# Explanatory document for the Nordic synchronous area proposal for the FRR dimensioning rules in accordance with Article 157(1) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

# 1. Introduction

The Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereinafter **"SO Regulation"**) sets out rules on relevant subjects that should be coordinated between Transmission System Operators, as well as between TSOs and Distribution System Operators and with significant grid users, where applicable. The goal of the SO Regulation is to ensure provision of an efficient functioning of the interconnected transmission systems to support all market activities. In order to deliver these objectives, a number of steps are required.

One of these steps is to define the FRR dimensioning rules. Pursuant to Article 119(1)(h) of the SO Regulation, all Transmission System Operators in the Nordic LFC Block shall jointly develop common proposals for the FRR dimensioning rules defined in accordance with Article 157(1).

According to Article 6(3)(e)(iv) of the SO Regulation the proposal for FRR dimensioning defined in accordance with Article 157(1) (hereafter referred to as "**Proposal**") shall be submitted for approval by the relevant national regulatory authorities (hereinafter "NRAs") no later than 14 September, 2018. The Proposal is submitted for regulatory approval to all NRAs in the Nordic LFC block. According to Article 6(6) of the SO Regulation the Proposal needs to be submitted to ACER as well, who may issue an opinion on the Proposal if requested by the NRAs.

This document contains an explanation of the Proposal from all TSOs of the Nordic synchronous area (hereinafter **"TSOs"**). It is structured as follows. The legal requirements for the Proposal are presented in Chapter 2. Chapter 3 starts with describing the objective of the FRR dimensioning rules. Chapter 4 provides an overview of the existing situation and Chapter 5 an outlook to future developments. The proposed FRR dimensioning rules are described in Chapter 6. Chapter 7 describes the expected impact on the relevant objectives of the SO Regulation. Finally, Chapter 8 provides the timeline for implementation and Chapter 9 describes the public consultation.

# 2. Legal requirements and interpretation

## 2.1 Legal references and requirements

Several articles in the SO Regulation set out requirements which the Proposal must take into account. These are cited below.

(1) Article 119(1)(h) and (2) of the SO Regulation constitutes the legal basis that the Proposal should take into account. Article 119 has the following content:

> *"1. By 12 months after entry into force of this Regulation, all TSOs of each LFC block shall jointly develop common proposals for: […]*
>
> *(h) the FRR dimensioning rules defined in accordance with Article 157(1); […]*
>
> *2. All TSOs of each LFC block shall submit the methodologies and conditions listed in Article 6(3)(e) for approval by all the regulatory authorities of the concerned LFC block. Within 1 month after the approval of these methodologies and conditions, all TSOs of each LFC block shall conclude an LFC block operational agreement which shall enter into force within 3 months after the approval of the methodologies and conditions;"*

(2) Article 157 of the SO Regulation has the following content:

> *"1. All TSOs of a LFC Block shall set out FRR dimensioning rules in the LFC Block operational agreement.*
>
> *2. The FRR dimensioning rules shall include at least the following:*

*(a) all TSOs of a LFC block in the CE and Nordic synchronous areas shall determine the required reserve capacity of FRR of the LFC block based on consecutive historical records comprising at least the historical LFC block imbalance values. The sampling of those historical records shall cover at least the time to restore frequency. The time period considered for those records shall be representative and include at least one full year period ending not earlier than6 months before the calculation date;*

*(b) all TSOs of a LFC block in the CE and Nordic synchronous areas shall determine the reserve capacity on FRR of the LFC block sufficient to respect the current FRCE target parameters in Article 128 for the time period referred to in point (a) based at least on a probabilistic methodology. In using that probabilistic methodology, the TSOs shall take into account the restrictions defined in the agreements for the sharing or exchange of reserves due to possible violations of operational security and the FRR availability requirements. All TSOs of a LFC block shall take into account any expected significant changes to the distribution of LFC block imbalances or take into account other relevant influencing factors relative to the time period considered;*

*(c) all TSOs of a LFC block shall determine the ratio of automatic FRR, manual FRR, the automatic FRR full activation time and manual FRR full activation time in order to comply with the requirement of paragraph (b). For that purpose, the automatic FRR full activation time of a LFC block and the manual FRR full activation time of the LFC block shall not be more than the time to restore frequency;*

*(d) the TSOs of a LFC block shall determine the size of the reference incident which shall be the largest imbalance that may result from an instantaneous change of active power of a single power generating module, single demand facility, or single HVDC interconnector or from a tripping of an AC line within the LFC block;*

*(e) all TSOs of a LFC block shall determine the positive reserve capacity on FRR, which shall not be less than the positive dimensioning incident of the LFC block;*

*(f) all TSOs of a LFC block shall determine the negative reserve capacity on FRR, which shall not be less than the negative dimensioning incident of the LFC block;*

*(g) all TSOs of a LFC block shall determine the reserve capacity on FRR of a LFC block, any possible geographical limitations for its distribution within the LFC block and any possible geographical limitations for any exchange of reserves or sharing of reserves with other LFC blocks to comply with the operational security limits;*

*(h) all TSOs of a LFC block shall ensure that the positive reserve capacity on FRR or a combination of reserve capacity on FRR and RR is sufficient to cover the positive LFC block imbalances for at least 99 % of the time, based on the historical records referred to in point (a);*

*(i) all TSOs of a LFC block shall ensure that the negative reserve capacity on FRR or a combination of reserve capacity on FRR and RR is sufficient to cover the negative LFC block imbalances for at least 99 % of the time, based on the historical record referred to in point (a);*

*(j) all TSOs of a LFC block may reduce the positive reserve capacity on FRR of the LFC block resulting from the FRR dimensioning process by concluding a FRR sharing agreement with other LFC blocks in accordance with provisions in Title 8. The following requirements shall apply to that sharing agreement:*

> *(i) for the CE and Nordic synchronous areas, the reduction of the positive reserve capacity on FRR of a LFC block shall be limited to the difference, if positive, between the size of the positive dimensioning incident and the reserve capacity on FRR required to cover the positive LFC block imbalances during 99 % of the time, based on the historical records referred to in*

*point (a). The reduction of the positive reserve capacity shall not exceed 30 % of the size of the positive dimensioning incident;*

*(ii) for the GB and IE/NI synchronous areas, the positive reserve capacity on FRR and the risk of non-delivery due to sharing shall be assessed continually by the TSOs of the LFC block;*

*(k) all TSOs of a LFC block may reduce the negative reserve capacity on FRR of the LFC block, resulting from the FRR dimensioning process by concluding a FRR sharing agreement with other LFC blocks in accordance with the provisions of Title 8. The following requirements shall apply to that sharing agreement:*

*(i) for the CE and Nordic synchronous areas, the reduction of the negative reserve capacity on FRR of a LFC block shall be limited to the difference, if positive, between the size of the negative dimensioning incident and the reserve capacity on FRR required to cover the negative LFC block imbalances during 99 % of the time, based on the historical records referred to in point (a);*

*(ii) for the GB and IE/NI synchronous areas, the negative reserve capacity on FRR and the risk of non-delivery due to sharing shall be assessed continually by the TSOs of the LFC block.*

*3. All TSOs of a LFC block where the LFC block comprises more than one TSO shall set out, in the LFC block operational agreement, the specific allocation of responsibilities between the TSOs of the LFC areas for the implementation of the obligations established in paragraph 2.*

*4. All TSOs of a LFC block shall have sufficient reserve capacity on FRR at any time in accordance with the FRR dimensioning rules. The TSOs of a LFC block shall specify in the LFC block operational agreement an escalation procedure for cases of severe risk of insufficient reserve capacity on FRR in the LFC block."*

(3) Article 6(3)(e)(iv) of the SO Regulation states:
*"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: […]*
*(e) methodologies and conditions included in the LFC block operational agreements in Article 119, concerning: […]*
*(iv) the FRR dimensioning rules in accordance with Article 157(1);*

### 2.2 Interpretation and scope of the Proposal

In accordance with Article 157(1) and (2) of the SO Regulation, the scope of this Proposal shall include the dimensioning of both manual FRR (mFRR) and automatic FRR (aFRR) for the Nordic LFC Block. The result of the dimensioning are the required amounts of upward and downward mFRR and aFRR for the Nordic LFC Block, including the geographical distribution.

Outside the scope of this Proposal is how the TSOs of the Nordic LFC Block will ensure that sufficient FRR will be available in practice.

## 3. Objective of FRR dimensioning

The Nordic Frequency Restoration Process (FRP) applies mFRR and in some hours aFRR. The main purpose of FRR is restoring the system frequency in the Nordic synchronous area and consequently replace activated FCR. mFRR can also be pro-actively activated to prevent for frequency deviations, e.g. in case of (expected) deterministic frequency deviations. FRR shall be sufficiently available to maintain the frequency and to be within system security limits. The objective of FRR dimensioning is to determine a volume of aFRR and mFRR that shall be available in the Nordic LFC block. As the Nordic LFC block experiences frequent

congestions in the grid, the dimensioning shall take the geographical requirements for distribution of FRR into account.

# 4. The existing situation

In this chapter, the existing FRR dimensioning rules are described. As aFRR is a process under development in the Nordics and the current total Nordic determined volume of aFRR is a fixed and limited volume (300 MW) in about 1/5 of the hours of the week, the current Nordic FRR dimensioning is strongly dominated by mFRR (at least 15 times the aFRR capacity). Section **Error! Reference source not found.** describes mFRR dimensioning, while section 4.2 elaborates on aFRR.

## 4.1 mFRR dimensioning

mFRR shall exist in order to restore the faster reserves FCR-N, FCR-D and aFRR when these reserves have been activated and to control flows in the grid within applicable limits. mFRR can also be pro-actively activated to prevent for frequency deviations, e.g. in case of (expected) deterministic frequency deviations. The mFRR shall in normal operation exist and be localized to the extent that the synchronous system can be balanced at any time. mFRR is dimensioned by the individual TSOs based on their control area assessment of local requirements. Bottlenecks on the network, dimensioning incidents and similar are included when assessing this.

The requirements for mFRR volumes in upward direction are currently defined by large national N-1 incidents: Each control area shall have mFRR volumes available equivalent to or greater than the dimensioning incident in the subsystem. The *'dimensioning incident'* is defined as *'faults which entail the loss of individual major components (production units, lines, transformers, bus bars, consumption etc.) and entail the greatest impact upon the power system from all fault events that have been taken into account.'*

In addition, the TSOs must also have reserves or other measures available to handle other imbalances which are correlated with N-1 incidents or two or more simultaneous faults which may occur within the TSOs control area and on the borders to other control areas.

In practice, all four TSOs dimension the mFRR volumes for their control area and determine the required distribution within the control area. The mFRR volumes are based on the dimensioning incident in the control area, as described above. However, some mFRR capacity is shared between Sweden and Denmark. mFRR that shall be available for handling of 'normal' BRP imbalances are not explicitly dimensioned for in Denmark East, Finland and Sweden. For this, these TSOs rely on voluntary mFRR energy bids that are available in the Nordic Regulating Power market. Also Statnett relies on voluntary mFRR energy bids for most of the time. However, if the probability for availability of sufficient mFRR is too low, Statnett contracts upward mFRR. This is normally an issue in winter.

There are currently no explicit Nordic arrangements for dimensioning nor contracting of downwards mFRR since historically availability of downward mFRR bids have been sufficient. However, the TSOs see a trend that the amounts of downward mFRR bids are reducing and the need for capacity is increasing. Due to this, the Nordic TSOs will now establish arrangements to secure downward mFRR capacity.

## 4.2 aFRR dimensioning

aFRR was introduced in the Nordic synchronous area in January 2013. The background for implementing and developing aFRR in the Nordics was the deteriorating frequency quality and aFRR was identified and agreed as one of the main measures to stop the weakening of the frequency quality.

The aFRR product shall be seen as an automatic "complement" to mFRR in the Frequency Restoration process.

The Nordic LFC block centrally activates aFRR from a single Load Frequency Controller (LFC). Based on the measured frequency, this LFC calculates the required activation of aFRR and distributes the activation

requests to the Nordic TSOs pro-rata. Consequently, each Nordic TSO distributes the requests to the contracted aFRR providers in its control area.

Currently, only procured aFRR capacity can be activated and therefore the complete dimensioned amount shall be procured. The TSOs procure aFRR in the morning and evening hours where the frequency variations are most challenging.

Each quarter of a year, all Nordic TSOs determine the hours for which aFRR shall be dimensioned. These hours include the hours where the frequency variations are most challenging. Dimensioned aFRR capacity will be at least 300 MW in at least 35 hours/week as today.

## 5. Outlook

The TSOs expect that future challenges will require more automated balancing. The Nordic TSOs will increase the number of aFRR contracting hours from 35 hours/week today to all hours. After that, the aFRR volume will gradually be increased from today's level of 300 MW to a tentative target volume of 600MW. From that point in time a new dimensioning method for aFRR will have to be implemented.

The proposal presented in section 6 of this document does not comply to the requirements in Article 157 of the SO Regulation in all aspects. Most importantly, the proposed dimensioning rules for mFRR will dimension mFRR per control area instead of for the entire LFC Block. Furthermore, the FRR dimensioning rules will not make use of a probabilistic methodology and historical records. The TSOs have agreed on an approach for a new Nordic balancing model. Within the implementation process, the TSOs are developing a FRR dimensioning process which will comply with the requirements in Article 157 of the SO Regulation. Once defined, the TSOs will start an amendment process to this proposal.

## 6. Proposal for FRR dimensioning

The proposal reflects the existing rules as discussed in section 4. In addition to the existing rules, the proposal includes dimensioning of downward mFRR. Downward mFRR will be even more important when the new HVDC interconnectors have been commissioned. This results in the following text for Article 3 and 4 of the Proposal:

### Article 3 – mFRR dimensioning

1. Each TSO is responsible for dimensioning of mFRR for their control area and for determining the required geographical distribution of mFRR capacity within their control area;
2. The mFRR capacity dimensioned for the control area shall at least cover the dimensioning incidents in the control area, in which the 'dimensioning incidents' is defined as 'faults which entail the loss of individual major components (production units, lines, transformers, bus bars, consumption etc.) and entail the greatest impact upon the power system from all fault events that have been taken into account.'. Both upward and downward mFRR shall be dimensioned.

### Article 4 – aFRR dimensioning

1. Each quarter of a year, all Nordic TSOs determine the hours for which aFRR shall be dimensioned and the dimensioned amount of aFRR capacity based on the targeted frequency quality and the specifications in 2 and 3 below;
2. The hours for which aFRR shall be dimensioned shall at least include the hours where the frequency variations are most challenging;
3. Dimensioned aFRR capacity will be at least 300 MW.

## 7. Expected impact of the Proposal on the relevant objectives of the SO Regulation

The Proposal generally contributes to and does not in any way hamper the achievement of the objectives of Article 4 of the SO Regulation. In particular, the Proposal serves the objectives to:

- Article 4(1)(c) determining common load-frequency control processes and control structures;
- Article 4(1)(d) ensuring the conditions for maintaining operational security throughout the Union;
- Article 4(1)(e) ensuring the conditions for maintaining a frequency quality level of all synchronous areas throughout the Union; and

The Proposal contributes to these objectives by specifying the dimensioning rules for mFRR and aFRR, which are key reserves that are used in the common Nordic load-frequency control processes. Sufficient mFRR and aFRR guarantee the right FRCE and frequency quality level and consequently maintain the operational security by reducing the risk for automatic Under Frequency Load Shedding (UFLS), automatic reduction of generation and for system blackouts due to under or over frequency.

## 8. Timescale for the implementation

The TSOs shall implement the Proposal not later than when Nordic LFC block operational agreement enters into force in accordance with Article 119 of the SO Regulation.

## 9. 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 will be consulted in the period 1 July to 15 August 2018.