TSOs' Assessment of the Imbalance Settlement Harmonisation Methodology (ISHM)

For Public Consultation

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Contents

1. Executive Summary

The Imbalance Settlement Harmonisation Methodology (ISHM)[1] was developed by all Transmission System Operators (TSOs) and approved by the Agency for the Cooperation of Energy Regulation (ACER) pursuant to Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing (EB Regulation)[2] Article 52(2) to 52(4) and is therefore legally binding. In accordance with ISHM Article 12(3), TSOs must assess the need for further harmonisation of imbalance settlement two years after the implementation deadline of the European balancing platforms pursuant to EB Regulation Articles 20(6) and 21(6). Based on the Balancing platforms implementation timeline, and according to ACER Opinion No 03/2025 of 16 April 2025 on the first amendment of the ENTSO-E Monitoring Plan, adopted in accordance with Article 63(2) of EB Regulation, the assessment of the need for further harmonisation of the imbalance settlement shall include an initial report to be submitted to ACER and the National Regulatory Authorities (NRAs) by July 2026 and a final report to be submitted by July 2027.. The assessment is carried out in line with the objectives of EB Regulation Article 3 and evaluates consequences and potential distortions from non-harmonisation pursuant to EB Regulation Article 59(3)(i).

Imbalance settlement translates real-time balancing actions and system conditions into charges and incentives for balance responsible parties (BRPs). The ISHM provides a common European framework for determining imbalances and imbalance prices in a context of evolving system conditions. Against this background, the assessment examines whether current ISHM arrangements remain appropriate and proportionate and identifies where clarification or limited adjustments could improve consistency and effectiveness.

The assessment focuses on Title III of the ISHM, Articles 7 to 11, and draws on the Compass Lexecon KPI-based evaluation framework using post-implementation evidence on market efficiency, operational security, and implementation feasibility. It verifies implementation, identifies remaining differences stemming from permitted flexibilities or from interpretation and practice, and derives proportionate options, prioritising clarification and streamlining where needed.

Key findings are as follows.

- First, the assessment does not provide evidence that broad additional harmonisation would deliver net benefits at this stage. Differences in imbalance settlement do not, in themselves, imply distortions provided that core principles are respected, including transparency, cost reflectivity, non-discrimination, and effective incentives, and provided that settlement remains calibrated to system conditions.
- Second, the main value lies in targeted clarifications to reduce ambiguity and interpretation-driven differences, thereby improving consistency and legal certainty without constraining necessary operational calibration.
- Third, proportionality requires assessing risks in both directions, since further harmonisation can also create risks through weaker incentives in some systems or higher operational costs.

While regulatory harmonisation under the ISHM has largely been achieved, the assessment shows that remaining differences primarily stem from methodological choices explicitly allowed by the framework or from interpretation at the operational level rather than from non-compliance.

Article 7 is implemented by all TSOs, but clarification is needed to ensure consistent interpretation on the relationship between activated balancing energy and satisfied balancing energy demand. Article 8 is

[1] ACER Decision 18-2020 on balancing ISHP - Annex I
[2] Regulation - 2017/2195 - EN - EUR-Lex

implemented by all relevant TSOs[3] and no material issues are identified, aside from limited improvements to readability and references for key terms. Article 9 remains appropriate in its core approach, but targeted clarification is needed on the consistent treatment of volumes in the calculation of the imbalance price, the boundary conditions and the Value of Avoided Activation (VoAA), as these elements drive implicit methodological differences across TSOs. Article 10 leaves room for different approaches to when to use the VoAA and would benefit from clarification on permissible inputs and application in netting situations. The assessment also flags a corner case risk where imbalance prices may be driven by a small subset of priced control cycles, potentially weakening representativeness. Article 11 confirms that dual pricing remains a valid option, and there is no case for removing this flexibility. Limited refinements are proposed, including adjusting the scarcity condition, further flexibility in applying dual pricing and removing the condition linked to imbalance settlement periods of thirty minutes or longer.

Overall, TSOs conclude that no comprehensive further harmonisation is needed at this stage. The recommended approach is targeted clarification and limited streamlining to reduce interpretation-driven differences while maintaining system-specific calibration. Since not all TSOs have yet joined the Manually Activated Reserves Initiative (MARI)[4] and the Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation (PICASSO)[5], and the adoption of the Network Code on Demand Response is imminent, more extensive changes are considered premature. TSOs suggest maintaining the current framework without prejudice for future reassessment once these developments can be fully assessed.

2. Introduction

Pursuant to Article 52(2) to (4) of the EB Regulation, the ISHM was developed by all TSOs and approved by ACER and is therefore legally binding on all TSOs.

According to Article 12(3) of the ISHM, two years after the implementation deadline of the European platforms for the exchange of balancing energy pursuant to Articles 20(6) and 21(6) of the EB Regulation, all TSOs shall assess the need for further harmonisation of imbalance settlement. Based on the Balancing platforms implementation timeline, and according to ACER Opinion No 03/2025 of 16 April 2025 on the first amendment of the ENTSO-E Monitoring Plan, adopted in accordance with Article 63(2) of EB Regulation, the assessment of the need for further harmonisation of the imbalance settlement shall include an initial report to be submitted to ACER and the NRAs by July 2026 and a final report to be submitted by July 2027.

The assessment must be carried out in line with the objectives set out in Article 3 of the EB Regulation and shall evaluate the consequences and possible distortions resulting from non-harmonisation in accordance with Article 59(3)(i) of the EB Regulation. All TSOs shall publish the assessment and invite stakeholders to submit comments. One year after publication, all TSOs shall submit the final assessment, including stakeholder feedback, to all regulatory authorities and ACER.

In the balancing time frame, market mechanisms (bids, schedules, and the results of balancing energy activation) and operational requirements (system security, real-time constraints, and control measures) come together. The EB Regulation and the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a

[3] With dual pricing methodology, there are cases where this is not applicable.
[4] See further information: Manually Activated Reserves Initiative
[5] See further information: PICASSO

guideline on electricity transmission system operation (SO Regulation)[6] codify this connection. Imbalance settlement operationalises the link by deriving BRP charges from actual balancing actions and system conditions, ensuring that prices reflect operational scarcity while incentives remain market-consistent.

The ISHM establishes a common European framework for determining imbalances and imbalance prices, ensuring transparency, efficiency, and coherence in the balancing market. It sets binding principles and minimum requirements within which TSOs design national settlement arrangements, thereby fostering market integration. In practice, however, the progressive and partly delayed implementation of the European balancing platforms means that full participation in MARI and PICASSO has not yet been achieved. As a result, the factual degree of harmonisation at the activation layer remains limited in some areas, still influencing operational outcomes.

In this context, the assessment examines whether the current degree of harmonisation under the ISHM remains appropriate in light of evolving market and operational conditions, including rising forecast uncertainty due to higher penetration of renewable energy sources, the shift towards shorter market timeframes, and the implementation of the European balancing platforms.

For the purpose of this assessment, harmonisation is understood by reference to different levels of alignment across TSOs:

- **Regulatory harmonisation** denotes a framework under which TSOs are governed by common binding principles and overarching rules, while a certain degree of flexibility is retained with respect to implementation choices or national parameters. The ISHM reflects the regulatory harmonisation of the imbalance pricing system.
- **Methodological harmonisation**, by contrast, implies the uniform and identical application of methodologies, including formulas, parameters and processes, thereby ensuring fully aligned outcomes across all TSOs. Certain frameworks include methodological flexibility in regulatory-harmonised processes to meet the specific requirements of TSOs.
- In the context of methodological harmonisation, the assessment has shown that a further distinction must be made between underlying drivers of different implementations. Specifically, two different sources of divergence can be identified:
- **Explicit flexibilities** arise where the ISHM itself provides for regulatory flexibility by allowing TSOs to choose between alternative methodological approaches, thereby explicitly foreseeing different implementation choices.
- **Implicit differences**, by contrast, occur where identical provisions of the ISHM are subject to differing interpretations or applications in practice. Although the same legal requirements apply, their implementation may not be uniform across TSOs, resulting in variation that is not explicitly prescribed by the regulatory framework.

Building on this analytical basis, the present review examines whether the existing ISHM provisions remain fit for purpose or warrant clarification or targeted adjustment, taking into account differing national conditions and the implementation of different rules over time before the EB Regulation and the ISHM entered into force. These national conditions, such as grid characteristics, asset mix, degree of system integration, and the presence of internal congestions, have shaped different balancing philosophies, leading to differences in local rules and systems. Imposing changes to these rules and systems should be duly justified based on a clear cost-benefits analysis.

[6] Regulation - 2017/1485 - EN - EUR-Lex

This assessment aims to identify those elements of the ISHM that are currently not fully harmonised and may therefore lead to risks and distortions, as well as to assess the need for further streamlining and potential adaptations of the methodological flexibilities.

3. Assessment Methodology

For this assessment, the analysis focuses on Title III of the ISHM (Articles 7-11), which defines the core methodology for determining and applying the imbalance price. Titles I, II and IV of the ISHM are addressed concisely to provide context.

- Title I sets out general provisions, definitions and scope. These establish the legal framework but do not contain methodological elements material to assessing imbalance price harmonisation.
- Title II describes reporting obligations and high-level requirements that support implementation but do not influence the pricing methodology.
- Title IV contains supplementary and final provisions which, while relevant for completeness, do not materially affect the assessment of Articles 7-11.

The assessment comprises two complementary steps:

1. Regulatory harmonisation: verification that Articles 7-11 have been fully implemented by all TSOs, including any NRA approvals or derogations.
2. Methodological harmonisation: analysis of
   - explicitly permitted flexibilities under the ISHM and the justification for national implementation choices,
   - implicit deviations arising from interpretation or practice,
   - observed inefficiencies in the current methodology,
   - risk assessment of identified issues (magnitude, persistence, cross-country scope) and derivation of the proportionate options (clarification, streamlining, targeted design adjustments).

For the relevant articles, a brief overview is first given, followed by the current implementation. Discussion points are then listed, and next steps are summarised. On this basis, TSOs indicate where discussion is needed on further methodological adjustments or where explicitly formulating required flexibilities would improve clarity and consistency.

The assessment draws on the Compass Lexecon ISHM Assessment Report (thereafter, “Compass Lexecon Report”) and its applied evaluation framework (see Annex 7.1.). The Compass Lexecon Report evaluates post-implementation market data (e.g., evolution of the imbalance price, price volatility, and system imbalance) pursuant to Article 59(4)(i) of the EB Regulation. Where applicable, KPIs are computed per country and analysed by country groups to reflect ISHM-permitted methodological choices (e.g., single vs. dual pricing, pricing approach, additional components).

Aligned with Article 3 of the EB Regulation and the ISHM operational objectives (ACER Decision, Whereas), the Compass Lexecon Report applies a multi-criteria KPI approach:

- **Market efficiency**: convergence of imbalance vs. day-ahead prices, imbalance price volatility, and the system imbalance ratio.
- **Operational security**: system imbalance ratio and qualitative operational evidence.
- **Implementation feasibility**: implementation progress, compliance or derogations, implementation lead time, and reasons for delay.

Taken together, this methodology provides a clear and reproducible basis for article-by-article evaluation. Conclusions are based on the defined KPIs, documented implementation practice, the ISHM framework, and, where indicated, highlight appropriate options for clarification, streamlining, or targeted design adjustments.

4. TSOs' ISHM Assessment

As part of the All TSOs' ISHM assessment, a general discussion on harmonisation and potential distortions associated with non-harmonisation in imbalance settlement is provided. TSOs then present the article-by-article assessment for Articles 7–11, applying the methodology set out in Chapter 3.

4.1. Limits of full methodological harmonisation and the role of methodological flexibility

While differences exist in how imbalance settlements are applied across Europe, all approaches pursue the same overarching objective: to provide BRPs with effective incentives to contribute to an efficient system balance and support grid operation. TSOs acknowledge that, for BRPs active across multiple price zones, a higher degree of harmonisation can simplify compliance and market participation strategies, as it reduces the need to adapt to multiple calculation logics. The following section therefore focuses on explaining why certain well-justified methodological flexibilities can be necessary to reflect structural differences in system operation, provided that core regulatory principles (transparency, cost reflectivity, non-discrimination and effective incentives) are respected.

- First**, operational conditions differ materially** across European power systems (generation mix, RES penetration, grid topology, interconnections). A **uniform design risks mis-calibrated price signals**: in systems where, generally, forecast uncertainty or tight reserves are more pronounced, BRPs require stronger incentives. An "average" design could dilute those signals and increase operational risk. Moreover, even within the same system or bidding zone, the appropriate imbalance design may evolve over time as the power system progresses along its energy-transition pathway and market conditions change. A **design calibrated to the "average" European system could therefore dilute balancing incentives in stressed systems**, increasing reliance on expensive operator interventions through balancing, grid management, and high reserve requirements, ultimately raising overall system costs. In this context, a certain degree of flexibility is not a market failure but a deliberate safeguard for operational reliability.
- Second, the **imbalance settlement is applied on a zonal basis and does not constitute a cross-border market** in itself. While BRPs active in multiple bidding zones may optimise positions across their portfolio, such behaviour is constrained by cross-zonal capacities, gate-closure times and forecasting uncertainty. Differences in imbalance settlement design therefore do not in themselves imply distortive cross-border competition effects.
- Third, TSOs acknowledge that, in principle, **BRPs active in multiple bidding zones could reallocate imbalances within their portfolios** by executing trades between bidding zones prior to the applicable cross-zonal gate closure time (CZGCT), in particular by allocating imbalances to bidding zones where lower imbalance prices are expected. In practice, such behaviour would require BRPs to reliably anticipate imbalance prices across bidding zones, overall system balances and their own imbalance positions, all of which are subject to considerable uncertainty ahead of CZGCT. Nevertheless, situations may occur in which imbalances are deliberately allocated to bidding zones with lower imbalance prices and subsequently remain open, i.e., are not actively balanced. The likelihood of BRPs maintaining open positions depends strongly on the strength of balancing incentives and intraday market liquidity. In

systems with sufficiently liquid intraday markets and structurally incentivising imbalance prices (e.g., systematically higher or lower, depending on imbalance situation, than intraday indexes) BRPs are consistently incentivised to minimise imbalances, thereby effectively discouraging the accumulation of residual open positions. However, the risk of imbalance shifting leading to increasing open imbalances in one bidding zone **cannot be fully mitigated through methodological harmonisation** alone, as structural differences related to local system conditions, underlying prices, market liquidity and forecast uncertainty would persist.

- Fourth, the **European balancing platforms (PICASSO, MARI) already harmonise the cross-border activation of balancing energy** at the core operational layer while imbalance settlement primarily allocates costs and incentives to BRPs locally. Remaining national differences therefore have limited impact on cross-border market efficiency. Against this backdrop, regulation should prioritise harmonisation of principles rather than identical designs: effective incentives require local calibration, and methodological differences are acceptable where they are explicit, justified by system conditions, and consistent with EU-level principles. Besides that, there are still TSOs that have yet to join the platforms which will lead to further harmonisation in the future.
- Fifth, full **methodological harmonisation would not result in uniform prices** across countries, as the imbalance price remains inherently linked to local market prices and conditions. Conversely, applying an identical imbalance price across all countries would fail to transparently reflect country-specific system conditions and market price signals. When discussing the risks of limited harmonisation, the risks of further harmonisation should be assessed in parallel to ensure a proportionate and balanced outcome.

4.2. Assessment of Article 7

Scope and objective of the Article

Article 7 establishes the framework for applying single imbalance pricing by default and only allows the use of dual pricing in specific cases where this has been approved by the regulatory authority. It defines the mechanism for determining the imbalance price for each Imbalance Settlement Period (ISP) and imbalance price area, linking the price to balancing energy activations and the results of the European balancing platforms, and integrating system direction and the VoAA through references to Articles 8-10. The purpose of Article 7 is to ensure that imbalances are settled at a price that reflects the real-time value of energy and that they remain within economically justified bounds, thereby maintaining effective incentives and avoiding distortions. In addition, Article 7 stipulates that its implementation must remain consistent with the requirements of Article 55 of the EB Regulation.

Current implementation

All TSOs have implemented Article 7, therefore regulatory harmonisation is achieved across all TSOs. In practice, all TSOs apply imbalance price calculation methodologies that are aligned with the principles of the boundary conditions set out in the ISHM, including the link to activated balancing energy and consideration of system direction. At the same time, operational aspects relevant to the determination of the underlying volumes are governed by Articles 9(1) and 9(2) of the ISHM and not explicitly harmonised in Article 7 itself. As a result, while the Article 7 framework is applied consistently, differences arise in operational practice where Article 9 allows discretion in the treatment of activated and netted volumes.

Additionally, three NRAs have approved the application allowing the use of dual pricing.

Need for further clarification or discussion

Ambiguity and implicit methodological differences arise from the interaction between Articles 7 and 9 of the ISHM, as well as Article 55(4)-(6) of the EB Regulation, regarding the volumes to be considered for imbalance price determination.

- Article 7(3) refers to the “activation of balancing energy for its satisfied balancing energy demand”.
- Articles 9(1) and 9(2) refer to “volumes for positive activated balancing energy” and “volumes for negative activated balancing energy” respectively, while Article 9(5) refers to the “volume for satisfied balancing energy demand”. EB Regulation Article 55(4)-(6) also refer to "activated balancing energy".

Operationally, these concepts may diverge, as balancing energy demand can be netted, partly activated, or fulfilled via cross-activation from other balancing areas, while activated volumes are determined at platform or local level. This can result in different interpretations of which volumes should be used consistently for imbalance price calculation.

TSOs therefore identify a need for clarification within the ISHM, both in Articles 7 and 9, to ensure a common understanding of the types of volumes to be applied in practice, including in cases of netting and cross-activation, and of how the concepts in Articles 7 and 9 interrelate.

Recommendation

It is recommended to clarify, within Articles 7 and 9 of the ISHM, the relationship between:

- activated balancing energy volumes, and
- volumes corresponding to the satisfied balancing energy demand,

for the purpose of imbalance price calculation under Article 7. Such clarification should define which volume concept prevails in specific operational situations (e.g., netting, partial activation, cross-activation) to ensure consistent and transparent application across all imbalance price areas.

4.3. Assessment of Article 8

Scope and objective of the Article

Article 8 contains two important definitions. On the one hand, it describes how to determine the direction of the total system imbalance. On the other hand, the character of a BRP (aggravating or non-aggravating) is defined.

The direction of total system imbalance is especially important to determine the correct imbalance settlement price in cases where activations in both directions occurred within a quarter-hour (pursuant to Article 7(3)(c)). In such a case the direction of total system imbalance decides if the imbalance settlement price is determined according to Article 9(1) or Article 9(2).

The general requirement for this distinction is given in Article 55(3) of the EB Regulation. The ISHM states that the direction of total system imbalance must be determined per imbalance price area and gives a concrete list of all the energy volumes that can be taken in account for the imbalance settlement price calculation. It also describes the sign convention which must be used to identify the direction of the total system imbalance.

The character of a BRP's imbalance can either be aggravating or non-aggravating to the total system imbalance. While this distinction is relevant in imbalance price areas and ISPs, where dual pricing is applied, its relevance depends on the specific design of the pricing scheme. In particular, Article 11(4)(a) and 11(4)(b)(ii) allow the use of the imbalance price pursuant to Article 9 both for aggravating and non-aggravating BRP imbalances. Therefore, the character of the imbalance is not relevant in all dual pricing areas, but only in those where the VoAA pursuant to Article 11(4) is used as imbalance price for non-aggravating imbalances, including – if applicable – additional components.

Current implementation

All relevant TSOs have implemented an imbalance settlement price calculation compliant to Article 8[7]. A special situation occurs for TSOs in the Nordic synchronous area except the Danish bidding zones. These TSOs partly calculate their frequency restoration control error (FRCE) as the frequency deviation and, therefore, use Article 8(3). This article allows TSOs to calculate the direction of total system imbalance based on a set of imbalance price areas. With their accession to both MARI and PICASSO, however, the Nordic TSOs will change to calculate their FRCE from their area control error (ACE). This will lead to significant changes in imbalance pricing. A different case is Italy, where a central dispatch model is applied. The country is divided into seven distinct imbalance price areas, each corresponding to one of the seven bidding zones. For the purposes of the definition of the total system imbalance, these imbalance price areas are aggregated into two macro-zones. As all TSOs are in line with the provisions of Article 8, regulatory harmonisation is fulfilled.

Need for further clarification or discussion

Methodological flexibility exists based on the volumes that may be included in the calculation of the total system imbalance, listed in Article 8(1)(a-e) and Article 9(5)(a-f). All volumes in this list are clearly part of the total system imbalance. Currently each of these volumes occurs in at least one imbalance price area, as different bidding zones need different measures for balancing and to solve system constraints. Therefore, the current level of methodological flexibility corresponds to the individual needs of the TSOs to compensate for their imbalance.

Furthermore, TSOs have identified that the terms "imbalance area" and "imbalance price area" are crucial to interpret the ISHM correctly. Although the basic definitions of these terms are both provided in Article 2(11) and Article 2(13) of the EB Regulation, the main provisions for their application are scattered over different regulations. While Article 54(2) of the EB Regulation states that the imbalance area must be equal to a scheduling area except in cases of central dispatch, it is prescribed in the Commission Regulation (EU) 2019/943 (CEP), Article 6(6) and in Article 1(2) of ISHM that the imbalance price area must be equal to a bidding zone except in cases of central dispatch.

Recommendation

The evaluation reveals that the list of volumes to be considered for the calculation of the total system imbalance provided in Article 8(1) remains up-to-date and necessary to respect the operational requirements in different bidding zones. The provision in Article 8(3) is currently used in most imbalance price areas in the

[7] With dual pricing methodology, there are cases where this is not applicable.

Nordic synchronous area and will remain necessary until these LFC areas change to calculate their FRCE from their ACE during their accession to MARI and PICASSO. In addition to Article 8(3), TSOs understand that the direction of total system balance per bidding zone stems from the ISHM methodology itself, while Article 6(6) of CEP establishes that the imbalance price area corresponds to the bidding zone (except in central dispatch systems).

In addition, TSOs would recommend including appropriate references regarding imbalance area and imbalance price area to the respective regulation Articles to improve the clarity of the ISHMe.

4.4. Assessment of Article 9

Scope and objective of the Article

Article 9 establishes the relationship between the prices of activated balancing energy from the different balancing energy products, the boundary conditions set out in the EB Regulation, and the resulting imbalance prices for each imbalance settlement period (ISP), imbalance price area, and system direction. It also provides the possibility to adjust the imbalance price through additional components in situations of scarcity, in order to strengthen incentives for BRPs to maintain balanced positions and, where relevant, to support the financial neutrality of imbalance settlement.

Current implementation

As discussed in Chapter 2 of the Compass Lexecon Report, the implementation of Article 9 of the ISHM largely depends on the balancing energy products that are actually used by a TSO and the extent to which the TSO is connected to the European balancing energy platforms. Article 9 therefore defines which balancing energy prices and, where applicable, volumes must be taken into account in the imbalance price calculation whenever those products are activated for an imbalance price area. In addition, the ISHM specifies the price formation approaches that TSOs may apply when determining the imbalance price. The balancing energy products whose prices (and, in the case of a volume-weighted calculation, also the corresponding volumes) may contribute to the imbalance price include:

- Replacement Reserves (RR) activated via the TERRE platform;
- manual Frequency Restoration Reserves (mFRR) activated via the MARI platform;
- automatic Frequency Restoration Reserves (aFRR) activated via the PICASSO platform;
- specific balancing energy products activated in addition to the use of the European platforms;
- local balancing energy products activated prior to the use of the platforms; and,
- balancing energy resulting from an integrated scheduling process, in the case of central dispatch systems.

With respect to the price formation methodology, the ISHM allows TSOs to determine imbalance prices using either:

- a volume-weighted average price approach; and/or
- a minimum/maximum price approach,

depending on the imbalance direction and the chosen national implementation.

In addition, TSOs may include additional price components in the imbalance price calculation to strengthen the intended incentives for BRPs or to address specific operational conditions. These components include:

- an incentivising component;
- a scarcity component;
- a financial neutrality component.

The use of additional components can influence price differences (e.g., increasing the gap between day-ahead and imbalance settlement prices). This effect is intentional and beneficial, as it strengthens incentives for BRPs.

All of these options are currently applied by one or more TSOs, meaning that none of the possibilities provided under the ISHM is unused. This reflects the different stages of platform accession, varying balancing philosophies, and differing approaches adopted by TSOs to incentivise BRPs in a manner that: 1) best suits the specific operational characteristics of each imbalance price area, and 2) is approved by the NRA.

Need for further clarification or discussion

Article 9 facilitates the incorporation of different balancing energy products into the imbalance price formation and ensures that the imbalance price is linked to the activation of balancing energy. As AST (Latvia) is delayed with the implementation of Article 9, there is no full regulatory harmonisation, but as all other TSOs have implemented Article 9 in their ISM except one, the linking of balancing energy to the imbalance price is explicitly harmonised between those TSOs.

At the same time, explicit methodological flexibility offers TSOs room to construct the imbalance price in different ways due to several factors:

- Differences in balancing philosophies;
- The use of a volume-weighted average price (VWAP), a minimum/maximum approach to reinforce incentives for BRPs, or a combination of both methods;
- Incentivising component for national boundary condition
- National regulatory requirement concerning to scarcity situations;
- National regulatory requirement with regards to financial neutrality.

In practice, the assessment has revealed the need for the full range of available options based on individual conditions. It is therefore essential that the discussion on the ISHM accommodates this diversity and continues to do so in the future. However, despite the necessity of maintaining this option space, a discussion point has emerged among TSOs regarding the practical implementation of specific elements of the methodology. Specifically, with respect to the volume-weighted average approach, there is a need to clarify which volumes should be included in the calculation (in line with a discussion point raised in Article 7). In particular, it remains under discussion whether the imbalance price should be based on satisfied balancing energy demand or on activated volumes (as the ISHM refers to satisfied demand which includes netting and the EB Regulation to activated balancing energy, as per Articles 55(4) and 55(5)), and which of these alternatives provides the most efficient price signal.

Recommendation

The foundation of Article 9 should remain as is, namely linking the used balancing energy to the imbalance price and allowing TSOs to provide appropriate incentives to BRPs through the optional additional components. The Articles 9(3)(a) and 9(5)(a) can be removed as TERRE has been phased out. Furthermore, the following should be clarified:

- Articles 9(1) and 9(2) are widely considered complex and would benefit from being redrafted to improve clarity.
- Volumes referred to in the calculation of the imbalance price (Articles 7, 9(1), 9(2), and 9(5) of the ISHM), the VoAA (Article 10 of the ISHM), and the boundary conditions (Articles 55(4) and 55(5) of the EB Regulation) are not defined consistently across these provisions, leading to ambiguity in interpretation:
    - Both 'activated balancing energy' and 'satisfied balancing energy demand' are used interchangeably as pricing bases.
    - The volumes underlying the imbalance price, VoAA, and boundary conditions are not consistently defined.
    - There seems to be overlap between Article 7(3) of the ISHM and Articles 9(1) and 9(2) of the ISHM, which, in conjunction with EB Regulation Articles 55(4) and 55(5), further contributes to interpretative uncertainty.

4.5. Assessment of Article 10

Scope and objective of the article

Article 10 defines the framework for the determination and application of the VoAA in imbalance settlement. Its primary objective is to ensure that a consistent and economically efficient imbalance price can be established in ISPs in which there has been no activation of balancing energy from aFRR, mFRR or RR in either direction for the imbalance price area. To this end, Article 10 specifies that the VoAA shall set the boundary conditions for the imbalance price in accordance with Articles 55(4)(b) and 55(5)(b) of the EB Regulation, i.e. the VoAA represents a lower or upper bound to the imbalance price that will apply in certain ISPs. This ensures that, even in the absence of activated balancing energy from aFRR, mFRR or RR, there will be an imbalance price reflective of system conditions. Furthermore, Article 10 establishes the principles governing the calculation of the VoAA, requiring compliance with the principles for imbalance settlement set out in Article 44(1) of the EB Regulation. Therefore, the VoAA provides economic signals that reflect the imbalance situation, reflect the real-time value of energy, and provide incentives to BRPs to keep their balance or help restore the system's balance.

Current implementation

There are two main aspects to the VoAA: its calculation and the conditions governing its application. Compass Lexecon's report does not elaborate on either aspect. This reflects an understanding that the VoAA does not play a significant role in setting the imbalance price in most countries. According to Article 10(2), the VoAA should be calculated at least for ISP:

- during which there has been no activation of balancing energy in either direction for the imbalance price area, i.e., when the imbalance price area is effectively in balance and has no demand for balancing energy (from the platforms or specific products) for that ISP, or

- when the imbalance of the imbalance price area is not zero, but the imbalance is resolved through netting.

While the first case is highly unlikely to occur, the second case is more relevant, as it applies for ISPs in which the imbalance price area's demand is fully netted by other TSO's demands within the platforms. It is not yet fully clear for countries that have not joined the platforms how often imbalance price areas are fully netted, with some TSOs witnessing that this does not happen often enough to justify a harmonisation of the way the VoAA is calculated.

Regarding the calculation of the VoAA, Article 10(4) sets out that the VoAA may only, if relevant, be calculated using aFRR, mFRR or RR bid price(s), per direction, available to the TSO, but does not specify which bids should be used in the calculation or whether bids should come from local or common merit order lists. According to the TSO survey carried out by Compass Lexecon carried, the VoAA is calculated differently among TSOs.

Regarding the application of the VoAA, at least one TSO uses the VoAA to implement deadbands. Within a defined range, the system is considered balanced for pricing purposes, and the imbalance price is set to the VoAA in both directions.

Need for further clarification or discussion

There is still an open question as to whether TSOs could expand the use of VoAA to handle some specific corner cases. One such corner case is for a nearly balanced bidding zone (could also be solved with a clear allowance to set a deadband in the system direction calculation). Another corner case is for ISPs where a bidding zone is nearly netted for the whole ISP, but either due to aFRR or last-minute direct activation mFRR, a balancing energy price in system direction is established. If, for example, most control cycles in aFRR are netted and only a few cycles are priced, the imbalance price can be driven by a small subset of events, yielding extreme and non-representative price signals for the ISP, even when volume-weighted averaging is applied. This issue is particularly relevant for countries with several and/or smaller bidding zones and cannot be solved by a deadband in the system direction, as the area may still exhibit a clear direction. The root cause is cycle-level volatility in aFRR pricing or late minute direct activation of mFRR and how the ISP-level need is covered. Against this background, TSOs consider it necessary to discuss how such corner cases should be treated to ensure that ISP prices reflect the full ISP rather than only a few minutes of it.

Recommendation

TSOs recommend to further investigate the possible use of VoAA in such situations and, if so, the criteria to identify them. This may result in changes or additions to Article 10.

TSOs also recommend removing the reference to RR.

4.6. Assessment of Article 11

Scope and objective of the Article

Article 7 of ISHM establishes that each connecting TSO shall implement the use of single imbalance pricing for all imbalances, except for specific or all ISPs where a regulatory authority approves the application of dual imbalance pricing, according to Article 52(2)(d) of the EB Regulation.

Article 11 of ISHM establishes the conditions and methodology for applying dual imbalance pricing for all imbalances pursuant to Article 55 of the EB Regulation, which defines one price for positive imbalances and one price for negative imbalances for each imbalance price area within an imbalance settlement period, encompassing:

(i) the conditions under which a TSO may propose to its relevant NRA the application of dual pricing and the justification that must be provided;

(ii) the methodology for applying dual pricing.

Current implementation

As indicated in chapter 2 of the Compass Lexecon Report, the Netherlands, Spain and Portugal are currently applying dual imbalance pricing. In all three countries the application of dual imbalance pricing is based on the condition set out in Article 11(1)(a), for specific ISPs during which the TSO subsequently requests activation of both positive and negative balancing energy from frequency restoration reserves. At present, none of the TSOs are applying the conditions laid down in Article 11(1)(b), (c), (d) and (e). While Article 11 provides methodological flexibility through the possibility of applying dual pricing, countries using this option remain harmonised from a regulatory perspective, as the application of dual pricing is explicitly foreseen and regulated under Article 11.

Need for further clarification or discussion

While most TSOs currently apply a single pricing approach, several TSOs see the need to retain the methodological flexibility to apply dual pricing. Article 44(1) of the EB Regulation explicitly allows TSOs to design the imbalance settlement so as to provide incentives for BRPs to be balanced and to establish adequate economic signals which reflect the imbalance situation. Where other measures are insufficient, dual price may be needed to achieve this objective. Moreover, the Compass Lexecon Report outlines that the dual pricing approach provides stronger incentives for BRPs to maintain balanced positions, while the single pricing approach tends to strengthen incentives to support the system. Therefore, TSOs see value in the possibility of requesting the application of dual pricing, if the relevant conditions are met.

The conditions of dual pricing in ISHM are designed to fulfil different objectives and incentives and to mitigate critical system behaviour, subject to the design of the dual-pricing scheme. For example, the possibility that the self-regulation of BRPs incentivised by imbalance prices could overcompensate for the system imbalance and create a balancing need in the opposite direction. This might trigger an opposite self-regulation response by BRPs and could seriously compromise system security. These abrupt changes in the system's balancing needs could affect certain system operation parameters established in the SO Regulation. Sudden power changes by BRPs generate an imbalance that affects frequency (in extreme cases, similar to what occurs during an incident, such as the loss of a thermal or nuclear generating unit) and could pose a risk of non-compliance with the ranges established for maintaining frequency within the specified limits (i.e., 100 mHz for 5 minutes, 50 mHz for 15 minutes).

In order to mitigate this effect, the ISHM already provides for the application of dual pricing in specific ISPs in which positive and negative balancing energy from frequency restoration reserves have been requested, where dual imbalance pricing is justified as a mitigation measure to avoid adverse effects on FRCE target parameters, frequency stability, and/or the ability to maintain power flows within the power flow limits.

Furthermore, Article 11 of the ISH Methodology provides for the application of dual pricing:

i. for specific ISPs in which imbalance price does not provide a locally adequate incentive because the imbalance area is nearly balanced;
ii. for specific ISPs in which the scarcity component is greater than zero (0) EUR/MWh;
iii. under a central dispatching model for specific ISPs; and
iv. for all ISPs with a duration of 30 minutes or longer.

Therefore, dual pricing is an appropriate design option to avoid or mitigate such situations. Additionally, at the system level, the Compass Lexecon Report does not reach a clear conclusion as to which methodology (single or dual pricing) is more efficient, nor have any risks been identified arising from maintaining both approaches rather than strictly excluding one of them. For this reason, it is crucial that the ISHM continues to provide for the possibility and conditions for the application of dual pricing, to align the economic incentives created by imbalance pricing with the balancing and operational approach of each TSO.

In conclusion, no need for further clarification or harmonisation has been identified regarding the current design of the Article 11. However, several amendments are recommended.

In addition to the above-mentioned system impacts, prior to real time, some TSOs conduct security studies based on BRPs' production schedules that must be carried out using the most accurate possible information. If the BRP's production facilities were to have a real-time output that differs significantly from the one scheduled in the markets, this could impact the security studies performed for the base case and for N-1 scenarios. The line flows used in the security studies could differ greatly from expected values and could lead to unacceptable line overloads, posing a system security issue (e.g., line trips, voltage problems, etc.). Likewise, abrupt power changes by a BRP with a high concentration of generation in a specific area could significantly influence line flows.

Also, for bidding zones with a high level of internal congestions, it may be crucial for both secure and efficient internal congestion management purposes that BRPs maintain their positions. A TSO facing internal bottlenecks will mark balancing energy bids submitted by BSPs as unavailable to avoid real-time congestion. A corresponding approach towards BRPs is to avoid allowing intentional changes to their imbalance positions within the imbalance area hereby preventing BRP actions from creating bottlenecks (that would need to be managed by the TSO in real time). Such actions would not be cost-effective as they could increase redispatch costs and could also be operationally challenging to manage due to their limited predictability.

Accordingly, some TSOs may find it useful to apply dual pricing in all the ISPs, rather than only in those specific ISPs where one or more of the conditions laid down in Article 11(1)(a), (b), (c) or (d) of the ISHM are fulfilled.

Furthermore, the potential need to review some of the conditions for dual pricing described in Article 11(1) has been identified. These conditions are analysed below:

- Article 11(1)(c): For specific ISPs in which the scarcity component is larger than zero.
  During the TSO assessment process, a need was identified to amend this condition so that dual pricing can be implemented whenever the scarcity component is different from zero. This is necessary, as the scarcity component may take either a positive or negative value, depending on the direction of scarcity in the system and the direction of the imbalance price. This amendment would allow dual pricing to be implemented whenever a scarcity component is applied – independent of the value or direction of the scarcity component.

Recommendation

Considering the analysis presented in the previous section, no further harmonisation is considered necessary but some targeted amendments to Article 11 are proposed.

On the one hand, it is recommended to amend Article 11(1)(c) by replacing the condition that the scarcity component must be greater than zero with a condition allowing it to be different from zero.

On the other hand, it is also recommended to add a new condition to allow TSOs to apply dual price in all ISPs, where dual imbalance pricing is justified to ensure that security studies conducted prior to real time based on BRP production schedules are carried out using the most accurate information possible or for TSO of bidding zones with high level of internal congestion.[8]

5. Summary of risks identified

The risks identified through the assessment are associated with specific methodological elements of Articles 7 to 11. They arise mainly from differences in the interpretation of volume treatment (Articles 7 and 9), potential corner-case pricing outcomes (Article 10), and incentive calibration choices, rather than from regulatory non-compliance or shortcomings of the ISHM framework.

Based on the Compass Lexecon Report and the TSOs' assessment, no material systemic risks have been demonstrated. The remaining risks are limited in scope and primarily relate to implementation and interpretation aspects rather than to system security or market functioning.

Market efficiency is assessed using three KPIs: the convergence between imbalance prices and day-ahead prices, imbalance price volatility, and the system imbalance ratio (i.e., the ratio of system imbalance to a country's total load before netting). The assessment shows that imbalance prices broadly follow wholesale market trends and that differences in convergence between imbalance prices and day-ahead prices reflect differing incentive structures rather than market inefficiencies. In particular, the lower convergence observed in countries applying dual pricing and/or additional components is associated with stronger incentives for BRPs to remain balanced, rather than with market distortions.

At the same time, the KPI on **imbalance price volatility** highlights that countries applying single pricing and/or additional components tend to exhibit higher volatility of imbalance prices. This volatility strengthens short-term price signals and supports balancing incentives.

Regarding the **system imbalance ratio**, the KPI results show stable imbalance volumes at the EU level, with observed differences largely explained by structural factors such as system size, generation mix, and reserve availability. Countries applying dual pricing and/or additional components tend to exhibit lower imbalance ratios; however, the assessment does not establish a causal relationship between the pricing approach and the observed outcomes. Overall, the KPI evidence does not indicate any market efficiency risk linked to the current degree of harmonisation under the ISHM.

Operational security is assessed using the system imbalance ratio and qualitative operational evidence collected through TSO surveys and interviews. The **system imbalance ratio** remains broadly stable over time, and no deterioration of system balance or operational performance is observed following the implementation of the ISHM. Variations across countries are largely driven by local system conditions rather than by imbalance settlement design.

Qualitative evidence from TSOs confirms that different imbalance pricing designs are applied consistently with national balancing philosophies and operational needs. Importantly, TSOs do not report adverse effects on frequency stability, security of supply or secure grid operation attributable to the ISHM framework. Potential cross-border incentive effects, which are sometimes discussed as a theoretical concern, are not supported by

[8] Ireland still applies an ISP of 30 minutes. Therefore Article 11(1)(e) cannot be removed.

operational evidence and are considered negligible in practice, particularly in the presence of liquid intraday markets. Overall, the operational security KPIs do not indicate any material risks arising from the current imbalance settlement arrangements.

Implementation feasibility is assessed based on implementation progress, regulatory compliance, derogations, implementation lead times, and reasons for delay.

The KPI evidence shows that the ISHM has been almost fully implemented across Europe, with a high level of regulatory compliance. The remaining derogations, such as the application of dual pricing in a limited number of countries, are explicitly foreseen under the ISHM and do not constitute compliance risks.

TSOs report that most implementation delays were driven by practical factors, including IT development, increased data volumes, coordination with market participants, and the need for regulatory approvals at national level. These challenges are reflected in longer implementation lead times for specific articles but are assessed as manageable and transitional in nature.

Importantly, the assessment does not identify any structural implementation risks that would call into question the feasibility of the ISHM or justify the need for further harmonisation. On the contrary, qualitative feedback indicates that the methodological flexibility embedded in the ISHM facilitates implementation under diverse national system conditions.

6. Conclusions

This assessment was prepared pursuant to Article 12(3) of the ISHM and in the context of the ENTSO-E report on the integration of balancing markets under Article 59 of the EB Regulation. In line with the objectives set out in Article 3 of the EB Regulation, it assesses the need for further harmonisation of imbalance settlement. The assessment evaluates whether the current level of harmonisation remains appropriate in light of evolving system and market conditions and examines whether differences in implementation may create distortions or other risks.

Overall, the assessment did not identify any significant systemic risks arising from the current degree of harmonisation beyond those already addressed by the existing ISHM framework and its overarching principles. TSOs support maintaining a framework that ensures transparency, cost reflectivity, non-discrimination, and effective incentives, while allowing sufficient flexibility to accommodate national operational conditions. Where concerns were raised, they primarily related to clarity and predictability rather than to the flexibility embedded in the framework. Accordingly, the main opportunity identified through the assessment is to improve consistency in interpretation and application through targeted clarification and limited streamlining, rather than by pursuing uniform outcomes.

The assessment confirms that differences in power system characteristics, balancing philosophies, and market arrangements can legitimately result in different implementation choices while still achieving the common objective of providing BRPs with effective incentives to support efficient balancing and secure system operation. These differences also limit the scope for full uniformity in outcomes, as imbalance prices remain inherently linked to local balancing actions and local market conditions. Against this background, the ISHM should be understood as a European framework that defines binding principles and minimum requirements, within which TSOs retain responsibility for applying the approach best suited to the characteristics and needs of their respective control areas.

Regarding possible amendments, the assessment indicates that discussions should focus on proportionate measures that improve clarity and reduce implicit differences, in particular where ambiguities in Articles 7 to

10 may lead to diverging interpretations in practice. Any such measures should be narrowly scoped, evidence-based, and preserve the ability to reflect system-specific operational conditions. More extensive amendments are not considered proportionate at this stage, particularly given that TSOs' participation in the platforms MARI and PICASSO platforms is still progressing and is expected to deliver further convergence over time.

This conclusion also considers forthcoming developments, notably the Network Code on Demand Response (NC DR), which is expected to introduce additional harmonised rules that may be relevant for the ISHM's scope. In light of these regulatory developments, proposing broader amendments at this stage could create inconsistencies or require subsequent revisions once the new framework is adopted and implemented.

Accordingly, **all TSOs conclude that, given that no risks have been identified** – other than the clarifications mentioned above - **no further harmonisation is required at this stage. This indicates that the existing ISHM remains robust and continues to effectively support the objectives of the EB Regulation despite the changed circumstances.** TSOs therefore propose to maintain Articles 12 and 13 of the ISHM unchanged, without prejudice to a future reassessment once the NC DR has been adopted and its implications for imbalance settlement can be fully evaluated.

7. Annexes

7.1. Compass Lexecon ISHM Assessment Report

The report is provided in a separate document.

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