Explanatory document concerning the proposal from the Transmission system operators Energinet, Svenska kraftnät and Statnett for the determination of LFC blocks within the Nordic synchronous area in accordance with Article 141(2) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

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1. Introduction

The Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereinafter "**SO GL regulation**") sets out rules on relevant subjects that should be coordinated between Transmission System Operators (hereinafter "**TSOs**"), as well as between TSOs and Distribution System Operators and with significant grid users, where applicable. The goal of SOGL 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 determine the load-frequency control (hereinafter "**LFC**") blocks of the synchronous areas in the EU and other areas. Pursuant to Article 141 of the SO GL regulation, all Transmission System Operators in the Nordic Synchronous Area (hereinafter "**Nordic SA**") shall develop a Proposal for determining the LFC blocks.

The Proposal for determination of LFC blocks shall be submitted for approval by the relevant national regulatory authorities (hereinafter "**NRAs**") no later than 14 January, 2018. The proposal is submitted for regulatory approval to all NRAs in the Nordic Synchronous Area.

This document contains an explanation of the proposal from the TSOs Energinet, Svenska kraftnät and Statnett for the determination of LFC blocks.

2. Legal requirements and interpretation

2.1 Legal references and requirements

Several articles in the SO GL Regulation set out requirements which the proposal for LFC block determination must take into account. These are cited below.

"Load-frequency control block" is defined in Article 3(2)(18) of the SO GL Regulation as:

> *"'load-frequency control block' or 'LFC block' means a part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other LFC blocks, consisting of one or more LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control;"*

The legal requirements for the LFC blocks determination are set out in Article 141(2) of the SO GL Regulation as follows:

> *"By 4 months after entry into force of this Regulation, all TSOs of a synchronous area shall jointly develop a common proposal regarding the determination of the LFC blocks, which shall comply with the following requirements:*
>
> *(a) a monitoring area corresponds to or is part of only one LFC area;*
>
> *(b) a LFC area corresponds to or is part of only one LFC block;*
>
> *(c) a LFC block corresponds to or is part of only one synchronous area; and*
>
> *(d) each network element is part of only one monitoring area, only one LFC area and only one LFC block."*

Further, Article 141(11) of the SO GL Regulation states that:

> *All TSOs of two or more LFC areas connected by interconnections shall have the right to form an LFC block if the requirements for the LFC block set out in paragraph 5 are fulfilled.*

"LFC block operational agreement" is defined in article 3(2)(136) of the SO GL Regulation as:

> *"'LFC block operational agreement' means a multi-party agreement between all TSOs of a LFC block if the LFC block is operated by more than one TSO and means a LFC block operational methodology to be adopted unilaterally by the relevant TSO if the LFC block is operated by only one TSO;"*

In regards to regulatory approval, Article 6(3) of the SO GL 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:*
>
> *…..*
>
> *g) common proposal per synchronous area for the determination of LFC blocks in accordance with Article 141(2)."*

2.2 Interpretation and scope of the proposal

The load-frequency control is one of the most crucial processes in ensuring operational security with a high level of reliability and quality. An LFC block represent a geographical area for which one or more TSOs are responsible for fulfilling the obligations of load-frequency control. Determination of the LFC blocks within a synchronous system is the first step towards enabling a well-functioning load-frequency control. Once the LFC blocks are determined, the TSOs of each block can develop common LFC block operational agreements, pursuant to Article 119 of the SO GL Regulation. The LFC block operational agreement describes specifications, requirements and methodologies for the LFC block that all parties to the agreement are required to adopt.

Article 141(2) of the SO GL Regulation sets out the requirements for the LFC block proposal and establishes the generic structure for monitoring areas, LFC areas, LFC blocks and synchronous system. The current proposal from Energinet, Svenska kraftnät and Statnett fulfils these requirements.

Furthermore, the proposal for the determination of LFC blocks shall be developed by the TSOs of the synchronous system. For the Nordic Synchronous area, the relevant TSOs are Fingrid, Kraftnät Åland, Energinet, Svenska kraftnät and Statnett. As described in section 3.3 of this explanatory document, the relevant TSOs have not succeeded in agreeing on a common proposal at this stage.

3. Proposal for LFC blocks in the Nordic Synchronous Area

3.1 Current status in the Nordic synchronous system

The Nordic synchronous area consists of four control areas where each control area is operated by a national TSO. Some control areas are divided into several scheduling areas whose borders are determined by structural transmission constraints inside the control areas, for others there is only one scheduling area in the control area. The scheduling areas are equal to the bidding zones defined in the wholesale market. In the case of Norway, Finland and Sweden, the control area coincides with the national borders. Denmark is split into two scheduling areas named Eastern Denmark and Western Denmark, where the latter is synchronously interconnected to Continental Europe. The Nordic SA and Western Denmark jointly constitute the *interconnected Nordic power system*. The operation of the interconnected Nordic power system is governed by the Nordic System Operation Agreement (hereinafter **SOA**) with the overarching objective to regulate collaboration, rights and commitments vis-à-vis system operation issues.

Figure 1: The interconnected Nordic power system and its control areas as defined in SOA. Note that only Eastern Denmark is part of the Nordic synchronous system.

The SOA thus constitutes a legal framework for collaboration between four parties in order to support operation and establish the technical prerequisites for cross border electricity markets. Each TSO is responsible for system security within their control area. However, in SOA Appendix 3, the four national TSOs agree that the national TSOs in Sweden (Svenska kraftnät) and in Norway (Statnett) shall have the task of maintaining the frequency and time deviation within the set limits in the Nordic SA. The national TSO in Finland (Fingrid) and in Denmark (Energinet) will normally only activate balancing energy after instruction from Svenska kraftnät or Statnett.

The distribution of work between Svenska kraftnät and Statnett is regulated bilaterally and described in the document "Frequency regulation in Nordel system" (Instruction for frequency regulation), which is distributed to all the Parties.

The Archipelago of Åland is connected to the Swedish distribution system in SE3 and the island is balanced by a Swedish BRP. Kraftnät Åland Ab was certified as a TSO in November 2015. Åland is regulated by the Åland self-government legislation within the field of energy having its own regulatory authority. In terms of determination of LFC blocks, due to the physical circumstances, Åland will be a part of the Swedish subsystem.

The fact that the interconnected Nordic power system is rather small in terms of number of collaborating TSOs and to a vast extent coincides with the synchronous system (except Western Denmark) has enabled a collaboration that deviates from what has been possible in Continental Europe. The current governance in the Nordic synchronous area is based on the historical Nordic framework conditions and does not fit with the SO GL requirements, e.g. with respect to securing reserve capacity. This becomes clear when comparing the SO

GL requirements in article 119 with the current SOA. There are obviously resemblances, but the need to rethink, adjust and expand the governance structure in the Nordics is evident in order to reach SO GL compliance.

In SO GL (article 3), the load-frequency control structure (hereinafter **LFC structure**) is defined per synchronous area as "the basic structure considering all relevant aspects of load-frequency control in particular concerning respective responsibilities and obligations as well as types and purposes of active power reserves". The current Nordic SOA does not define any LFC structure and the terms LFC Area and LFC Block as defined in SO GL, have not been used in the Nordics before and are therefore not reflected in the control structure and processes in the SOA.

SO GL implies that the Nordic TSOs should explore the possibilities to agree on "all relevant aspects of load-frequency control", "responsibilities and obligations" and "types and purposes of active power reserves". The outcome should influence whether the Nordic TSOs find it suitable to form four individual LFC blocks or blocks consisting of a set of control areas. The Nordic TSOs should develop and propose an LFC structure fit for the purpose of achieving an efficient development towards European harmonization of the system operation compliant with the Nordic and European operational framework.

3.2 Assessment of prerequisites for the proposal

As there is no existing LFC structure established in the Nordics as set out by the SO GL, the potential for the Nordic TSOs to agree on a structure which consists of more than one Nordic control area must be assessed. The proposal should have its origin in article 139 and the related article 140 and 141. However, the assessment should also include article 119 which governs the LFC block agreement. To propose an LFC block structure without investigating the potential of successfully establishing the associated agreements to govern this structure is deemed not to be a feasible way forward. This is not only necessary in order to reach compliancy with the guideline, but it is also inevitable if the Nordics shall be able to benefit from merging into the European governance framework.

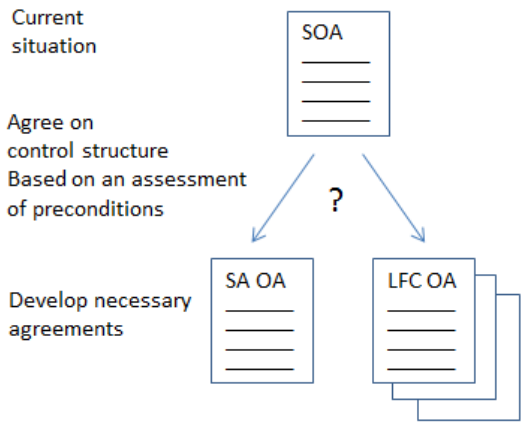

Figure 2: The proposal of control structure should be based on an assessment of preconditions

The balancing of the Nordic SA is currently almost entirely performed by manual FRR activations based on frequency as the control parameter. aFRR as a supplementary tool has been introduced over a period of several years. The Nordic SA has experienced a deteriorating frequency quality for many years, but the Nordic TSOs have been unable to achieve consensus about the extent to which this aFRR process is needed. It has also been difficult to achieve consensus about the design of processes on distribution of reserves, needed volumes and distribution of costs.

Nordic system operation is facing increased challenges in the years to come. There will be a substantial increase in HVDC capacity between the Nordic and surrounding synchronous

areas. The share of renewables in the production mix will increase significantly, and European integration will continue rapidly with intensified exchange of balancing products all across Europe. The markets will develop towards shorter time resolution and preparations for balancing will have to be done closer to real time. These challenges are documented in a common Nordic TSO report, *Challenges and opportunities for the Nordic power system*. The challenges impose a need to rethink the Nordic balancing process to modernize and adapt it to completely new framework conditions.

3.3 Process to form a block with three parties

Based on this acknowledgement, the Norwegian TSO Statnett and the Swedish TSO Svenska kraftnät, as responsible TSOs for balancing of the Nordic SA, explored an update of the Nordic balancing process during the spring 2017. This objective was to benefit from the deepened European market integration and to be able to facilitate a continued integration of renewable energy and HVDC interconnectors. The work led to a proposal for a new balancing concept. This balancing concept outlines the process activation structure in accordance with SO GL Article 140 and the process responsibility structure in accordance with SO GL article 141.

In October the three TSOs Energinet, Svenska kraftnät and Statnett agreed to enter into a deeper cooperation and to form a common LFC block based both on a common understanding of the development of balancing, described in the Scandinavian Balancing Concept (hereinafter the **SBC**), and an agreed model for cooperation within the LFC block. Fingrid was also invited to join the cooperation but has not wished to participate. As a consequence of this, the three TSOs concluded that the prerequisites for an LFC block including all Nordic control areas were not in place. The three TSOs have however decided to start the process of establishing an LFC block including Eastern Denmark, Sweden and Norway (hereinafter the **Scandinavian LFC block**).

Figur 3:The proposed Scandinavian LFC block consists of Norway, Eastern Denmark and Sweden.

With this proposal Energinet, Statnett and Svenska kraftnät will enter into a deeper cooperation in the balancing area with the joint goal of developing the balancing function to meet the future challenges in the energy system in line with the regulations set up in System Operation Guideline and Electricity Balancing Guideline. Together the three TSOs aim to be a strong force for development in balancing.

The goal of the SBC is to facilitate the green energy market, to maintain Security of Supply, to improve efficiency in European balancing, to develop regional coordination and control within national responsibility for system security, to achieve price signals that incentivizes BRPs, BSPs and TSOs to contribute to an effective development of balancing and to get a fair distribution of benefits and costs between countries.

The SBC is designed to ensure clear roles and responsibilities, adequate FRR dimensioning rules as well as activation and settlement principles integrating advantageous European procedures. Adapting to the continental balancing market principles, will prepare the ground for European activation platforms in balancing.

The SBC further proposes:

- Utilization of modern IT technology for more automatization/digitalization
- Creation of more precise price signals in markets to improve the distributed capability to balance where and when needed and to enable benefits and costs to be allocated more precisely between participants, bid areas and countries
- Improvement of system security control within agreed specifications and methods (frequency, congestions and reserves) by physical control per bid area and a central optimization function to benefit from netting – activation control by MACE (Modernized Area Control Error) – which is compliant with coming European activation platforms
- Standardization of products and activation procedures to improve efficiency in European balancing markets considering the specific challenges with HVDC connections

The implementation of the SBC will take some time. Still Energinet, Svenska kraftnät and Statnett will formalize the proposed control structure as soon as possible knowing that investments in IT and design of markets and other arrangements need predictability over some time to achieve an effective implementation.

3.4 Expected impact of the proposed load-frequency control structure

The proposed Scandinavian LFC block - in which three TSOs will cooperate - is based on a jointly agreed development plan and target model for the Frequency Restoration Process backed up with an associated governance structure. This warrants an efficient cooperation within the block. The anticipated consequence of the proposal is the creation of a sound foundation for LFC block agreements under article 119 which will ultimately result in:

- An effective regional decision process within the LFC block for decisions related to SO GL and EB GL
- Added value for the block as a whole when three TSOs coordinate their balancing processes, e.g. due to sharing of reserves and common market arrangements
- Established preconditions for the (European and Nordic) Balancing target model

3.5 Public consultation

SO GL article 11 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 23 November to 31 December 2017.

4. Timescale for implementation

The proposal for a Scandinavian LFC block will be included in the LFC block operational agreement delivered to regulators within 12 months after EIF of SO GL as required by article 119.

Implementation of the Scandinavian Balancing Concept will however be done in steps as shown in Fig.4 below.

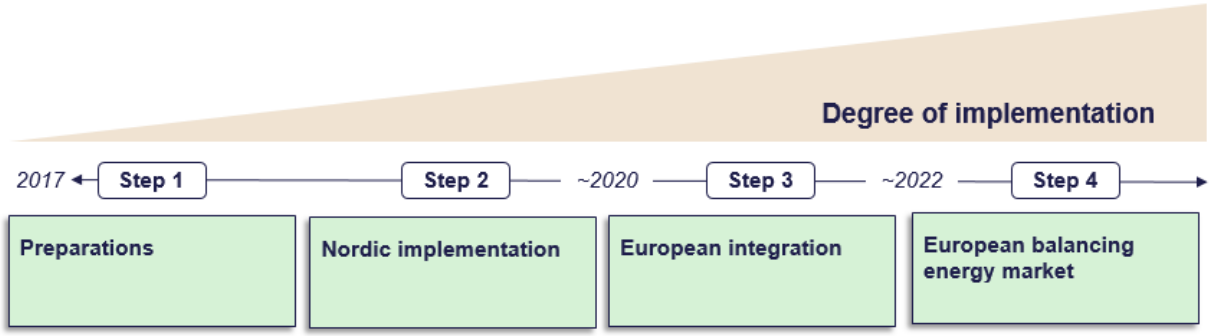

*Figure **4**: The plan for implementation of the SBC*