NBM
Nordic Balancing Model

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Nordic TSOs discussion paper on imbalance pricing

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Feedback and input regarding the content of this paper is welcome and can be sent to the following e-mail address: info@nordicbalancingmodel.net. Please consider sending feedback as soon as possible and at the latest by 1.1.2020. Please write “Feedback/input to Nordic TSO’s discussion paper on imbalance pricing” in the subject of the e-mail.

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1. Background

During the update process of the NBM roadmap, the Nordic TSOs evaluated two high-level implementation timeline possibilities for the new single price – single balance imbalance model (referred to as "single price model" in this document). As a result of the evaluation, the Nordic TSOs propose to implement the new imbalance model by Q2/2021. When making the decision, the steering group of the NBM program took into consideration a strong stakeholder position, legal boundaries and operational concerns of the TSOs.

The implementation is based on an assumption in which dual imbalance price model can be applied on imbalance settlement periods (ISPs) with divergent[1] balancing directions within the same ISP. If the TSOs together with stakeholders cannot find a methodology with dual pricing in certain ISPs, the implementation of the single price model may be delayed until the introduction of 15 min ISP. The purpose with dual pricing in specific ISPs is to mitigate risks for operational security as a result of power oscillations in the system balance. The power oscillation may either occur when the self-regulation response overcompensates for the system imbalance or when the imbalance price incentives are misaligned with TSO real-time and geographical need of balancing energy.

This discussion paper has been prepared with the purpose to start a discussion with stakeholders regarding the concept of the single price model and especially the application of dual imbalance price model on ISPs with divergent balancing directions. It should be noted that there are a number of other components to be detailed and agreed on, but this document focuses on dual pricing in diverging ISPs. Annex 1: Components to consider, lists these other components which are to be detailed and agreed on, they are however not discussed in detail in this paper. The paper presents the concept and options for a future market design, it should not be understood as a TSO position or proposal as such.

It is assumed that the reader of this discussion paper is already familiar with the previous TSO report on imbalance pricing. The report on "Analysing different alternatives for single price model implementation timeline" is available on the NBM webpage.

[1] ISP with balancing both upwards and downwards directions.

2. Single price model in general

Single pricing of imbalances and single position are two main design features in the harmonised imbalance settlement scheme[2]. Both features will impose changes on the current settlement rules in the Nordics.

The use of single position will per definition reduce the financially settled imbalances since it allows the balance responsible parties (BRPs) to net the total imbalances in one position, as illustrated in Figure 1.

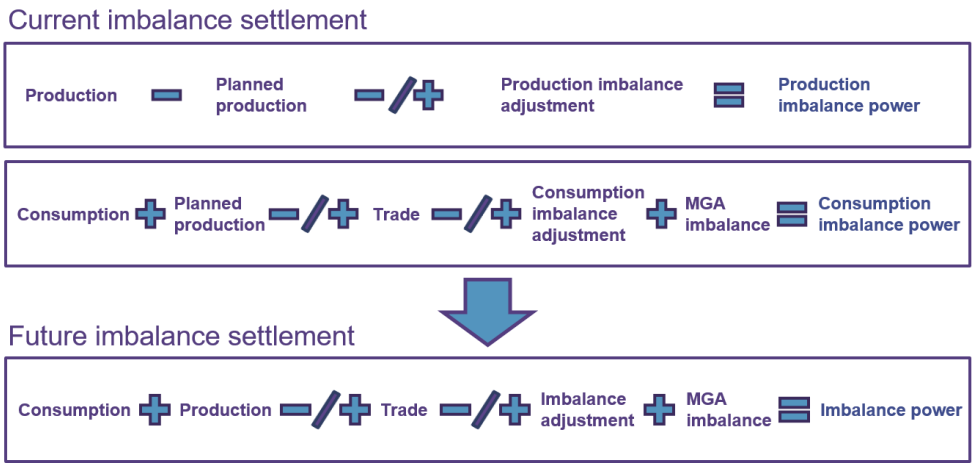


Figure 1: Current and future imbalance settlement methods[3], source: NBS Handbook/eSett.

The current imbalance settlement consists of both an imbalance settlement for production and for consumption, whereas the future imbalance settlement, which is also the principal behind the single price model, only consists of one total imbalance settlement, where both production and consumption are included.

Single position is a simplification in terms of allocation of energy volume[4], imbalance adjustment[5] and for active participation of smaller flexible units in the balancing market. Smaller units of all types[6] (i.e. production, consumption, batteries and prosumers) can be aggregated in one balancing energy bid without the need to separate the resulting imbalance adjustments on two portfolios.

The calculation of a BRP position shall also be based on commercial trade schedules and not include production plans, which is currently the case. This implies that the BRP imbalance is the difference between trade (sum of day-ahead, intraday and bilateral trades) and the metered exchange (corrected with imbalance adjustments as today). This will inevitably result

[2] All TSOs' proposal to further specify and harmonise imbalance settlement in accordance with Article 52(2) of the Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing.

[3] In Figure 1: Production and consumption refers to metered production and consumption.

[4] 'allocated volume' means an energy volume physically injected or withdrawn from the system and attributed to a BRP, for the calculation of the imbalance of that BRP.

[5] 'imbalance adjustment' means an energy volume representing the balancing energy from a balancing service provider (BSP) and applied by the connecting TSO for an ISP to the concerned BRPs, used for the calculation of the imbalance of these BRPs.

[6] Currently there's different practices in Nordics how small units are considered in imbalance settlement. For example, in Norway production units less than 3 MW can be included in consumption position, whereas in Sweden all production units needs to be included in the production position.

in the decoupling of imbalance settlement and production plans, and consequently the current financial incentives to follow the production plan, which are given by the production portfolio position. However, there can still be national requirements for production plans.

The use of single pricing will have an even more profound effect on the imbalance settlement, in particular the incentives to BRPs and the TSO cash flow. While a dual pricing regime incentivises the BRPs to manage their imbalance risk with the objective of minimizing the imbalance of their portfolio at all times, single pricing financially creates incentives to also minimize the system imbalance. Single pricing means that any imbalance that coincides with the system balancing need will be reimbursed with a price that reflects the balancing energy price in the dominating direction, currently derived from the marginal price of the regulating power market.

3. Concept of dual pricing on divergent ISPs

The rationale behind dual pricing is to avoid undesired self-regulation by BRPs. A 60 min ISP combined with single pricing opens a relatively long time window for self-regulation actions, which may trigger oscillations in the system, which in turn can impact negatively on the efficiency of the system operator balancing actions and consequently on the operational security.

On this basis, the Nordic TSOs find it necessary to supplement the introduction of a single price model with dual pricing during ISPs where up and down regulation occurs within the same period. The intention is to dampen self-regulation behaviour in those ISPs which can possibly be harmful for the system balance.

Dual pricing in certain ISPs implies introducing a new regulation state which is neither up (system is short), down (system is long) or balanced as we have today, but which is both up and down. This requires the development of a rule to define for which ISPs the regulation state is both up and down. Within these ISPs, dual pricing implies that the BRPs pay an imbalance price based on the direction they are in, reflecting the regulation price of that direction.

This is a different concept than today's dual pricing for the production position, as the dual price applies regardless of the regulation state of the system.

Dual pricing is allowed by the current regulation, cf. EBGL, article 52 (d) and by the proposed ISHP[7], art 8.1(a) and the method has already been implemented in the Dutch system, which is further described in Annex 2: The Dutch case.

[7] ISHP refers to all TSOs proposal on Imbalance Settlement Harmonization based on EBGL article 52.

4. Details to be defined

This section introduces aspects to be defined related to the dual pricing model during divergent ISPs. The main questions of defining the dual pricing model for divergent ISPs are:

- How are the divergent ISPs defined?
- How are the prices to be defined in the dual pricing model?

The choices regarding these parameters should be guided by what the objectives for dual pricing during divergent ISPs are and that the dual pricing in certain ISPs is considered an interim solution before the implementation of 15 min ISPs.

Today the Nordic TSOs use both mFRR and aFRR to balance the Nordic power system. The first question is whether both mFRR and aFRR activations contribute on the definition of a divergent ISP, or if divergent ISPs are defined only based on the mFRR or aFRR activations. Annex 3: Diverging FRR activations, 2018, presents the current (2018) situation of diverging FRR activations in the Nordic synchronous system.

Balancing in the Nordic synchronous area is driven by frequency deviations. mFRR will be regulated in the same direction if there are no congestions that requires separate regulation of parts of the system. aFRR will in the synchronous areas always be regulated in the same direction in today's system. For mFRR it would therefore be natural to look at the areas that are mutually regulated when defining the ISPs that are divergent, while it would apply to all areas in the synchronous area for aFRR. DK1 is regulated separately for aFRR.

Extensive self-regulation may significantly reduce the imbalance without changing the direction. Similarly, in hours with small imbalances around zero a limited amount of self-regulation can change the direction. It is necessary to define which situations are problematic from an operational perspective. It is possible to define a band around zero imbalances if these situations should not be problematic.

Regardless of the choice of basing divergent ISPs on activations of mFRR, aFRR or a combination of both, the definition of divergent ISPs can be based on either the sum of activated volumes of balancing energy or on the trend of the activated balancing energy (the latter is the Dutch method).

If the classification is based on the sum of activated volumes of FRR, the following alternatives have been identified for defining whether an ISP is classified as divergent:

- Limit based on activated energy (MWh)

- Limit based on activated power (MW)
- Limit based on relation between dominant and non-dominant balancing direction (%)
- For mFRR only: Limit based on time or duration of mFRR activations within the ISP (an exception if balancing bids are activated right at the end of the ISP).

As the proposal is to apply dual pricing only in ISPs where there are activations in both directions, we will also have activation prices for both directions, which will be used when setting the imbalance price in the dual price regime. Both mFRR and aFRR prices will be based on the pricing rules of the respective markets (even if aFRR prices currently are administratively set, and are equal to the mFRR prices if defined, or day-ahead price if not defined).

If we base the definition of diverging ISPs only on mFRR, it will be natural to use the prices for mFRR. If we base the definition of diverging ISPs on aFRR, then aFRR prices will be a natural choice. If we base the definition of diverging ISPs on both mFRR and aFRR, it needs to be further investigated.

Also, availability of real-time or close to real-time information of the system state and information if current ISP is considered diverging or not, should be considered when implementing the proposed model.

5. TSOs work plan

This section describes the Nordic TSOs draft work plan to implement the single price model. The work plan is subject to updates and will be followed in the context of NBM reference group meetings.

Task	Date
Publication of discussion paper on imbalance pricing (this paper)	20.11.2019
NBM Stakeholder reference group – Presentation	27.11.2019
Imbalance Settlement Harmonization Proposal - Expected NRA approval or escalation to ACER	January 2020
Confirmation on implementation of single price model (to be on track to go-live by June 2021**)**	By end of January 2020 (to be confirmed)
NBM Stakeholder reference group – Presentation on imbalance pricing details and a short discussion paper on how to ensure a good quality of production plans	February 2020 (meeting date to be confirmed)
Implementation plan for Single price model published for stakeholders. Containing practical information, IT-guides and test plans	June 2020
Publish TSOs consultation version of updated national terms & conditions for BRPs (proposal for Nordic harmonization)	July 2020
Update of national terms and conditions of BRPs, including, where relevant, formal stakeholder consultation	Start in October 2020 – NRA approval foreseen by March 2021
Go-live of single price model	June 2021 – Date to be confirmed

Annex 1: Components to consider

The table below introduces components to consider when the Nordic imbalance price calculation is determined. These are however not further discussed in this paper, but are presented for the sake of completeness.

Table 1: Other components to consider when determining the Nordic imbalance price in addition to the single price model.

Component	Description
Main components when calculating the imbalance price	The BRP settlement is based on the balancing energy cross border marginal prices. These prices will be determined by the European platforms for aFRR, mFRR and RR balancing energy. The Nordic TSOs currently use two balancing energy products (aFRR and mFRR) and will consequently base the imbalance price calculation on two different cross border balancing energy marginal prices in the future.
Scarcity pricing	The Nordic TSO cooperation framework for balancing[8] and the European harmonisation proposal of BRP settlement[9] allows for inclusion of a scarcity component in the imbalance price. The design of such a component is however not detailed and could be done in several ways.
Pricing in case of dispatch of strategic reserves	Dispatch of the strategic reserve shall have a direct impact on the imbalance price. This shall not only be implemented as a general BRP fee, but also as a price setter during those specific ISPs when the strategic reserve is dispatched.
Incentivising component to be used to fulfil boundary conditions	All TSO proposals (ISHP) article 5(5) includes the possibility to use the incentivising component in case the TSO identifies a need for incentivizing market participants to attempt to close their positions on earlier markets, rather than leaving it for imbalance settlement.
Component with regards to financial neutrality	TSO financial neutrality (according to EBGL, article 44) shall be ensured by each regulatory authority. Thus, since financial neutrality is not a harmonised matter, there might be a need for some NRAs to use an adjustment of the imbalance price to achieve this.
Publication of information	TSOs shall publish, as close to real time as possible but with a delay after delivery of no more than 30 minutes, the current system balance of their bidding zones, the estimated imbalance prices and the estimated balancing energy prices. Real-time information enable market players to act on real-time data. On the other hand, this requires that the TSOs can publish reliable data that reflects the actual need of balancing energy.
Imbalance service fees	The application of single imbalance pricing means that the TSO financial surplus generated by the settlement of production portfolios on dual pricing must be recovered by another process since the financial neutrality of the TSO shall be ensured according to EB regulation, article 44.1(i). The total TSO cost for system operation is not only limited to the balancing energy why an additional income stream is needed in order to ensure financial neutrality in case of a price based and single imbalance pricing design.

[8] Cooperation agreement (Nordic balancing cooperation), page 6.

[9] The BRP settlement is subject for a European harmonisation proposal currently under development.

Annex 2: The Dutch case

The Dutch system is based on a self-regulation concept. To avoid undesired actions by the BRPs, even with a 15 min ISP, the Dutch imbalance pricing includes a dual pricing concept in all ISPs, which are defined to be in system state 2.[10] In this state, the BRPs receive the balancing energy price of the same direction as their imbalance (a short BRP gets the up-regulation price and a long BRP gets the down-regulation price). An ISP is defined to be in system state 2 if the series of so-called balance deltas within the ISP both increases and decreases. The balance delta is calculated as the power of the activated upward bids minus the power of the activated downward bids (to account for energy still delivered from deactivated bids when regulation direction changes). This means the focus is on the trend of the activation of balancing energy when defining for which ISPs dual pricing will apply.

An example of how the balance delta is calculated and examples on the different regulation states are added below to help understand the Dutch model.

Table 2: Example on calculation of the balance delta.

			All numbers are in MW				
Date	Sequence number	Time	aFRR_up	aFRR_down	mFRR_up	mFRR_down	Balance delta
01/01/2018	1	00:00	0	-93	0	0	-93
01/01/2018	2	00:01	0	-89	0	0	-89
01/01/2018	3	00:02	0	-68	0	0	-68
01/01/2018	4	00:03	0	-45	0	0	-45
01/01/2018	5	00:04	0	-32	0	0	-32
01/01/2018	6	00:05	0	-24	0	0	-24
01/01/2018	7	00:06	5	-13	0	0	-8
01/01/2018	8	00:07	13	-10	0	0	3
01/01/2018	9	00:08	28	-7	0	0	21
01/01/2018	10	00:09	40	-6	0	0	34
01/01/2018	11	00:10	56	-5	0	0	51
01/01/2018	12	00:11	78	-4	0	0	74
01/01/2018	13	00:12	98	-4	0	0	94
01/01/2018	14	00:13	106	-3	0	0	103
01/01/2018	15	00:14	95	-2	0	0	93

[10] See https://www.tennet.eu/fileadmin/user_upload/SO_NL/ALG_imbalance_pricing_system.doc.pdf

Figure 2: Example on the development of the balance delta in state 0.

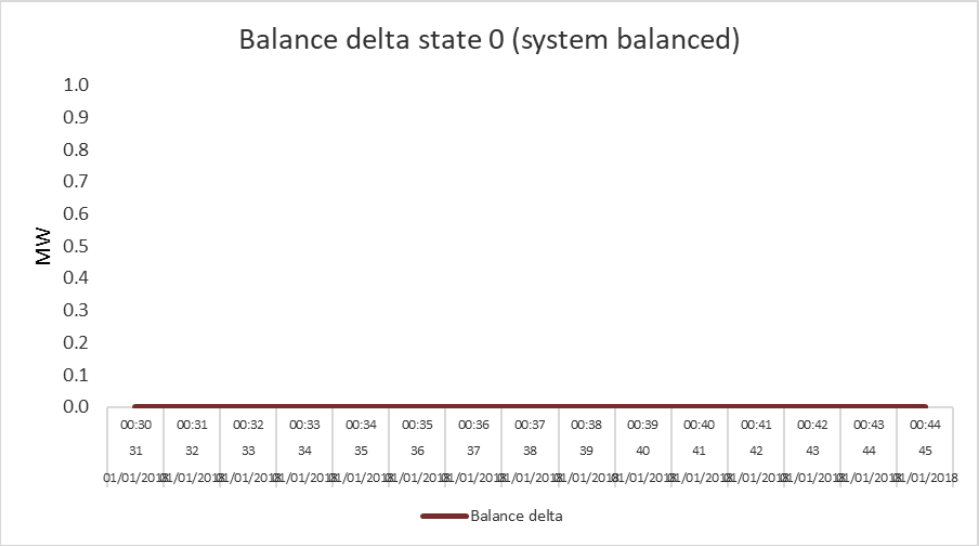


Figure 3: Example on the development of the balance delta in state +1.

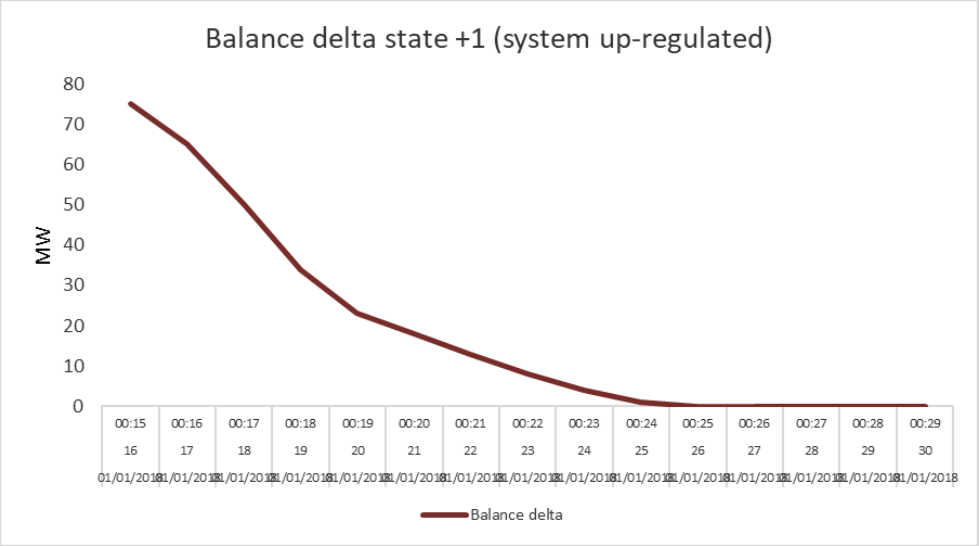


Figure 4: Example on the development of the balance delta in state -1.

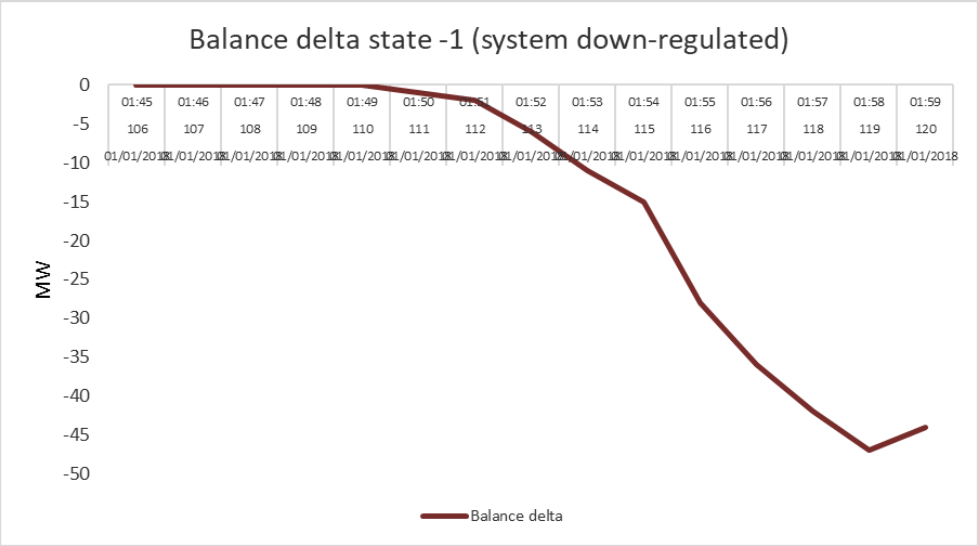
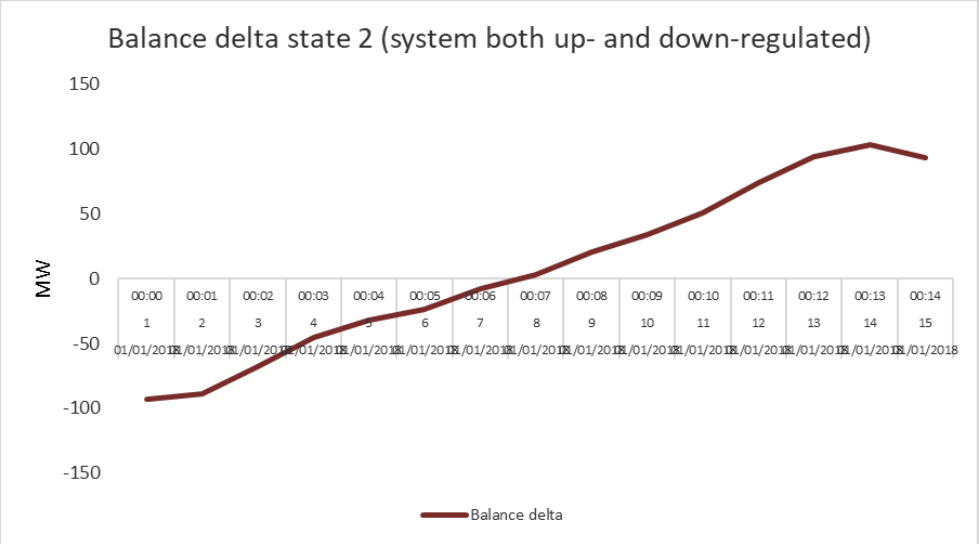


Figure 5: Example on the development of the balance delta in state 2.



Annex 3: Diverging FRR activations, 2018

This annex presents the current situation of diverging FRR activations in the Nordic synchronous system. Data is based on 2018 figures.

In 2018 there were diverging aFRR activations per Nordic synchronous area in approximately 70% of the relevant ISPs.

Diverging mFRR activations in 2018 per bidding zone:

Area	ISPs (hours)	% of hours
NO1	7	0,1
NO2	53	0,6
NO3	69	0,8
NO4	28	0,3
NO5	63	0,7
SE1	149	1,7
SE2	121	1,4
SE3	19	0,2
SE4	3	0,0
FI	104	1,2
DK2	14	0,2
Nordic Synchronous area	720	8,2
DK1	27	0,3