Explanatory note to the Methodology for pricing balancing energy and cross-zonal capacity used for the exchange of balancing energy or operating the imbalance netting process

in accordance with Article 30(1) of Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing

31 January 2024

Table of Contents

This document contains partly the same content as mentioned in the recitals of the amendment to which it is attached. AllTSOs have decided to keep the duplicate content in order not to lose the link to the background information provided during the public consultation.

1 Permanent and lower transitional harmonised maximum and minimum balancing energy prices

1.1 Introduction

1.1.1 Background

With Decision No 01/2020 of 24 January 2020 ACER has approved the methodology for pricing balancing energy and cross-zonal capacity used for the exchange of balancing energy or operating the imbalance netting process in accordance with Article 30 of EB Regulation ('Pricing Methodology').

With Decision No 03/2022 of 25 February 2022 ACER has approved the amendment to the Pricing Methodology, by which transitional harmonised maximum and minimum balancing energy prices of ±15.000€/MWh for balancing energy bids were introduced, Article 9(3)(a) of Pricing Methodology. According to Article 9(6) of the Pricing Methodology all TSOs shall perform an assessment of the functioning of the balancing energy market 36 months after the implementation deadline of the European balancing platforms to investigate whether different harmonised maximum and minimum balancing energy prices are needed for efficient functioning of the market.

1.1.2 Experience gained

Based on the experience gained within the first 15 months of operating the European Balancing Platforms and in the context of the energy crisis, all TSOs consider that the transitional harmonised maximum and minimum balancing energy prices of ±15,000€/MWh is too high and propose alternative limits at ±10,000€/MWh. This is consistent with the priorities set by the European Commission to reduce the bills for European households and businesses, and to avoid that electricity producers would be making exceptional profits while their generation costs have remained low[1].

Regarding the longer term, i.e. after 24 July 2026, all TSOs consider that technical price limits below ±99,999€/MWh are necessary and proposed limits of ±15,000€/MWh instead, that would only vary in case of an increase of the price limits applicable to the SIDC. Considering the responses in the public consultation and the shadow opinion provided by ACER and NRAs, all TSOs agree that limits depending only on SIDC price limits may not be adequate and propose to introduce an alternative (or complementary) adjustment mechanism. In order not to delay the submission and approval processes of the amendments to the Pricing methodology, which is considered important in view of the existing and future connection of TSOs to the European balancing platforms, all TSOs propose to set the initial value of the long-term limits at ±15,000€/MWh and to complement it at a later stage with an alternative adjustment mechanism. Considering BSP's observed market behaviour, having a reasonable initial value is increasingly seen by TSOs as essential for connecting to the European balancing

[1] See EU action to address the energy crisis (europa.eu)

platforms. Acting as neutral market facilitators, the TSOs do not consider acceptable the prospect of exposing BRPs, and indirectly the consumers, to energy prices as high as 99,999€/MWh.

All TSOs commit to perform an assessment of the functioning of the balancing market by 24 July 2025, and develop and propose for approval an alternative adjustment mechanism applicable from these ±15,000€/MWh limits. This would allow them to thoroughly consider alternative adjustment mechanisms and discuss them with ACER, NRAs and market parties.

In the following, the TSOs present the underlying reasoning for the proposal for amendment.

1.2 Objectives and characteristics of the balancing energy market

1.2.1 Possibility of introducing harmonised maximum and minimum balancing energy prices

Pursuant to Article 30(2) of the EB Regulation, in case TSOs identify that technical price limits are needed for efficient functioning of the market, they may jointly develop, as part of the proposal for the pricing methodology, a proposal for harmonised maximum and minimum balancing energy prices, including bidding and clearing prices, to be applied in all scheduling areas. In such a case, harmonised maximum and minimum balancing energy prices shall take into account the maximum and minimum clearing price for day-ahead and intraday timeframes pursuant to the CACM Regulation.

Pursuant to Article 10(1) second sentence of Regulation (EU) 2019/943 allows for technical price limits which may be applied in the balancing timeframe. Therefore, all TSOs understand that Regulation (EU) 2019/943 does not restrict the possibility, provided by the Article 30(2) of the EB Regulation of introducing technical price limits in the balancing timeframe, if it is deemed necessary by the TSOs. This amendment to the pricing methodology sets the technical price limits for balancing energy prices, including both bidding and clearing prices, equal to 15,000 €/MWh and 15,000 €/MWh for both positive and negative balancing energy. These price limits are not lower that the limits imposed within the day-ahead and intraday timeframes and do not restrict price formation. These concerns of disproportionality are also resolved by the fact that a mechanism for an automatic adjustment of the technical price limits for balancing energy prices will be proposed by all TSOs latest 42 months after the implementation deadline of the European balancing platforms. This approach was chosen because the adjustment mechanisms applied in the DA and ID markets are not considered as an equally suitable, less intrusive means for the balancing market due to its specific market conditions and it is not possible for all TSOs to develop an appropriate approach within a short period of time, i.e. within 2024. Therefore, the foreseen timeframe ensures sufficient stakeholder involvement, allows the results of the assessment of the functioning of the balancing market (which is to take place 36 months after the implementation deadline of the European balancing platforms) to be considered, and guarantees a suitable adjustment mechanism to be available latest 48 months after the implementation deadline of the European balancing platforms also respecting the legal deadline of six months within that the Agency shall adopt a decision according to Article 6(2) of EB Regulation.

1.2.2 Objectives of Commission Regulation (EU) 2017/2195 (“EB Regulation”)

Pursuant to Article 3(1)(b), EB Regulation aims at enhancing efficiency of balancing as well as efficiency of European and national balancing energy markets.

Pursuant to Article 3(1)(d), EB Regulation aims at contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union while facilitating the efficient and consistent functioning of day-ahead, intraday, and balancing energy markets.

Pursuant to Article 3(1)(e), EB Regulation aims at ensuring that the procurement of balancing services is fair, objective, transparent and market-based, and that it avoids undue barriers to entry for new entrants, fosters the liquidity of balancing energy markets while preventing undue distortions within the internal market in electricity.

1.2.3 Objectives of Regulation (EU) 943/2019 ("Electricity Regulation")

Pursuant to Article 3(a) of the Electricity Regulation, market rules shall ensure that prices shall be formed based on demand and supply.

Pursuant to Article 3(b) of the Electricity Regulation, market rules shall encourage free price formation and shall avoid actions which prevent price formation based on demand and supply.

1.2.4 Characteristics of the balancing energy market

1.2.4.1 Characteristics of an Efficient Market

The balancing energy market is a market organised to allow TSOs to procure balancing energy to balance the system in real-time. To be efficient, this market needs to be sufficiently deep to allow TSOs to cover their demand for balancing energy, and sufficiently diversified to ensure competition between suppliers. Such competition is essential to ensure a price formation that reflects the true value of balancing energy (i.e., the marginal cost of the marginal asset providing balancing energy). In principle, this can be achieved with prices well below the Value of Lost Load (VoLL). If price stays below that level, such a market will be more efficient than an inelastic market with even a perfectly optimal level of adequacy.[2] Resulting, a maximum price for balancing energy of 99,999 EUR/MWh is not considered to ensure an efficient functioning of the balancing energy market.

1.2.4.2 Requirements for efficient functioning of marginal pricing

For marginal (pay-as-cleared) pricing to lead to a welfare-maximising market outcome, several conditions need to hold:

- Homogeneous goods: The goods being sold should be identical or very similar. This ensures that buyers have no preference for one seller over another based on the product itself. This is ensured by standard balancing energy product.
- Perfect competition: The market should have many buyers and sellers, none of whom have significant market power. This prevents any single participant from influencing prices. Only a limited number of BSPs are present in the local balancing energy markets to be integrated via the balancing platforms potentially leading to high local market concentration.
- All-round price flexibility: Prices should be able to adjust freely based on changes in supply and demand, without any artificial restrictions or interventions.
- Single-unit-supply bidders (i.e., bidders who submit only one bid), which may only submit a single bid based on their marginal cost.
- Rational behaviour: Buyers and sellers should make decisions based on their own self-interest and preferences, without any collusion or manipulation.
- Profit maximisation: Sellers should aim to maximise their profits, which encourages efficiency and fair competition. This is observed and results in strategic bidding behaviour.
- Auction is a one-shot game: The balancing energy gate-colure times take place repeatedly, once every 15 minutes, with similar bidders and similar volumes put out to tender. The auctions thus

[2] Cramton, Stoft: Forward reliability markets: Less risk, less market power, more efficiency. 2008, p.195

constitute a repeated game rather than a one-shot game between the bidders, which has an influence on incentives and expected outcomes.

It is important to note that in real-world markets, these conditions are rarely met perfectly. However, the closer a market comes to meeting these conditions, the more likely marginal pricing will lead to competitive prices and efficient market results. The Balancing Energy market according to EB Regulation hardly fulfils any of the conditions. Therefore, measures are necessary to avoid market distortions and to increase the efficiency of the balancing energy market.

1.2.4.3 (No) Free Price Formation

An efficient market can only be considered to exist if price formation takes place freely within the framework of this market. This is not the case in balancing energy markets where it can only be considered a one-sided and therefore asymmetric price formation.

The necessity of harmonised maximum and minimum balancing energy prices also results from the fact that the balancing energy market is not subject to the same free price formation as is the case in the day-ahead and intraday market. In a wholesale market, energy providers and consumers can determine the quantity and prices they are willing to pay. This is not the case in the balancing energy market. While providers can set the quantity and price of the energy, they are willing to offer, there is – at least for most TSOs´ a/mFRR demands – no price sensitivity on the demand side, as TSOs balance the system at any costs, i.e., TSOs are required to take whatever amount is necessary to restore system balance. The amount required is determined by an external variable, namely the sum of feed-in and withdrawal of the system's energy. In scarcity situations, whether the scarcity is real, forced by BSPs or caused by errors, balancing energy markets are likely to be inefficient because BRPs are not flexible and cannot participate in the price formation, which is determined solely by the bids of BSPs. In these circumstances, BSPs are not given the incentive to submit balancing energy bids representing their marginal costs but see the possibility of maximising their profits by submitting strategically motivated bids.

The evaluation of the submitted balancing energy bids shows a significant number of bids not related to the level of wholesale energy prices (or a low ratio of them), as presented by TSOs to Stakeholders during the EBSG Meeting dated 25/05/23[3]. This is further underlined by the "ACER report on the progress of EU electricity wholesale market integration"[4] published in November 2023, stating that on average, prices in the day-ahead and intraday timeframes correlate the best (0.97), followed by prices in the intraday and balancing timeframes (0.84). The correlation between prices in the day-ahead and balancing timeframes is the lowest (0.83). ACER states in their report, that the numbers are justified by the fact that in theory, market prices in day-ahead and intraday timeframes share the same main driver: economic efficiency, where security of supply is a strong fundamental in the balancing timeframe. From all TSOs' point of view it is at least questionable whether such a decoupling of fundamental spot-market prices and balancing energy bids is justified, where bidding close to marginal costs should take place in the balancing energy market according to the fundamentals of the applied market design established through EB Regulation.

The fundamental effects of aiming at balancing energy prices being close to real underlying costs can be summarised as follows:

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[3] https://www.entsoe.eu/Documents/MC%20documents/balancing_ancillary/2023/230525_EBSG_materials.zip

[4] [Progress of EU electricity wholesale market integration - 2023 MMR (europa.eu)]

1. Ensuring affordability and accessibility: A maximum price for balancing energy protects market participants, consumers and producers from excessively high prices for balancing energy. Without such regulation, uncontrolled bidding might drive up prices to unsustainable levels, leading to increased costs for consumers and potential affordability issues. By implementing a maximum balancing energy price and thus keeping imbalance costs at an acceptable level, energy markets can maintain affordability and accessibility for all consumers, including households and businesses. This also effects collaterals of market participants which must be huge in case of extreme imbalance prices, which would create unjustified market entry barriers. Insufficient collaterals would on the contrary imply socialising the risk of a BRP's bankruptcy, which may be considered unfair.
2. Enhancing efficient system operation: Harmonised maximum and minimum balancing energy prices can contribute to maintaining grid stability in a cost-efficient way, particularly during periods of high balancing energy demands. With the proposed harmonised maximum and minimum balancing energy prices, the TSOs can activate the necessary balancing energy without facing unjustified high costs for BRPs. Additionally, the exercise of market power is more when total demand moves closer to total supply capacity during peak demand periods[5].
3. Supporting long-term investment: By introducing a maximum price for balancing energy bids, market participants can have more certainty about the potential costs associated with balancing their energy needs. This stability encourages long-term investment in renewable energy sources, storage technologies, and demand response programs. Investors are more likely to finance projects when they have reasonable assurance that balancing energy prices and thus imbalance costs will not skyrocket unexpectedly. Not addressing the risk of extreme price levels is likely to lead at some points to urgent regulatory interventions which is highly unpredictable and creates a significant risk for investors in balancing energy markets. Market participants have already expressed their concerns about frequent changes in market design during past consultations on EB Regulation related methodologies. Therefore, reliable market conditions are considered necessary. Additionally, the stakeholders' feedback on sudden market interventions in the context of the energy crisis was much restrained.
4. Limiting distorting effects: the proposed harmonised maximum and minimum balancing energy prices limits consequences of failures observed caused by humans or algorithms. For example, all TSOs' proposal limits the consequences of a "fat finger error", what may otherwise have dramatic consequences but also provide erroneous price signals to the market and possibly result in inadequate market reactions and thus inefficient market outcomes.

1.2.4.4 Concentration issue

Sufficient competition is essential for an efficiently functioning market. However, the local balancing energy markets are too concentrated, as reported by the TSOs to ACER and NRAs in accordance with Articles 9 of the Pricing Methodology. In such cases BSPs face little competition and have the potential to exercise market power. Such market power may lead to strategic bidding, meaning financial/economic withholding, which involves bidding in prices higher than the marginal bid to be expected under perfect market conditions. [3] The principle that the market self-regulates so that providers of balancing energy offer just above their marginal cost does not apply for a significant number of bids. As shown in [1], more than 10% of the submitted bids for positive aFRR energy

[5] Twomey, P.; Green, R.; Neuhoff, K. and Newbery,D.: A Review of the Monitoring of Market Power. Cambridge Working Papers in Economics CWPE 0504; Cambridge 2006.

exceeded 7,500€/MWh over a period of several months. Additionally, stakeholders have acknowledged that BSPs consider strategic aspects, e.g., the possibility of a congestion, in their bids.

The objective of EB Regulation to integrate national balancing energy markets is based on the assumption of available CZC to increase competition across borders. However, EB Regulation does not guarantee enough CZC by default – instead balancing platforms shall consider cross-zonal capacities remaining after the single intraday coupling. This holds true for the current situation in which very few TSOs are connected to the platforms but is likely to continue in the future even when balancing platforms are mature. The overall energy market design, setting out a sequential utilisation of CZC will always result in most of the CZC being allocated to previous timeframes, notably day-ahead and intraday, while leaving little to no CZC to the balancing timeframe.

Even if the CZC issue would be solved and if opportunities trigger investments to participate in the balancing energy market and result in additional liquidity at a reasonable price, such process needs time between the observation of opportunities on the market and the actual participation of (new built) flexibility. The moment when sufficient competition will emerge is unknown, and mitigation measures are necessary in the meantime to limit the potential damages caused by a lack of competition.

Balancing services are essential for reliable system operation, which is why TSOs have established technical requirements for them. This ensures that the service is provided with the necessary quality and that the European interconnected system can be operated reliably. At the same time, the justified requirements for this indispensable "insurance service" also lead to a smaller group of participants than in the regular energy market. Therefore, the supply side of the balancing energy market can be considered oligopolistic.

1.3 Necessity for harmonised maximum and minimum balancing energy prices

1.3.1 Suitability of harmonised maximum and minimum balancing energy prices fostering efficient markets in general

Academic literature on the application of harmonised maximum and minimum prices in energy markets is mostly available with the focus on spot markets. Due to sufficient competition harmonised maximum and minimum prices are not strongly recommended for spot markets. Nevertheless, harmonised maximum and minimum prices have been introduced for SDAC and SIDC according to CACM Regulation. The specifics of the balancing energy market as set out here makes it necessary to differentiate the conclusions in literature. Resulting the proposal under consideration is a suitable measure to mitigate the identified drawbacks.

According to academic literature, harmonised maximum and minimum prices in a marginal pricing market characterised by imperfect competition and market design aspects (see above under general principles) can limit market power and strategic bidding by setting a maximum price that participants can charge. This prevents dominant players from excessively raising prices. Strategic bidding, where participants exaggerate their bids to influence prices, becomes less effective as the price cannot exceed the cap. This reduces the potential impact of anticompetitive behaviour, benefiting both consumers and the overall market. Strategic bidding can be considered a form of market manipulation. It involves participants intentionally submitting bids in a way that doesn't reflect their true preferences or costs, with the goal of influencing market prices in their favour. This behaviour can distort market outcomes, reduce competition, and harm the efficiency of the market. Therefore, the TSOs proposal increases the efficiency of the market in general, as bids are forced closer to their real underlying costs.

At the same time, TSOs acknowledge the need for a sufficiently high harmonised maximum and minimum balancing energy prices in order not to force out of the market BSPs whose liquidity is required to secure the system but whose marginal cost would be above the selected harmonised maximum and minimum balancing energy prices. This, in turn, would have a negative impact on security of supply, as the amount of available balancing energy might not be sufficient to meet demand. Resulting, proposed harmonised maximum and minimum balancing energy prices also must be relatively high and above harmonised maximum and minimum prices for SDAC and SIDC. This increases welfare as compared to the situation without harmonised maximum and minimum balancing energy prices, as the harmonised maximum and minimum balancing energy prices eliminates/decreases the incentive to withhold in high demand scenarios and thus increases the efficient functioning of the market[8].

1.3.2 Harmonisation of DA, ID & Balancing energy markets

TSOs and NEMOs are to set maximum and minimum clearing prices for SIDC and SDAC in accordance with Article 54 CACM. If setting a maximum/ minimum price in a market which is deemed to have sufficient liquidity so as to avoid any abuse of market power, where both seller and buyer may adjust both the amount of energy they are willing to sell or buy and the price they are willing to pay or sell for, is deemed legally compliant, this - a fortiori - must be true for the balancing energy market, in which both of the above mentioned requirements are not fulfilled.

1.3.3 No less intrusive, equally suitable means

There are also no less severe, equally suitable means apparent to ensure an efficiently functioning balancing energy market.

1.3.3.1 Market Surveillance and Transparency

In particular, the measures that can be taken pursuant to the REMIT Regulation are not an equally suitable means of preventing market manipulation and thus the efficient formation of prices.

According to Article 7 REMIT Regulation, ACER and NRAs are obliged to monitor the market. If ACER and NRAs find infringements of Articles 3, 4 and in particular Article 5 REMIT Regulation, the NRAs can impose sanctions. However, proving conduct with the aim of market manipulation as distinct from lawful business conduct is extremely difficult because the underlying strategies are often very complex. It is therefore to be expected that many behaviours will not be detected, even though they would influence the price formation and could therefore be considered as a behaviour in line with Article 5 REMIT Regulation, considering ACER's REMIT Guidance. Moreover, such proceedings are often very lengthy, which is why, from a preventive point of view, investigative proceedings are insufficient. Timely investigation plays a central role in the prevention of further violations. However, if there is a long period of time between the indictable behaviour and the sanction, sanctioning miss part of its preventive power because market participants cannot see a connection between the offence and the sanction.

In contrast, by setting a maximum price for balancing energy bids, the regulatory authorities can discourage many attempts to distort the market ex ante by effectively limiting the consequences of strategic bidding. The harmonised maximum and minimum balancing energy prices proposed by all TSOs can therefore be considered as a risk mitigation measure that increases the efficiency of the market. This helps maintain a level playing field and ensures that market participants compete fairly, without distorting the market dynamics even further. Need for coordinated measures.

The measures proposed herein will only have full effect together with the proposed amendments within the framework of the aFRR Amendment. They are designed to jointly address the problems observed in the operation of European balancing energy markets. As each of them is only able to address one of the problems, a holistic introduction is required.

While the adaption of the determination of the aFRR CBMP aims mostly at reducing price peaks often corresponding to an aFRR CBMP that does not reflect the value of activated aFRR balancing energy bids, it cannot prevent the submission of exaggerated balancing energy bids.

While the introduction of partly elastic aFRR demand may (if applied) bring some elasticity to the aFRR demand side, part of the TSOs' aFRR demand must stay inelastic and thus will be covered at any cost.

Finally, the need for adapted maximum and minimum balancing energy prices results from the fact that neither of the above-mentioned measures can sufficiently limit exaggerated bids for balancing energy. Therefore, all TSOs propose to amend the currently valid harmonised maximum and minimum balancing energy prices.

1.3.4 Proposed harmonised maximum and minimum balancing energy prices

Based on the discussions above, the TSOs consider the following harmonised maximum and minimum balancing energy prices to provide for an efficient balancing energy market.

The determination of an ideal maximum and minimum balancing energy prices is done by approaching it from both sides of the supply and demand side, converging somewhere in between. In doing so, the interests of the BSPs are considered as well as the interests of the TSOs and BRPs.

Therefore, the maximum and minimum balancing energy prices below the marginal costs of BSPs would be inefficient, as it would force BSPs into operating below their costs (lower bound). As a result, BSPs would leave the balancing energy market and TSOs would not have sufficient supply to meet their demand[6]. Therefore, the maximum and minimum balancing energy prices should not limit the minimum volume required for TSOs to balance their systems. At the other end of the interval (upper bound), as shown, a balancing market would become inefficient if the costs exceeded the price BRPs would be willing to pay before preferring load shedding. Any value above the VoLL would increase the consequences of an inefficient pricing while not bringing benefits to the market functioning.

Thus, marginal costs form the initial lower bound, while the Value of Lost Load describes the upper bound. Within this margin, the TSOs take the following arguments into account in the further determination: harmonised maximum and minimum balancing energy prices that ensures this today are relatively low (probably lower than the harmonised maximum and minimum prices that apply to the SIDC) and are expected to remain low in the coming few years. For upward balancing, it has been qualitatively demonstrated that efficient balancing services should be provided by thermal plants with SRMC close to the DA spot price, which leads to lowest opportunity costs and thus lowest system balancing costs.[7] When looking further in the future, TSOs cannot exclude that higher harmonised maximum and minimum balancing energy prices may become necessary to access the required volume

[6] Grimm, V.; Zoettl, G.; Production under Uncertainty: A Characterization of Welfare Enhancing and Optimal Price Caps, 23. July 2008

[7] J. Hu et al.: Identifying barriers to large-scale integration of variable renewable electricity into the electricity market: A literature review of market design, Renewable and Sustainable Energy Reviews 81 (2018)

of reserves. To cover such possibility, TSOs propose a higher level of permanent harmonised maximum and minimum balancing energy prices, in line with the VoLL, and commit to propose an alternative adjustment mechanism. Therefore, All TSOs propose to introduce a temporary harmonised maximum and minimum balancing energy prices of ±10,000 €/MWh until July 2026 and higher permanent harmonised maximum and minimum balancing energy prices of ±15,000 €/MWh afterwards, starting from ±15,000€/MWh and adjusted according to a mechanism to be developed also considering the assessment of the functioning of the balancing market 36 months after the implementation deadline of the European balancing platforms.

1.3.4.1 Need for a transitional harmonised maximum and minimum balancing energy prices of ±10,000€/MWh

10,000 €/MWh is the lowest value (i.e., the higher risk mitigation for BRPs and system costs) that guarantees sufficient volumes to satisfy TSOs' needs while being above harmonised maximum and minimum prices for SIDC.

The proposed transitional harmonised maximum and minimum balancing energy prices of ±10,000 €/MWh is not considered to restrict the free price formation as balancing energy prices that exaggerate their underlying costs distort price signals and incentives to market participants, which may lead to disruptive imbalance settlement prices, not reflecting the real-time value of energy anymore.

Additionally, all TSOs consider that the proposed level still facilitates the development and investment in new technologies and are no undue barriers to entry for new entrants as required by Article 3(e) of the EB Regulation. For instance, tremendous investments are observed (e.g., in batteries) for a participation to the aFRR market, even in countries currently having harmonised maximum and minimum balancing energy prices much lower than the considered ±10,000 €/MWh. On the other hand, new market entries may not be efficient if motivated by distorted (exaggerated) high price signals, which may indicate a need not for new capacity, but for the efficient use of existing capacity[8].

If the harmonised maximum and minimum prices for balancing energy led to BSPs only covering their marginal costs, there will not be enough revenue to cover the fixed costs of their units/portfolio. As the maximum price for the intraday timeframe has not materialised until today, all TSOs consider that the ±10,000 €/MWh ensure that marginal cost (including opportunities) behind balancing energy bids can sufficiently be covered. Based on TSOs' experience in national markets, sufficient liquidity is available at prices below 10,000 €/MWh, meaning that this harmonised maximum and minimum balancing energy price is above the marginal cost of the marginal asset that is necessary to balance the system. This has been clearly observed e.g., in Germany, where the increase of the harmonised maximum and minimum balancing energy prices to 99,999 €/MWh followed by a decrease to 9,999 €/MWh and an increase again to 15,000 €/MWh had no significant impact on the volume of balancing energy bids[9]. Consequently, there is no demonstrated need at this stage that additional volumes offered at a price higher than 10,000 €/MWh are necessary to fulfil efficiently the role of the balancing market.

[8] Borenstein, S.; Bushnell, J. B.; Wolak, F. A.; Measuring Market Inefficiencies in California's Restructured Wholesale Electricity Market.

[9] Ehrhart, K.-M.; Fleck, A.-K.; Meitz, C.; Ocker, F.; Ott, M.; Wambach, A.; Wang, R.; Analysis of the EU target market design for balancing services - Report prepared on behalf of the Federal Ministry for Economic Affairs and Energy (BMWi). April 2022.

1.3.4.2 Need for a permanent harmonised maximum and minimum balancing energy prices limit of ± 15,000 €/MWh

With the massive development of intermittent RES, TSOs expect an increase in needs for balancing reserves. This implies to capture more flexibility in the balancing energy market and to invest to develop more liquidity. The level of harmonised maximum and minimum balancing energy prices that would still allow that is unknown at this stage. TSOs cannot exclude that it would be higher than the interim harmonised maximum and minimum balancing energy prices of ± 10,000 €/MWh. In any case, there is no valid reason why harmonised maximum and minimum balancing energy prices should be higher than the VoLL10 11 (for which a value of 15,000 €/MWh was considered by ENTSO-E as a base case for the former European resource adequacy assessment12). The VoLL differs per Member State. Nevertheless, all TSOs consider it as given that the same price limit applies to all Member States participating in the single European balancing energy market to ensure a level playing field for all market participants. As a result, all TSOs propose ± 15,000 €/MWh as the higher bound to secure that such needed investments can take place, while still mitigating the risks related to high harmonised maximum and minimum balancing energy prices as identified above. Considering the challenge to determine a unique, stable reference value for the VoLL that would be relevant for all European balancing energy markets, the value of 15,000 €/MWh may have to be adjusted in future. Therefore, all TSOs commit to develop and propose for approval an alternative adjustment mechanism applicable from ±15,000 EUR/MWh as a starting point after the transitory price limit expires. This allows allTSOs to thoroughly develop an appropriate adjustment mechanism considering the special conditions at balancing markets and discuss these with relevant stakeholders.

2 Improving CBMP determination by considering local LFC output

2.1 Introduction

The determination of the CBMP for positive (negative) energy by the aFRR Platform is currently set by the highest (lowest) price of all aFRR bids selected by the aFRR platform AOF in the same uncongested area. As the aFRR bids selected by the aFRR platform AOF are only used as input of the frequency restoration controller within each LFC area, this leads to situations where the CBMP does not reflect the price of the bids that are locally activated. The CBMP is in such case a theoretical value, not corresponding to the value (nor the bid price) of the balancing energy activated.

The operational experience with aFRR platform operation and the reports established in accordance with the amended Pricing Methodology show high activations costs and a significant number of aFRR price incidents (meaning that the aFRR CBMP exceeds the threshold of 7,500 EUR/MWh). The observed price incidents mostly occur only for a small time ≤ 1 min. This is shown in the histograms below analysing the aFRR price incidents per direction from 01.01.2023 until 27.08.2023.

[10] Re-powering Markets - Market design and regulation during the transition to low-carbon power systems, IEA, 2016, p. 111, 122f.;
[11] J. Hu et al.: Identifying barriers to large-scale integration of variable renewable electricity into the electricity market: A literature review of market design, Renewable and Sustainable Energy Reviews 81 (2018)
[12] ERAA 2021 - European Resource Adequacy Assessment 2021 – ENTSO-E

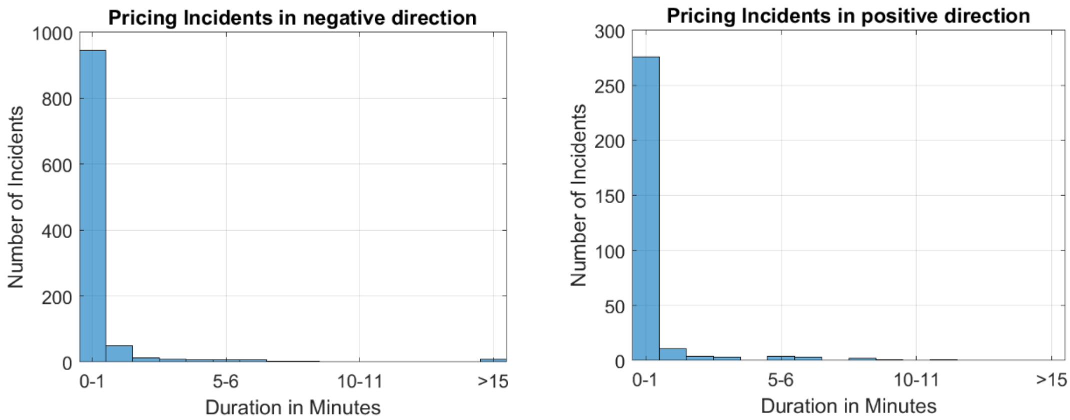

Figure 1: Number of aFRR price incidents per direction

Due to the distortive effect of these price peaks on the balancing energy markets, a short-term solution to reduce these price peaks often corresponding to a CBMP that does not reflect the value of activated aFRR balancing energy bids is seen as beneficial. Under the current conditions the aFRR CBMP can be determined by a bid that is not even considered for activation by a local frequency restoration controller. The occurrence of price incidents of short duration can be reduced by considering within the determination of the CBMP the local setpoints for automatic FRR activation.the locally activated aFRR balancing energy bids.

In the following subsections all TSOs first give some background on the relationship between activations and CBMP determination, then the proposal for amendment is described, and finally the expected consequences of this change on market functioning and stakeholders is described.

Any examples and descriptions in this explanatory material will assume selection and activation of bids for positive balancing energy.

2.2 Relationship between activations and CBMP determination

According to Article 145(4) of SO Regulation, the automatic Frequency Restoration Process ('aFRP') is operated in a closed-loop manner where the Frequency Restoration Control Error ('FRCE') is an input and the setpoint for aFRR activation is an output. The setpoint for aFRR activation shall be calculated by a single frequency restoration controller operated by a TSO within its LFC area. Resulting, the submission of TSO aFRR demand to the aFRR Platform happens each aFRR optimisation cycle.

Short term imbalances may not lead to any activation of aFRR. Therefore, it is considered as not efficient to determine the CBMP just based on the price of the aFRR bids selected by the aFRR platform AOF regardless of their activation by the local frequency restoration controller; doing so would exaggerate the true value of real aFRR activation. Therefore, the proposed measure aims to avoid aFRR CBMP based on the price of an aFRR bid that is selected by the aFRR platform AOF for a period that is too short to result in any setpoint for automatic FRR activation (LFC outputs) of TSOs, leading to unnecessarily high costs.

A BSP cannot react faster than the local frequency restoration controller, which resulting from Article 145 of SO Regulation has to have a proportional-integral behaviour. The integral part also reflects the fact that very short-term fluctuations in the system balance do not have to be fully compensated for to prevent overshooting of the system. This integral behaviour of the local frequency restoration controller is not considered by the AOF, which leads today in short term price spikes that cannot be related to the output of the frequency restoration controller and hence cannot be related to any BSP reaction.

The revenues resulting from short term price spikes are thus to be considered as "random profits" of (typically large) BSPs that were already activated (providing aFRR) before the price peak and similarly affects TSO-TSO financial exchanges. Further, for investors, given the low probability of revenues price spikes are not attracting investments[13]. The already provided aFRR will then be remunerated with a very high CBMP, while the BSPs having set this very high CBMP did not receive any activation signal due to the proportional-integral behaviour of the frequency restoration controller and will hence not receive any remuneration although their aFRR bid was selected (for short time) by the aFRR platform AOF. Therefore, the aFRR CBMP should not be built only on the pure input data of the LFCs, as it is currently the case.

In these situations, the price peaks do not reflect actual activation of balancing energy, nor the required aFRR to solve the imbalances based on the local setpoint for automatic FRR activation (output of the frequency restoration controller of the LFC area) and in this way give a misrepresentation of scarcity and actual aFRR need in the system; price peaks that cannot be related to the outputs of the LFC do not reflect a need for aFRR. Resulting, the CBMP should also consider the LFC output (i.e., the local setpoint for automatic FRR activation) to better reflect real activation of aFRR.

It's to be noted that the above explanation is based on events with price spikes but is equally valid for any fast evolution of the CBMP, including when the CBMP remains below the price incident threshold of 7.500€/MWh. This means that the current approach of building the aFRR CBMP purely based on the input data of the LFCs is increasing the amount of price spikes but is also more generally increasing the activation costs.

2.3 Proposal for determination of CBMP by PICASSO platform

To better consider local activation within the CBMP in a manner that allows fairly fast implementation, it is proposed to adjust determination of the CBMP by the AOF. It is important to note that all other steps of the AOF algorithm remain unchanged compared to the current situation, in particular:

- The bid selection is unaffected;
- The determination of power interchange between LFC areas is unaffected;
- The determination of the uncongested area is unaffected.

It is proposed to keep a single CBMP for each optimisation cycle per uncongested area, in the direction of the aFRR bid selection by the aFRR platform AOF within the uncongested area (also in the case where there are local activations in multiple directions), and to determine the CBMP considering both the local setpoint for automatic FRR activation (LFC outputs) and the AOF selected volume (LFC inputs) of each LFC area in the direction of the aFRR demand in the uncongested area. This means that also the determination of the direction for the CBMP is the same as in the current situation.

Considering that the setpoints for automatic FRR activation (LFC Outputs) are now proposed to be used as an additional input for the determination of the CBMP (as described in this proposal for amendment), the following definition is proposed to be added to the aFRR IF:

[13] Re-powering Markets - Market design and regulation during the transition to low-carbon power systems, IEA, 2016, p. 115

'setpoint for automatic FRR activation' the output of the frequency restoration controller within a LFC area as described in Art. 145(4) of SO Regulation. The setpoint for automatic FRR serves as the basis for determining the setpoints for BSPs within this LFC area but does not consider the BSP ramping restrictions that could be taken into account before sending the final activation signals to the BSPs.

The setpoint for automatic FRR activation in relation to the other steps of the local frequency restoration controller is visualised below:

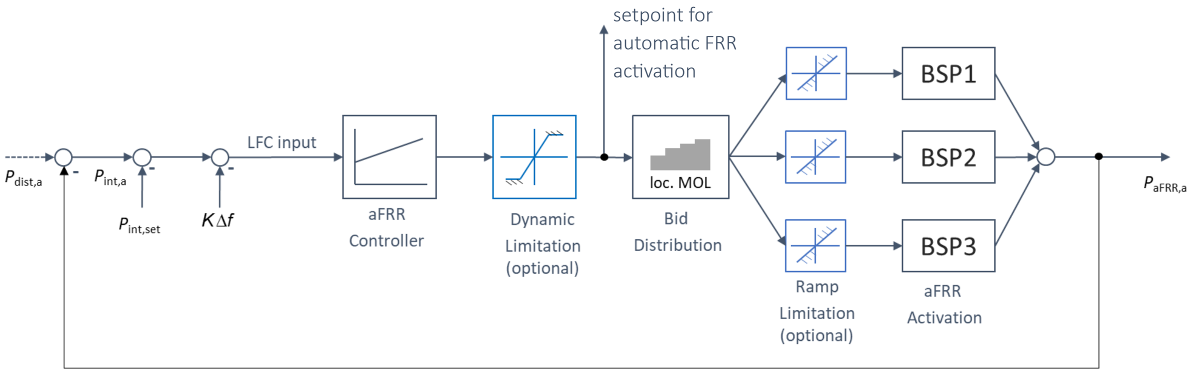

Figure 1: Visualization of the different steps that could be present in a local frequency restoration controller and the setpoint for automatic FRR activation

The adjusted CBMP will be used for TSO-TSO settlement in the same way the current CBMP is used today.

The proposal for the determination of the CBMP consists of two parts:

1. Determining the CBMP based on each LFC area setpoint for automatic FRR activation;
2. Limiting the CBMP to the price corresponding to the selection of bids by the AOF.

2.3.1 Part 1: Determining the CBMP based on each LFC area setpoint for automatic FRR activation

The CBMP in an uncongested area will be determined based on the highest price of all aFRR bids determined by the setpoint for automatic FRR activation of each LFC area in that same uncongested area.

For this part of the price determination the AOF would hence compare the setpoint for automatic FRR activation of each LFC area within the uncongested area to the local merit order list of that LFC area, and, in the direction of the volume of aFRR bids selected by the aFRR platform AOF, determines the CBMP as the highest of the respective prices on the local merit order lists. By using the setpoints for automatic FRR activation, the CBMP determination prevents price peaks resulting from bids that are selected by the aFRR platform AOF but not activated by local frequency restoration controller.

The aFRR Platform has the necessary data to compute the CBMP based on each LFC area setpoint for automatic FRR activation: the setpoints for automatic FRR activation are already provided to the aFRR Platform in real-time and the local merit order lists are already available to the platform ex ante.

2.3.2 Part 2: Limiting CBMP by the aFRR platform AOF selected volume

Local frequency restoration controllers can have different proportional-integral behaviour to effectively balance the local LFC areas. A consequence is that if the CBMP would be solely based on the setpoints for automatic FRR activation and the local merit order lists, more slow local frequency restoration controllers could remain setting the CBMP for a certain period after the bid is not selected anymore by the aFRR platform AOF. This is illustrated in Figure 3. In case the CBMP would be solely determined by the setpoints for automatic FRR activation, the CBMP would in the illustrated situation below correspond to the volumes activated under the blue line in the activation phase, and under the green line in the deactivation phase, i.e. faster controllers would set the price at the start of an imbalance, and slower controllers would set the price after the imbalance has been solved, due to the lagging effect of the controller.

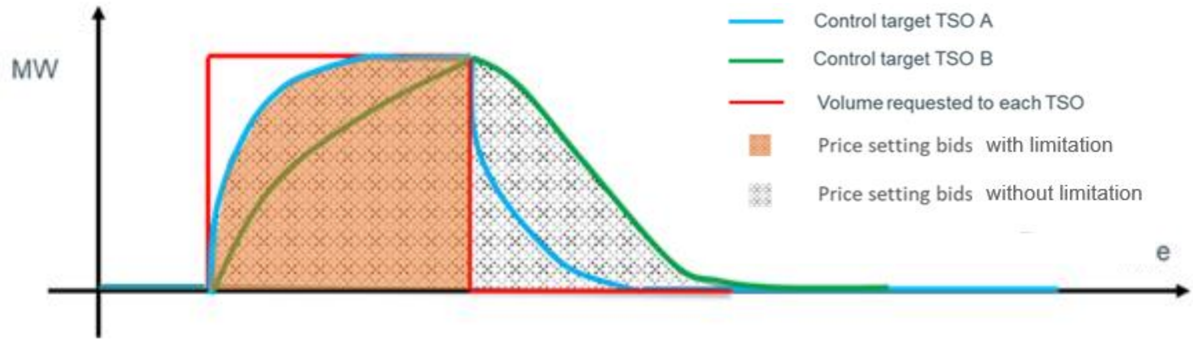

Figure 3: Illustration of different setpoints for automatic FRR activation for the same aFRR platform AOF selected volume

An additional step proposed is therefore to limit the CBMP to the price corresponding to the aFRR balancing energy product bids selected by the AOF within the different LFC areas.

This means that before comparing the setpoint for automatic FRR activation to the local merit order list per LFC area as described in part 1, this volume is compared to the AOF selected volume of the LFC area, and in case the latter is lower, the AOF selected volume is used for the CBMP determination instead. In Figure 3, this would result in a CBMP corresponding to the blue line in the first part, and the red line in the second part.

The consequences of this additional step compared to a CBMP determined on the setpoints for automatic FRR activation (part 1) without this second step are as follows:

- Reduces cross-border impact of differences in controller settings. With keeping the AOF selected volume included, bids that are no longer selected by AOF will not affect the CBMP;
- Prevents that the CBMP is determined by bids that are unforeseeably activated (e.g., due to local unavailability of bids or controller overshoots); without including the AOF selected volume, local unforeseeably activated bid will have a negative impact on the CBMP of the whole uncongested area;
- Will further reduce price peaks' duration and activation costs (depending on bidding behaviour);
- Will increase the amount of volumes that require pay-as-bid remuneration compared to the situation without AOF selected volume; then the only volumes requiring pay-as-bid remuneration are due to differences between the setpoints for automatic FRR activation and the accepted bid volumes, depending on local arrangement.

2.4 Expected effects of the proposed change

With this proposal the CBMP should better reflect real activation of bids. This will reduce overall activations costs and price incidents. When the price aligns with the actual activation of bids, several benefits arise:

Cost: The price more accurately represents the marginal cost of the marginal bid activated to balance the system by including each LFC area setpoint for automatic FRR activation in the aFRR CBMP determination. It avoids an over-remuneration of the BSP in case of expensive selected bids that are not part of the local setpoint for automatic FRR activation. This ensures that participants are compensated appropriately for their actual contributions to maintaining system stability and avoids grid users to pay for non-activated bids.

1. Incentive Alignment: Accurate prices encourage participants to submit bids that reflect their true willingness to provide or consume energy, as only bids determined by the local frequency restoration controller can set the CBMP. This reduces the likelihood of strategic bidding and encourages more efficient resource deployment.
2. Reduced Market Distortion: Accurate pricing reduces the potential for market distortions that can arise from misaligned incentives or inaccurate signals, which currently occurs during short-term price spikes with aFRR balancing energy bids determining the CBMP without being activated.

In summary, a price for balancing energy that reflects the real activation of bids supports efficient, transparent, and better incentivised markets.