coupling (SDAC), together with NEMOs and the algorithm service provider. The debate on 2030 market design options triggered by ENTSO-E has also highlighted how stakeholders and policy makers' views can substantially diverge on certain topics. This confirms the need to continue with an open stakeholder discussion on key priority topics, while taking stock of experiences and innovative solutions implemented both within and beyond European borders.

Lastly, it should not be forgotten that 2030 is only an intermediate milestone on the long and ambitious journey towards climate neutrality by 2050. As such, the consideration of challenges and solutions for European electricity markets, and for the energy system as a whole, must take place within a broader and forward-looking perspective.

In 2022, ENTSO-E will continue contributing to the public debate on future market design by facilitating targeted stakeholders' interactions on specific policy areas and by proposing a 2050 Vision of the European energy system, building on TSOs' technical expertise and the role of market facilitation.

Glossary

CACM	Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management
CEE	Central Eastern Europe
CfD	Contract-for-Differences
CM	Capacity Markets
DC	Direct current
DH	Dispatch hubs
DSR	Demand side response
EEOM	Enhanced Energy Only Markets
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
FB	Flow-based
FCA	Forward capacity allocation
LMP	Locational Marginal Pricing
NEMO	Nominated electricity market operator or power exchange
PPA	Power purchasing agreements
PST	Phase shifting transformer
RES	Renewable energy sources
SCED	Security Constrained Economic Dispatch
SCUC	Security Constrained Unit Commitment
SR	Strategic Reserves
TSO	Transmission system operator
TYNDP	Ten-Year Network Development Plan

The terms used in this document have the meaning of the definitions included in Article 2 of the CACM, FCA and EB regulations.

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