# Explanatory document for the amended Nordic synchronous area methodology to determine limits on the amount of exchange of FRR/RR between synchronous areas defined in accordance with Article 176(1)/178(1) and to determine limits on the amount of sharing of FRR/ RR between synchronous areas defined in accordance with Article 177(1)/179(1) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

## Contents



# 1. Introduction

The Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as the **"SO Regulation"**)[1] sets out rules on relevant subjects that should be coordinated between Transmission System Operators (hereafter referred to as "**TSOs**"), as well as between TSOs and Distribution System Operators (hereafter referred to as "**DSOs**") and with significant grid users, where applicable. The goal of the SO Regulation is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. In order to deliver these objectives, a number of steps are required.

One of these steps is to determine the limits for the exchange of FRR between synchronous areas. Pursuant to Article 118(1)(z) of the SO Regulation, all TSOs in the Nordic Synchronous Area shall jointly develop common proposals for the methodology to determine limits on the amount of exchange of FRR between synchronous areas defined in accordance with Article 176(1) and the methodology to determine limits on the amount of sharing of FRR between synchronous areas defined in accordance with Article 177(1). Furthermore, pursuant to Article 118(1)(aa) of the SO Regulation, all TSOs in the Nordic Synchronous Area shall jointly develop common proposals for the methodology to determine limits on the amount of exchange of RR between synchronous areas defined in accordance with Article 178(1) and the methodology to determine limits on the amount of sharing of RR between synchronous areas defined in accordance with Article 179(1).

According to Articles 6(3)(d)(ix) and 6(3)(d)(x) of the SO Regulation the methodologies for limits on the amounts of exchange/sharing of FRR/RR between synchronous areas in accordance with Articles 176(1),

[1] As amended by Commission Implementing Regulation (EU) 2021/280 of 22 February 2021, amending Regulations (EU) 2015/1222, (EU) 2016/1719, (EU) 2017/2195 and (EU) 2017/1485 in order to align them with Regulation (EU) 2019/943.

177(1), 178(1) and 179(1) shall be submitted for approval by the relevant national regulatory authorities (hereafter referred to as the "**NRAs**").

The methodology that is accompanied by this explanatory document amends the methodology that has been approved by the NRAs in July 2019. This methodology is from all TSOs of the Nordic synchronous area.

This document contains an explanation of the amended Methodology. The legal requirements for the Methodology and the interpretation of the scope are presented in Chapter 2. Chapter 3 describes the objective of the limits on the amount of exchange/sharing of FRR/RR between synchronous areas. Chapter 4 provides an overview of the existing situation and chapter 5 describes the developments that trigger the need for this amendment. Chapter 6 describes and explain the amendments introduced in each (sub)-article. Finaly, Chapter **Error! Reference source not found.** describes the public consultation.

# 2. Legal requirements and interpretation

## 2.1 Legal references and requirements

The SO Regulation provides the mandate and approval framework for this Methodology and defines the substantive requirements that the Methodology must fulfil. There are several articles in the SO Regulation which the Methodology must take into account. These are cited below:

(1) Pursuant to Article 118(1)(z) and 118(1)(aa) of the SO Regulation, all TSOs of the Nordic synchronous area shall jointly develop a methodology to determine limits on the amount of exchange and sharing of FRR between synchronous areas, and, where applicable, a methodology to determine limits on the amount of exchange and sharing of RR between synchronous areas. Article 118(1)(z) and 118(1)(aa) has the following content:

*"1. By 12 months after entry into force of this Regulation, all TSOs of each synchronous area shall jointly develop common proposals for:[…]*

*(z) the methodology to determine limits on the amount of exchange of FRR between synchronous areas defined in accordance with Article 176(1) and the methodology to determine limits on the amount of sharing of FRR between synchronous areas defined in accordance with Article 177(1); and*

*(aa) the methodology to determine limits on the amount of exchange of RR between synchronous areas defined in accordance with Article 178(1) and the methodology to determine limits on the amount of sharing of RR between synchronous areas defined in accordance with Article 179(1);*

(2) In accordance with Article 118(2) and Article 6(3)(d)(ix)–(x) of the SO Regulation, the Methodology is subject to approval by all regulatory authorities of the concerned synchronous area and, following approval, shall be incorporated into the synchronous area operational agreement. Article 6(3)(d)(ix) and 6(3)(d)(x) has the following content:

*"The proposals for the following terms and conditions or methodologies shall be subject to approval by all regulatory authorities of the concerned region, on which a Member State may provide an opinion to the concerned regulatory authority: […]*
*(d) methodologies, conditions and values included in the synchronous area operational agreements in Article 118 concerning: [...]*
*(ix) limits on the amount of exchange of FRR between synchronous areas defined in accordance with Article 176(1) and limits on the amount of sharing of FRR between synchronous areas defined in accordance with Article 177(1);*

*(x) limits on the amount of exchange of RR between synchronous areas defined in accordance with Article 178(1) and limits on the amount of sharing of RR between synchronous areas defined in accordance with Article 179(1)"*

Article 118(2) has the following content:

*"All TSOs of each synchronous area shall submit the methodologies and conditions listed in Article 6(3)(d) for approval by all the regulatory authorities of the concerned synchronous area. Within 1 month after the approval of these methodologies and conditions, all TSOs of each synchronous area shall conclude a synchronous area operational agreement which shall enter into force within 3 months after the approval of the methodologies and conditions."*

(3) Article 176(1) of the SO Regulation requires that the synchronous area operational agreement specify a method to determine limits for the exchange of FRR with other synchronous areas. Article 176(1) has the following content:

*"All TSOs of each synchronous area shall specify in the synchronous area operational agreement a method to determine the limits for the exchange of FRR with other synchronous areas. That method shall take into account:*
*(a) the operational impact between the synchronous areas;*
*(b) the stability of the FRP of the synchronous area;*
*(c) the ability of TSOs of the synchronous area to comply with the frequency quality target parameters defined in accordance with Article 127 and the FRCE target parameters defined in accordance with Article 128; and*
*(d) the operational security."*

(4) Article 177(1) of the SO Regulation requires that the synchronous area operational agreement specify a method to determine limits for the sharing of FRR. Article 177(1) has the following content:

*"All TSOs of each synchronous area shall specify in the synchronous area operational agreement a methodology to determine limits for the sharing of FRR with other synchronous areas. That methodology shall take into account:*
*(a) the operational impact between the synchronous areas;*
*(b) the stability of the FRP of the synchronous area;*
*(c) the maximum reduction of FRR that can be taken into account in the FRR dimensioning in accordance with Article 157 as a result of the FRR sharing;*
*(d) the ability of the synchronous area to comply with the frequency quality target parameters defined in accordance with Article 127 and the FRCE target parameters defined in accordance with Article 128; and*
*(e) the operational security."*

(5) Articles 178(1) and 179(1) of the SO Regulation establishes corresponding requirements for the exchange and sharing of RR. As the Nordic TSOs currently do not utilise RR, this Methodology does not specify limits for RR.

### 2.2 Interpretation and scope of the Methodology

The Nordic TSOs apply two types of Frequency Restoration Reserves (FRR): manual FRR (mFRR) and automatic FRR (aFRR). The two types have different specifications and could in theory be handled differently

in this methodology. However, as different European TSOs currently use aFRR and mFRR differently in the balancing process and future processes are uncertain, Nordic TSOs propose that articles 3-5 of this methodology applies to the sum of mFRR and aFRR. The TSOs currently do not utilise Replacement Reserves (RR). Consequently, this methodology does not include limits on the amount of exchange and sharing of RR between synchronous areas in accordance with articles 178 and 179 of the SO Regulation.

The dimensioning rules for FRR in accordance with Article 157 of the SO Regulation result in the required FRR capacity to be guaranteed by each TSO. Part of this FRR capacity requirement can be fulfilled by exchanging or sharing FRR with other synchronous areas. The framework for the exchange and sharing is the scope of this Methodology.

Currently, the exchange and sharing of FRR capacity is only taking place between Nordic TSOs. More bilateral agreements or extended/other capacity markets may be relevant in the future.

It is expected that the Nordic TSOs will join the European platform for the exchange of balancing energy from frequency restoration reserves with manual activation (hereafter referred to as "**MARI**") within the next year. Energinet and Fingrid have already acceded to the European platform for the exchange of balancing energy from frequency restoration reserves with automatic activation (hereafter referred to as "**PICASSO**"), while Statnett and Svenska kraftnät are expected to join within the next years.

This Methodology will apply to both the exchange and sharing of FRR capacity and to the exchange of FRR energy via the European platforms.

## 3. Objective of limits for the exchange and sharing of FRR

Exchange and sharing of FRR capacity contribute to the efficient operation of the electricity system by allocating FRR capacity more efficiently. However, in order to maintain operational security, FRR exchange and sharing of capacity must be limited as there are limitations in available grid capacity. The objective of the limits on the amount of exchange and sharing of FRR capacity is to guarantee that operational security is maintained. In particular, one of the objectives is that the limits shall make sure that the stability of the Frequency Restoration Process can be ensured and that the synchronous area can comply with the frequency quality target parameters defined in accordance with Article 127 and the FRCE target parameters defined in accordance with Article 128.

## 4. The existing situation

Currently, the Nordic FRR requirements are specified per control area, and each TSO has the obligation to meet their required amount of FRR. For fulfilling part of their obligation each TSO may exchange or share FRR capacity with one or more TSOs in one or more other synchronous area(s). Since situations may be different for the different HVDC interconnectors, the TSOs do not apply generic rules on limits of the amount of FRR that can be exchanged or shared with TSOs in other synchronous areas. The Nordic TSO involved in the exchange or sharing is responsible for assessing and monitoring the impact of the exchange and/or sharing on the available FRR in its own area and the possible impact on other control areas in the synchronous area. The exchange and sharing arrangements between TSOs within the LFC block and with other synchronous areas are included in the Nordic System Operation Agreement.

The Nordic activation process for FRR is changing gradually:

- Energinet (18 October 2024) and Fingrid (28 March 2025) have acceded to the aFRR balancing platform PICASSO.
- The TSOs have implemented a common Nordic activation optimisation function (AOF), that automated the activation of mFRR from the common bid list (previously activated manually), since 4 March 2025. This was driven by the move to 15-minute MTU resolution, and it functions as a necessary bridge between the old manual processes and integration into MARI.

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## 5. Developments in the balancing markets triggering this amendment

Today, exchange on the HVDC interconnectors between the Nordic and CE Synchronous Areas is mainly based on the results of the day-ahead and intraday markets as the volumes of FRR exchange are small.

Considering the future developments in the Nordic power system , the Nordic TSOs expect that the operation of HVDC interconnectors will be different from today. Firstly, there will be more flow changes than today because of increased volatility in production due to increased production shares from wind- and solar production. Secondly, there will be increased exchange of balancing energy when the Nordic balancing markets connects to MARI and PICASSO. This will result in more fluctuation caused by 15 minutes schedules of day-ahead, intraday and scheduled mFRR exchange and increased maturity of centralized FRR activation in the European activation platforms. In addition, occasionally there will be the need for mFRR direct activation, sometimes with large volumes, especially related to disturbances. Moreover, there will also be continuous changes (every 4 seconds) for aFRR exchange. In general, the TSOs expect larger volatility than today over time because of more automated activations.

By connecting all Nordic LFC areas to the MARI and PICASSO platforms almost all European countries will have access to Nordic balancing energy and the other way around. Because of the large availability of FRR at a competitive price in the Nordic synchronous area, potentially large amounts of FRR may be exchanged over the HVDC interconnectors between the Nordic and other synchronous areas. This exchange may have significant impact on the flows on these HVDC interconnectors and consequently an impact to frequency quality, FRCE parameters for LFC areas and flows within the Nordic synchronous area.

In addition, the volatility of exchange over the HVDC interconnectors is expected to increase after connecting to MARI and PICASSO. This means that balancing market results may require more frequent changes of the HVDC setpoints. Older HVDC interconnectors are however designed for a more stable operation, and they do not necessarily support continuously changing setpoints. Therefore, TSOs strive to operate these interconnectors to stay below 1000 direction changes per year, as the vendors for older HVDC interconnectors specify that more than 1000 direction changes per year may have significant impact on the lifetime of the cables. Some relevant challenges may be:

- Operation within dead bands around zero flow;
- Frequent direction changes of flows as a result of energy markets and balancing markets;
- Large and fast changes in flows.

Since the TSOs operate a variety of HVDC interconnectors these operational restrictions are different for each HVDC interconnector. Consequently, the TSOs conclude that it shall be possible to set operational restrictions for FRR on each HVDC interconnector individually.

**Balancing markets vs the energy markets**

Considering that the limitations for energy exchange for the day-ahead and intraday markets were defined to maximise the use of the interconnector under given frequency quality considerations, there may be little room for additional exchange of balancing energy, unless the day-ahead and intraday market do not use the full potential or exchange capacity has been reserved for balancing timeframe.

The TSOs consider it inefficient to restrict the day-ahead and intraday market in order to create the possibility to exchange more in the balancing markets. Furthermore, the TSOs do not want to compromise on operational security or the ability to comply with the frequency quality target parameters defined in accordance with Article 127 and the FRCE target parameters defined in accordance with Article 128. Consequently, the TSOs conclude that the allocation constraints for exchange on HVDC interconnectors as defined under the Methodology in accordance with SOGL 137 (3, and 4) shall – after the connection to the European balancing platforms – apply to the day-ahead market, intraday market and the exchange of balancing energy together.

Given all uncertainties that come from the combined introduction of relatively new features in the wholesale electricity markets (15 min MTU day-ahead and intraday), recent introduction of Nordic mFRR EAM, the Flowbased Market Coupling, the continuing increasing amount of renewable energy, combined with FRR capacity market and the coming MARI and PICASSO accessions, it is impossible to know how the activation of Nordic bids and hence how the flows via the HVDC interconnectors with Continental Europe will be affected. Also, it is uncertain how that could affect the transmission grid in terms of congestions. Therefore, the TSOs decided to implement a two-step approach:

- **STEP1** is introduced with this amendment and will be applicable from the approval of this methodology until 3 years after all Nordic TSOs are connected to PICASSO. STEP1 is characterised by that the different LFC areas may face different magnitude and local effects of FRR exchange with Continental Europe and hence the Nordic TSOs have agreed that each TSO should have a possibility to define allocation constraints based on local needs and assumptions, within certain boundaries and conditions that are explained in chapter 6, where each article is described. For safety reasons for the total synchronous area, a maximum flow change is introduced for each interconnector, safeguarding the system.

- TSOs intend to address a **STEP2** in a separate amendment to the methodology at a later stage, based on the TSOs' evaluation of operational experience gained from the use of the European balancing platforms during the initial years of operation. This STEP2 methodology is intended to enter into force when STEP 1 no longer applies. It is the intention that STEP2 will include requirements for a yearly evaluation of FRCE parameters as the TSOs will have sufficient experience with activation procedures in MARI and PICASSO and the resulting activation requests coming from these balancing platforms. The result of each yearly evaluation are allocation constraints for each Nordic LFC area. The TSOs are aware that the criteria for these yearly evaluations must be known before STEP2 enters into force. The expectation is that there will not be a need for an upper bound as determined by article 5.1 of the proposal and that the lower bound can be raised as long as the monitored FRCE-parameters and potential other agreed KPIs are within their agreed limits.

## 6. Amendments to the Methodology

The amendment includes some minor linguistic clarifications to the Whereas section, as well as some small legal and factual precisions added to provide content.

### 6.1 Amendment to Article 1 and 2

The text has been updated to make the sentences more clear and in article 2 we added definitions for clarification. The term technical profile is used in the Implementation Framework-documents for MARI and PICASSO and commonly used within the TSO-community. However, it has not been defined in official legislation, so far.

### 6.2 Amendment to Article 3 and 4

The word "capacity" has been added to make a distinction between article 3 and 4 relating to capacity, and the new article 5 relating to energy.

### 6.3 Amendment: new Article 5

Given the developments mentioned in chapter 5, the TSOs consider the activation of FRR very similar to a change in the day-ahead or intraday schedule and consequently also adding to the issues being mitigated by allocation constraints as stipulated for the day-ahead and intraday markets.

The starting point will be that the same restrictions on maximum flow change between MTUs which is applicable for the Day Ahead and Intraday markets will also apply for the Balancing Markets. This

methodology does however acknowledge, as mentioned before, that there are different needs for different LFC areas within the Nordic LFC block. The number of HVDC interconnectors and the local grid situation varies a lot between the LFC areas, and therefor the ability to manage structural imbalances caused by HVDC flow changes also varies. For this reason, Article 5(1) opens for increasing the allowed flow change between MTUs for FRR up to 600 MW per interconnector.

The 600 MW is a limit based on TSOs' best assessment of the needs for secure system operation. Even if frequency quality currently is good, this limit is based on concerns related to future frequency quality given the expected increase in exchange between the Nordic and CE Synchronous Areas.

The purpose of having a bandwidth for restrictions, is to allow each TSO to maintain system security in their control area and at the same time not to restrict exchange more than necessary. A generic Nordic restriction would have been more restrictive for market parties. By this, each TSO can consider technical and operational limits only for the HVDC interconnectors or the LFC Areas that cannot facilitate the expected volatility in FRR exchange or sharing for their control area.

Article 5(2) ensures that if a TSO applies combined restrictions, based on the Methodology under Article 137 of the SO Regulation (ramping restrictions of active power output), in day-ahead and intraday, then these restrictions may also be applied for the exchange of FRR with other synchronous areas.

Article 5(3) stipulates that TSOs may use a technical profile in the MARI and PICASSO platforms, for system security reasons. A technical profile can limit the sum of capacity for a set of both HVAC and HVDC interconnectors together. This may be used for instance when encountering grid issues. It may be used for shorter or longer time periods. The TSOs will justify when it uses or applies technical profiles.

Finally, Article 5(4) describes that TSOs are allowed to impose additional allocation constraints when dealing with technical limitations of HVDC-interconnectors, in accordance with Articles 4(2)(d)(ii) of the Implementation Frameworks of MARI and PICASSO. This ensures that the differences in technical capabilities of the different HVDC interconnectors can be respected. This possibility is necessary due to the different technology and age of these interconnectors. Some are quite new and are not impacted by rapid flow changes, while others are old and not built for the power markets we see today and further ahead.

Lastly, TSOs of other synchronous areas may have their own allocation constraints. As the Balancing Platforms must use one cross-zonal capacity limit (which allocation constraints may restrict in the capacity calculation) for each clearing for the exchange of FRR, the most restrictive value of two connected TSOs of an interconnector will be used to safeguard system security. Hence, the end-result may lead to deviation from the resulting allocation constraints according to the rules in this methodology.

### 6.4 Amendment: new Article 6

Article 6 arranges the validity of article 5, regulating the different steps the TSOs have defined (see paragraph 5.2). The TSOs think it is necessary to make sure that the methodology is valid until 3 years after all Nordic TSOs have acceded to the PICASSO platform. The TSOs will then have sufficient data to redraft the Methodology making it fit for STEP2, where the yearly evaluation of the limits can be performed.

Moreover, in case not all TSOs have connected to PICASSO, Article 5 shall be applicable until the latest 1 January 2032.

### 6.5 Amendment to Article 7

In the previous 2019 version of the Methodology, paragraph 2 of Article 5 (corresponding to Article 7 of this version) has been removed. This paragraph was about implementing the proposal not later than when the Nordic synchronous area operational agreement entered into force.

## 7. Public consultation

Article 11 of the SO Regulation states that: *"TSOs responsible for submitting proposals for terms and conditions or methodologies or their amendments in accordance with this Regulation shall consult stakeholders, including the relevant authorities of each Member State, on the draft proposals for terms and conditions or methodologies listed in Article 6(2) and (3). The consultation shall last for a period of not less than one month."*

This proposal is under consultation in the period 20 April to 20 May 2026.

To be updated after the public consultation.