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Memo - Process for activating products – update June 2021

This memo gives an outlook for product development and how the mFRR energy activation market is an integrated part of the system operation. This is an updated, fourth version of the memo that was originally published in 2019. Further versions will be published when new information is available, and experience is gathered in the development process and from the stakeholder dialogue. Contact information for each TSO can be found on the NBM website: [Automated Nordic mFRR energy activation market – nordicbalancingmodel](https://nordicbalancingmodel.net/automated-nordic-mfrr-energy-activation-market).

Introduction

The Nordic region has had a common regulating power market (RPM) since 2002. Simplified, RPM can be described as the mFRR energy activation market of today. Many changes are necessary before we have an automated mFRR energy activation market that meets all EBGL¹ requirements. These are both changes in internal TSO processes, product definitions, market processes and development of terms and conditions for market participation, as well as processes on the market participant side. Changes in internal TSO processes are not only necessary for legal compliance and European market integration but are also driven by the need for automation in order to be able to operate the future green power system in a secure and efficient manner.

Efficient and well-functioning activation markets are integral tools in the TSO operational processes and critical for a secure and efficient operation of the power system. This includes reliable fall-back arrangements and any interim solutions. The coming years imply a sequence of complex changes in core operational processes. These changes must be deployed in a continuously operating environment

¹ Electricity Balancing Guidelines (EBGL - [EUR-Lex - 32017R2195](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R2195) - EN - [EUR-Lex \(europa.eu\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R2195))

and carried out in such a way that the impact of each change is thoroughly understood and that all relevant risks are appropriately mitigated. To secure a safe transition, the TSOs will need to apply an adaptive approach to the implementation which implies that adjustments to the solutions are continuously considered and incorporated when new learnings from both TSO and stakeholder processes unfold.

Balancing process today

Today, Nordic balancing is frequency-based. Frequency deviations are caused by imbalances in the whole Nordic synchronous area, including four countries and 11 bidding zones. DK1 is also a part of the Nordic balancing and thus the Nordic Regulating Power Market.

Balancing and congestion management are currently performed in one integrated process. The operator can select regulating power bids for activation either because of imbalances or to relieve overload of the network elements. When activating bids for balancing the operator can choose to deviate from the price order (Merit Order List) to avoid creating or worsening overload.

The requested volumes and geographical restrictions of activations are defined by the TSOs' control room operators today. Regulating power bids, provided by balancing service providers (BSPs) in all Nordic countries, are visualised in a common merit order list (CMOL) from which the operators choose the cheapest available bids that will not create or worsen overload. Operators of the Nordic TSOs continuously co-ordinate in the above-described process with Svenska kraftnät and Statnett sharing the co-ordination lead.

In addition to the activation process, described above, the operators perform planning and preparation activities, such as changes in production schedules and grid re-configuration. This is done both before the operational day, but also close to real-time and is linked to the manual congestion management process.

TSO-BSP process

After the TSO operator has chosen a bid, the BSP is contacted, either by phone or electronically. The BSP confirms that the bid will be activated, and the exact timing of the activation is agreed upon between the TSO and the BSP.

Products

Today, the bids in the RPM are directly activated². The formal full activation time (FAT) is 15 minutes, but it is often agreed as part of the TSO-BSP process to activate quicker than 15 minutes. Also, bids with longer FAT than 15 minutes may be accepted by some TSOs. The bids are used for both congestion management and balancing. Gate closure time for submitting bids is 45 min before the start of the operational hour, and the validity period of a bid is one hour.

A bid stays activated for the validity period (hour) or until it is deactivated. The current practice varies between the TSOs. In Norway, a manually activated bid is activated until it is deactivated (for more than one delivery period), while electronically activated bids in Norway and all bids in Sweden, Finland and Denmark must be re-activated for a new hour.

Transition until Nordics join MARI

Before the Nordic countries connect to the European mFRR energy activation market, facilitated by platform MARI ([Manually Activated Reserves Initiative \(entsoe.eu\)](https://www.entsoe.eu)), there are many changes needed in both internal TSO processes, market processes and balancing product characteristics. These changes will be developed, tested and implemented in steps. From a planning and change implementation perspective, the period until the Nordics join MARI can be divided into three sub periods:

- Preparation and stepwise implementation period before Automated operation pre 15-minute ISP
- Automated operation pre 15-minute ISP
- Period between 15-minute ISP and joining MARI

The two first periods focus mainly on preparing the IT- and operational systems and processes, both from a TSO and BSP point of view. Larger changes in market incentives are planned from 15-minute ISP. When both operational and market changes are implemented, the Nordics will be better prepared for joining the

² Directly activated bids can be activated continuously, while scheduled bids can only be activated at defined scheduled times.

European mFRR platform MARI. These periods are further described in the following sections.

The new mFRR balancing process will be based on the model described in European regulation³. This means that balancing needs are calculated in each bidding zone, and a common regional optimization is performed every 15 minutes.

The TSOs must decide the mFRR need per area before every 15-minute period, based on an imbalance prognosis. Together with the available bids and the available transmission capacity this makes it possible to find the optimal bids to activate. Since the bid selection process is done per 15 minutes, also the balancing product - standard mFRR energy product - is defined for a 15-minute period.

The bid selection is done for 15-minute periods, and each bid selection is independent of the previous period.⁴

Preparation and stepwise implementation before Automated operation pre 15-minute ISP (transitional period)

This period lasts until the start of the Automated operation pre 15-minute ISP in Q4 2022. To be able to initiate the Automated operation pre 15-minute ISP, the process for activating products needs to be prepared for automation, including IT and process development. It is important to emphasise that many changes are therefore required in the relatively near future. These changes will also require changes in the Balancing Service Provider's (BSP) processes and tools.

The focus in this phase is on developing and testing the most important tools and processes for bidding and activation. The BSPs can start testing – and in some countries start applying - the new CIM-format for bid submission and activation to prepare themselves for the end of the preparation phase, where the current legacy format can no longer be applied. Furthermore, the BSPs have to prepare to submit new standard product bid attributes and to support submitting bids with 15-minute time resolution. In some countries BSPs will have a possibility to submit bids with 15-minute time resolution and/or possibly to submit a selection of the new bid attributes during normal operation already during this transitional period – as a pilot. Further TSO-specific IT-information on requirements and possibilities related to bid submission and activation is to be found in the “Implementation Guide mFRR energy activation market – BSP” on Nordic Balancing Model program's homepage nordicbalancingmodel.net.

³ The European regulations shaping the model for the balancing process are primarily EBGL and SOGL.

⁴ The BSP can indicate some dependencies between 15 min periods through linking bids by attributes, see Table 2 regarding technical and conditional linking.

Nordic TSOs are developing fallback solutions for situations when new automated processes for some reasons are not available or cannot provide a safe operation. Two types of fallbacks are foreseen: a simpler bid selection algorithm is used as fallback to the primary bid selection solution; and fallback solutions that will be more manual, both with respect to input to the bid selection process, as well as for the bid selection and activation process itself.

Automated operation pre 15-minute ISP

Automated operation pre 15-minute ISP is the start of the new Nordic mFRR energy activation market. That means new bid characteristics, attributes and formats, bid selection, and activation will be put into operation. This period is planned to take place between Q4 2022 and Q2 2023. The most important purpose of the Automated operation pre 15minute ISP period is to gather operational experience on the automated processes and tools required to be able to implement 15-minute ISP. After the introduction of 15-minute ISP manual balancing is not considered to be viable, so confidence must be built in the new processes before this 'point of no return' is passed.

Period between 15-minute ISP and joining MARI

This period will take place from the implementation of 15-minute ISP until the Nordic countries connect to the common European mFRR platform, MARI. Some of the market design aspects that have been decided for the common European mFRR energy activation market will be implemented in the Nordic countries for this period.

The European standard mFRR energy product will be fully implemented once the Nordic countries join MARI.

Important process and product changes

In this section, some specific topics with related changes are described in more detail as well as when the changes are expected to be implemented.

The standard Nordic mFRR product during Automated operation pre 15-minute ISP

In the coming Nordic mFRR Energy Activation Market from go-live of Automated operation pre 15-minute ISP, the standard Nordic product for scheduled activation is a 15-minute product⁵, shown with the yellow line in the Figure 1. The standard Nordic product is based on the European standard product for MARI platform.

The purple line shows the activation, delivery and deactivation profile of a standard product. This profile is the agreed standard profile for exchange of balancing energy between TSOs and that is also the profile BSPs are requested to deliver.

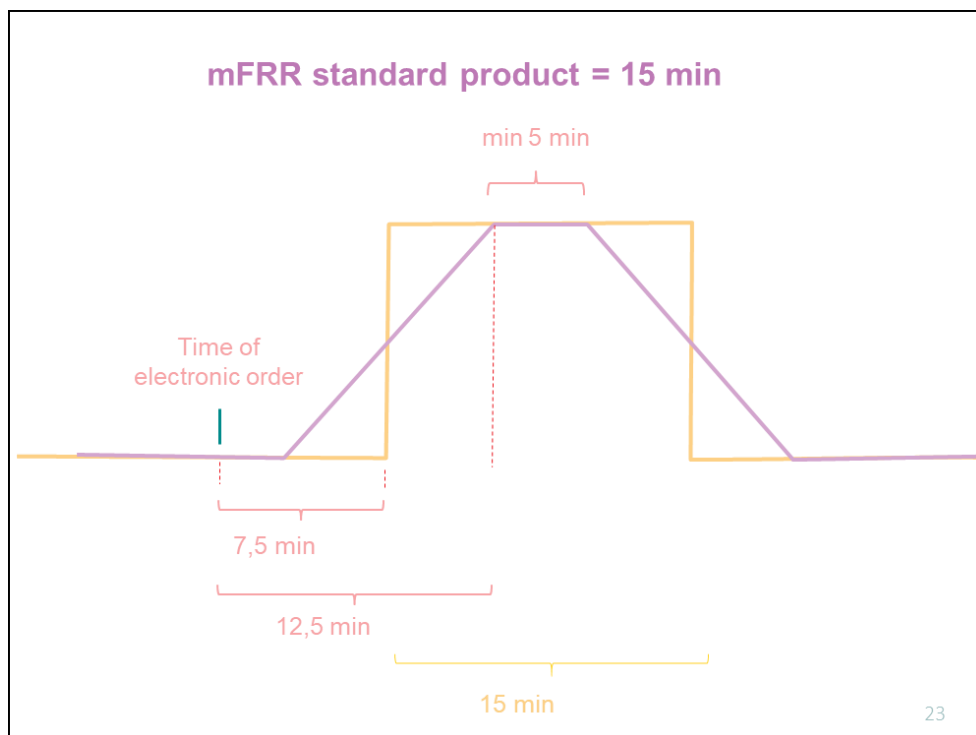


Figure 1 Standard mFRR product

⁵ The standard product includes both scheduled and direct activations, for more information on the difference of activation, see the next sub-chapter.

Scheduled and direct activation

There are two types of standard product activations – scheduled and direct (see Figure 2).

Scheduled activated bids will be activated every 15 min and activation signal will be sent 7.5 min before quarter-start (Q-7.5). Direct activated bids can receive an activation signal at any point in time. A scheduled activation of a bid lasts for 15 mins unless it is reactivated, whilst a direct activated bid will run to the end of the following quarter.

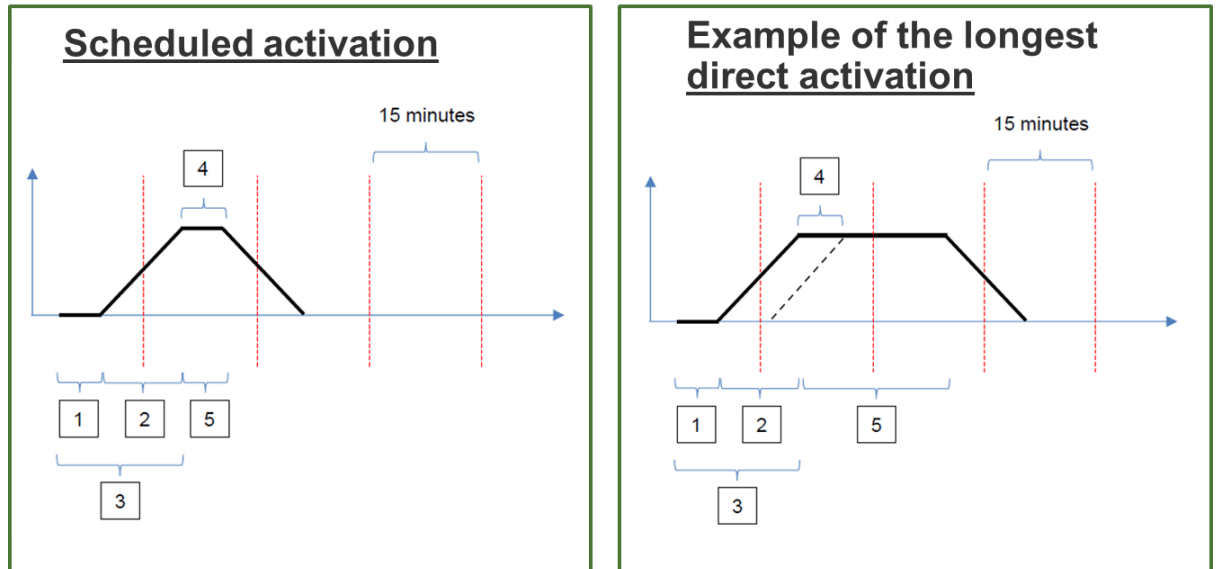


Figure 2 Scheduled and Direct activation of standard mFRR product

Figure explanation:

- 1 - Preparation period
- 2 - Ramping period
- 3 - FAT – full activation time
- 4 - Minimum duration of delivery period (5 min)
- 5 - Maximum duration of delivery period:
 - a) 5 min in scheduled activation
 - b) 20 min in direct activation

Implementation of market design features

Table 1 gives an overview of the stepwise implementation of the different market design features. Some details differ among the TSOs. Please see the Implementation guide for the details of each TSO.

Table 1 Stepwise implementation of market design features

	Today	Automated operation pre 15-minute ISP (Q4 2022-Q2 2023)	After 15-minute ISP but before connection to MARI	When connecting to MARI
Full Activation Time, FAT (minutes)	15	15	12.5	12.5
Maximum/minimum price (EUR/MWh)	5000/no min. price	5000/no min. price	5000/no min. price	99 999/-99 999
Price granularity (EUR/MW)	0.01 or 0.5 ¹	0.01 or 0.5 ¹	0.01	0.01
Minimum bid size (MW)	5 or 10 ²	1 or 10 ³	1	1
BSP bid time resolution for price and volume (minutes).	60 ⁴	60 and 15 ⁵	15	15
Marginal price resolution (minutes)	60	60	15	15
Bid activation	Electronic and manual	Electronic	Electronic	Electronic
BSP Gate closure time	H-45 min	H-45 min ⁶	Q-25 min ⁷	Q-25 min

¹ Statnett will continue the current practice with 0.5 EUR price granularity from the start of Automated operation pre 15-minute ISP but foresees to remove this constraint no later than at the introduction of 15-minute ISP.

² The minimum bid size differs today depending on the bidding zone.

³ Statnett will continue with a minimum bid volume of 10 MW in Automated operation pre 15-minute ISP. Exceptions may apply in some bidding zones or for pilot projects.

⁴ In Norway volume resolution is 15 minutes.

⁵ Fingrid will support both 15 min and 60 min bid time resolution. The dynamics and activation examples for 60 min bids during Automated operation pre 15-minute ISP is further described in Implementation guide.

⁶ H and Q marks the start of the MTU, 60 minutes and 15 minutes respectively. This means that in Automated operation pre 15-minute ISP bids will be submitted for all four quarters at 45 min prior to the start of the hour.

⁷ Earlier introduction of BSP GCT at Q-25 as compared to what has been previously communicated.

Bid attributes

Bid attributes in this section are divided into ‘New bid attributes, common for all Nordic countries’ (Table 2) and ‘National bid attributes’ (Table 3).

Table 2 includes the *New bid attributes*, which are the European standard product bid attributes. These will be supported by the Nordic mFRR energy activation market process and ultimately by MARI. All new bid attributes are supported for the 15-minute bids in Automated operation pre 15-minute ISP, while new bid attributes will not be supported for 60-minute bids. The Implementation guide includes detailed information on the support and handling of 60-minute bids.

Table 2 Common Nordic bid attributes

New bid attributes, common for all Nordic countries		
Valid from Automated operation pre 15-minute ISP Q4-2022		
Type	Bid attribute	Description
Simple bids One bid, one price	Minimum offered volume	Can be applied to set a minimum volume to be activated even though the bid is divisible.
	Indivisible Bids	A bid which cannot be activated partially. Therefore, the volume of an indivisible bid is always activated altogether.
Complex bids Combination of simple bids	Exclusive Group Order	The exclusive bid is a group of bids where solely one of the bids can be activated; hence, the activation of a bid belonging to an exclusive bid excludes the activation of the other bids belonging to the same group.
	Multipart (Parent/child) ⁶	A multipart bid consists of two or more simple bids within the same quarter hour. The bids must have different prices but may have the same or different volumes. A component of an upward multipart bid cannot be activated unless all other components with a lower price have been activated up to their entire offered volumes. A component of a downward multipart bid cannot be activated unless all other components with a higher price have been activated up to their entire offered volumes.
Bids linked in time Between consecutive quarter hours	Conditional bids	Conditional linking is the linking of simple bids in two or three subsequent quarter hours. Conditional linking is used to adjust the availability of a bid in Q0 (available/unavailable) based on the activation outcome of linked bids in previous quarter hours Q-1 and/or Q-2.
	Technical linked bids	Technical linking is the linking of two simple or complex bids in two subsequent quarter hours. Technical linking ensures that a bid in Q0 is not available for clearing if the bid in the previous quarter hour was used for direct activation (DA). This is important in order not to activate the same balancing resource twice.
Activation type	Direct	A bid that can be activated at any point in time in the quarter hour for which the bid is submitted. This means it can be activated after the point of scheduled activation until the point of scheduled activation of the following quarter hour. Every bid available for direct activation is also available for scheduled activation as well.

⁶ Within the MARI project there has been a discussion on the “Advanced Parent Child” attribute, which is a different version of exclusive bids. Here, the start-up cost is given as well as the variable cost. The algorithm activates the desired amount up to a given amount. The parent reflects the full start-up cost, the child the decreasing costs. Currently this attribute is not foreseen in MARI.

All the new bid attributes are supported by CIM bid format.
In Table 3 below, additional national bid attributes are described.
These attributes will be handled locally by the TSO.

Table 3 National bid attributes

Bid attribute	Description	Supported by
Maximum duration	BSPs include information on the technical limitations regarding how long a bid can be activated. This attribute is necessary to allow BSP to send in bids in advance so that they do not need to update bid if they are activated.	Statnett, Svenska kraftnät, (Energinet)
Resting time	The BSP can add information on the required minimum duration between the end of deactivation and the following activation.	Statnett, Svenska kraftnät, (Energinet)
Inclusive bids	If one bid is activated, another bid (e.g. a resource downstream) must also be activated.	Statnett, Svenska kraftnät
Locational information	More detailed location on where the resources in the bid are situated, than bidding zone (e.g. on station level).	Statnett, Svenska kraftnät, Energinet, Fingrid
Slower activation time	Indicate activation time that is longer than 15 min FAT. The attribute indicates that the product is non-standard and cannot be activated through Nordic activation optimization.	Svenska kraftnät, Energinet
(Availability for) Faster activation	Indicate the shortest possible activation time under 12,5 min. Faster activation will only be used for direct activation and only to handle grid problems. Bids with this attribute can also be selected for normal scheduled or direct activation.	Statnett
(Availability for) Period shift	Indicate that the bid can be used for Period Shift. When activated for period shift the bid can be selected for activation for only the start of or the end of the quarter hour. Bid selection for period shift be done after the AOF and will therefore not affect the bid selection in the AOF. Bids with this attribute can also be selected for normal scheduled or direct activation. Use of period shift will replace the use of the existing products "kvartersflytting" and "kvartsaaffär".	Statnett, Svenska kraftnät

More information on the submission of bid attributes can be found in the Implementation Guide.

Non-standard products

The automated bid selection process can only support standard mFRR energy products. Therefore, Nordic TSOs will strive to use the standard products and processes as much as possible, but there can be cases where we need to deviate from the standard processes. Some of these might at a later stage (when connecting to MARI) require the definition of a ‘specific product’ as described in the Electricity Balancing Guidelines (EBGL - [EUR-Lex - 32017R2195 - EN - EUR-Lex \(europa.eu\)](#)).

Fingrid and Svenska kraftnät procure strategic reserves (effektreserven for Svenska kraftnät) today and Energinet purchases slower reserves. Nordic TSOs will continue using these reserves for balancing and in case of power system incidents – after go-live of the Nordic automated mFRR energy activation market.

These non-standard products will not be made available for selection and activation by the Nordic platform algorithms for scheduled and direct activation, but they will be made visible in the common Nordic bid list and activated outside the common bid selection when standard products are not sufficient.

Slower reserves are the resources that have longer activation time than the allowed Full Activation Time. Some resources might have restrictions on ramping speed and therefore not able to activate according to the required 15 min activation process. These resources can be used for operational security reasons and might still be needed in scarcity situations or in case of incident.

Congestion management

Before sending bids to the Nordic Platform the TSOs must address the operational security. If there are (predicted) congestions in the grid, some mFRR energy bids will be activated to resolve them locally, and such bids are then marked as unavailable for the Nordic platform. If some bids can cause a congestion when activated, they will be marked as unavailable for activation by the Nordic platform as well.

This challenge varies significantly between the TSOs.

Period shift

Around the start of a given Market Time Unit (MTU), large imbalances can arise due to differences between the gradual changes in consumption and HVDC ramping on one side, and often very fast changes in production on the other.

Today, Statnett and Svenska kraftnät have handled these structural imbalances through products known as "Produksjonsflytting" and "Kvartsaffär" respectively. They expect that they will continue to have a need for tools that can smoothen out production changes also after the introduction of Automated operation pre 15-minute ISP and go-live of 15-minute ISP, and have therefore developed the period shift tool.

Period shift is a separate bid attribute that makes it possible for the BSP to indicate that they can be used for period shift handling at the beginning or end of each quarter. Period shift activation will be ordered periodically every 15 minutes based on the amount of structural imbalance around the period shift. The activation process is described in the Implementation Guide.

In parallel, the Nordic TSOs will analyse possible measures to reduce structural imbalances, and thus the need for period shift tools. Such measures can include ramping requirements around period shifts.

BSP activation and response

The activation of selected energy bids (electronic ordering) will be requested in a fixed cadence every 15 minutes for scheduled activation, and at any time for direct activation. In scheduled activation, the electronic order will be sent exactly 7.5 minutes before the start of the quarter hour (Q-7.5). In direct activation 7.5 min before BSPs are expected to have activated their bids halfway to the full volume.

The (European) mFRR standard product regulates a full activation time of 12.5 minutes. The standard profile for mFRR energy exchange between TSOs consists of 2.5 minutes preparation time and 10 minutes ramping time. BSP delivery according to the 12.5 minute standard product profile is recommended in Automated operation pre 15-minute ISP.

Figure 3 below shows the process for activation of the standard product with 12.5 minute FAT. During Automated operation pre 15-minute ISP period, FAT of 15 minutes will be allowed. This means that the BSP can use the time from receiving the activation order (Q-7.5 min) until the midpoint of the delivery period Q+7.5 min to ramp-up to the full bid-volume. If not re-activated, at Q+7.5 min BSPs should start deactivating (ramping down).

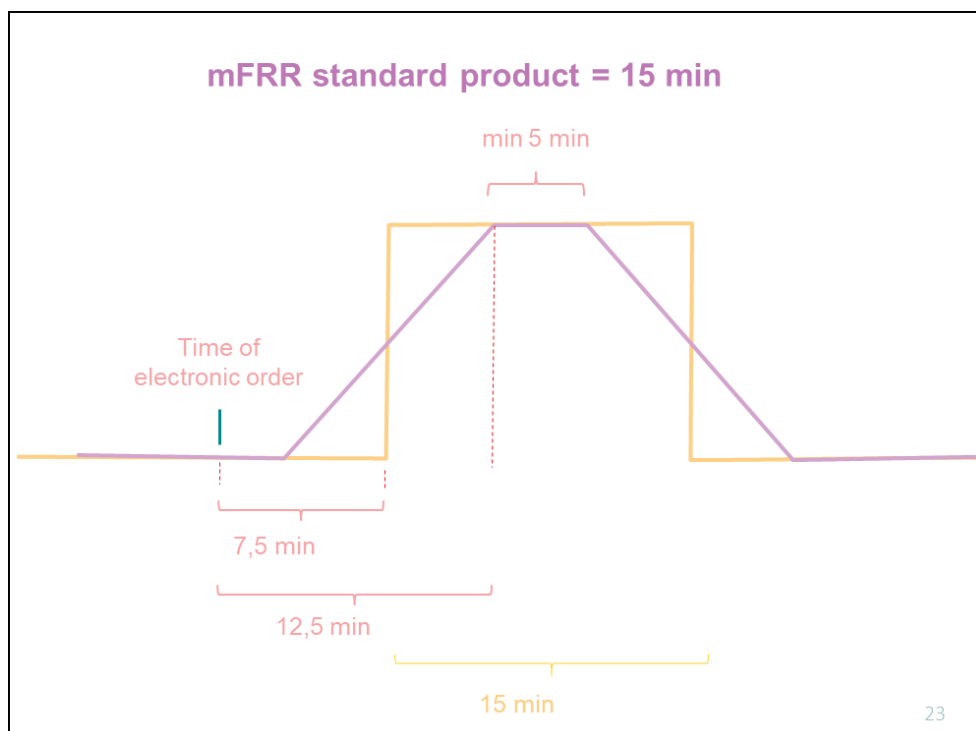


Figure 3 Standard mFRR product activation profile

In the new process where everyone receives synchronized activations it is more important than before to get a predictable response. Reasons for this are linked to system security:

- There will be exchange of mFRR between the Nordic synchronous system and DK1. After MARI, also to the rest of Europe. This exchange over HVDC will follow the standard product. If the BSP activation deviates from this product this will lead to imbalances in the activation area and frequency deviations in the Nordic synchronous area
- Changes in the merit order list or the available transmission capacity can mean that there are bids ramping up and other bids ramping down at the same quarter hour shift. If the response is not predictable, this will lead to system imbalances.

Symmetrical ramping

The recommended BSP activation response is the standard product profile, also during Automated Operation pre 15-minute ISP. If the BSP is not able to follow this activation profile, the expected BSP response is at least to ramp symmetrically around the quarter shift (see Figure 4 below).

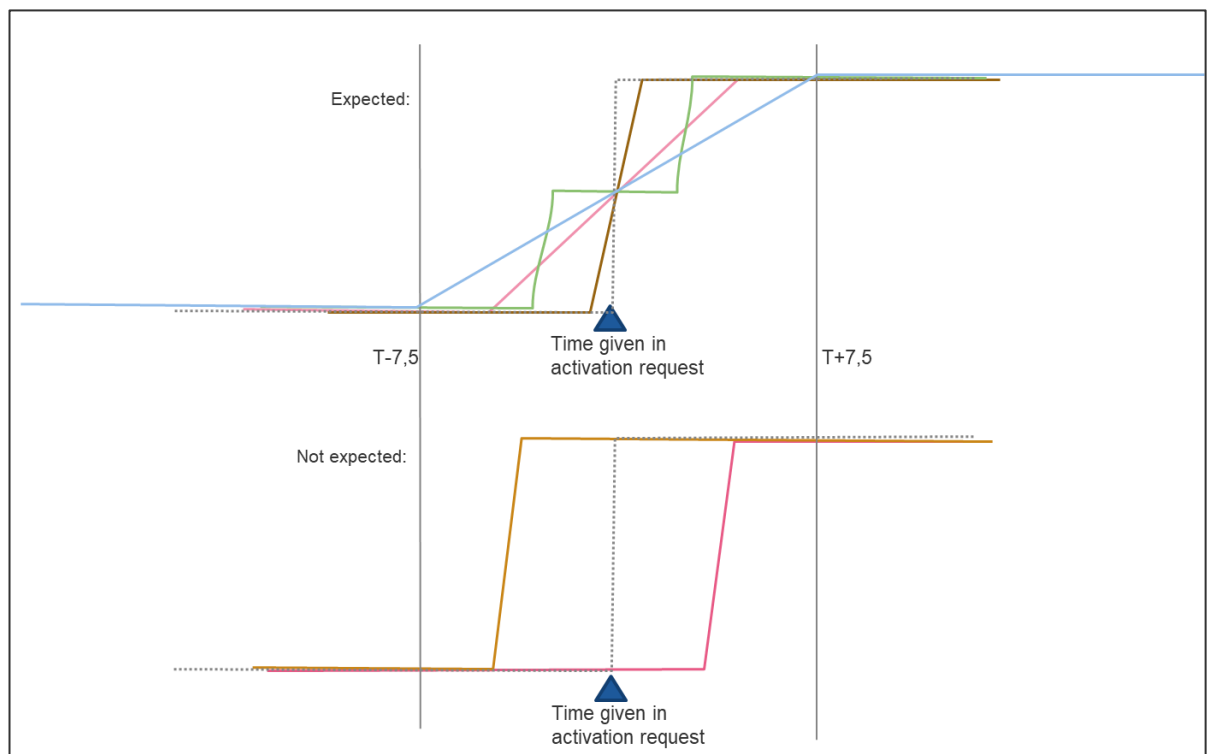


Figure 4 Expected BSP activation response during Automated operation pre 15-minute ISP period.

During the Automated operation pre 15-minute ISP, the imbalance adjustment for the BRPs will be done the same way as today with a "block volume" (for more on block volume, see next chapter). This means that imbalance adjustments will be calculated based on 60 min periods without taking into account ramping requirements or

recommendations. From the start of 15-minute ISP, the imbalance adjustment will be calculated according to the ramped profile.

Pricing and settlement principles for mFRR in Automated operation pre 15-minute ISP

This chapter describes the principles for pricing and settlement of mFRR for the Automated operation pre 15-minute ISP period. These principles will be changed at the latest when connecting to the European platform MARI, where the pricing rules are given by the [Pricing Methodology](#) in accordance with Article 30(1) of the EB GL. More information on the future development within pricing and settlement is given at the end of the chapter.

The goal of pricing and settlement principles during the Automated operation pre 15-minute period, is to keep today's pricing regime and corresponding incentive structure, so that it changes as little as possible.

mFRR pricing and settlement

1. 60 minutes Market time unit (hourly price)

During Automated operation pre 15-minute ISP, the Market time unit (MTU) will be kept at 60 minutes, meaning that an hourly mFRR balancing energy price will apply (one price per direction).

Full variation in bid volume and price for each 15 minutes is however allowed.

2. One mFRR balancing energy price per direction

During the Automated operation pre 15-minute ISP, there will be only one mFRR-price per direction (up and down) as there is today. This means that both scheduled and direct activations will influence the hourly price.

Hourly marginal price will be set as a result of the marginal prices from each run of scheduled activations (one per quarter) and direct activations (several possible per direction per quarter).

3. All bids activated in merit order can set the marginal price

All bids that are activated respecting common merit order and available transmission capacity can set the marginal price. Generally, this applies to bids that can solve balancing needs or system constraints regardless of its location within a bidding zone. Activation of bids that is due to specific needs (and based on national bid attributes like location or period shift) will not set the mFRR-price.

System constraints can also be solved with other remedial actions than mFRR.

4. Nordic optimisation

Bids will be selected in a common Nordic bid selection process, which will match Nordic mFRR demands with mFRR bids as optimally as possible, given available cross-border capacity. As a main rule this means that the mFRR balancing energy price will be set based on the demand and supply in the whole Nordic area.

If trade with other synchronous areas outside of DK1 takes place, this can also influence the activation of bids and the marginal price.

5. The mFRR balancing energy price is common across uncongested areas

The mFRR optimisation for activation of balancing bids and exchange of balancing energy across bidding zones is subject to cross-border capacity constraints. When there are no congestions, the marginal price will be the same for the whole market area.

However, if congestions occur during the operating hour, the price will only be the same in neighbouring uncongested bidding zones.

6. Day-ahead price is used as reference price as today

The day-ahead price will still be used as reference price and provide a floor and cap for the mFRR-price, as well as set the mFRR price in hours without activation (seen per direction).

7. Activation volume and imbalance adjustment

The activation volume to be settled with the BSP will be calculated as a block volume per quarter. It is based on the ordered volumes for scheduled activation per quarter (see Figure 5 below) and summed up for the hour. For direct activation the block is calculated based on the two mid ramping points for activation and deactivation⁷. The imbalance adjustment towards the BRP will also be a block volume and set to the same volume as settled with the BSP.

⁷ And other special activation types, e.g. period shift, faster activation.

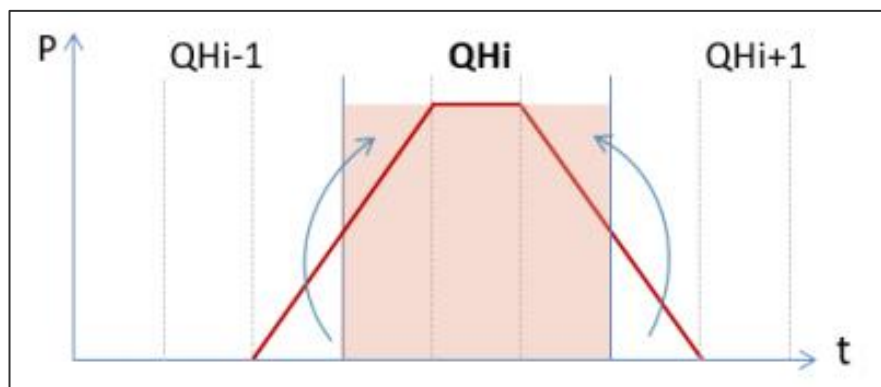


Figure 5 Ordered volume of standard product with scheduled activation.

In accordance with the description in the previous chapter, it is recommended that the bid activation response and activation volume follow the standard 12,5 min activation and delivery profile. Activation and delivery should as a minimum be symmetric around quarter shifts.

8. Settlement price

Activated mFRR bids will in general be settled with the best of the mFRR balancing energy price and bidding price. For settlement of activated bids due to other specific attributes such as period shift, see local terms and conditions.

Future development within pricing and settlement of mFRR

Moving towards start of 15-minute ISP and connection to the MARI platform, several of the above principles will change.

Both bidding prices and mFRR balancing energy prices will be set per 15 minutes when the 15-minute ISP phase starts. The imbalance adjustment towards BRPs will be changed to follow the standard product. It will be evaluated before the start of 15-minute ISP if we will implement separate pricing of scheduled and direct activation, as well as remove of the use of the day-ahead as a reference price. These changes will happen at the latest when connecting to MARI.

Short note on imbalance pricing and settlement

The market design for imbalance pricing and settlement which will enter into force with single pricing of imbalances (1. November 2021) is planned to be kept unchanged during the Automated operation pre 15-minute ISP phase.

For more information on imbalance pricing and settlement, please see the [Common Nordic Market Design paper](#) and the [response paper](#) to the informal consultation of the market design paper which have both been developed by the Single Price project under NBM.