Supporting document from Fingrid to proposal for determination of LFC blocks 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

Load-frequency control (LFC) is a critical process of the power system in ensuring operational security and stable system frequency. Effective LFC is possible only if the TSOs cooperate to balance generation and demand in real time to achieve stable system frequency of 50 Hz.

In order to ensure the quality of the common system frequency, it is essential that a common set of minimum requirements and principles for Union-wide LFC and reserves have been defined as a basis for both the cross-border cooperation between the TSOs and, where relevant, for utilising characteristics of the connected generation and consumption.

Article 141(2) of the Commission Regulation (EU) No 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission operation ("SO Regulation") requires that by 4 months after the entry into force of the SO Regulation all Transmission System Operators ("TSOs") of a synchronous area submit a common proposal regarding the determination of the LFC blocks ("LFC Proposal") to all National Regulatory Authorities ("NRAs") for approval pursuant to Article 6(3)(g) of the SO Regulation. According to Article 6(6) of the SO Regulation the LFC Proposal needs to be submitted to ACER as well, who may issue an opinion on the proposal if requested by the NRAs.

Approach taken in LFC Proposal has an effect to all LFC related issues within the SO Regulation, such as the LFC structure and operational rules, the quality criteria and targets, the reserve dimensioning, the exchange, sharing and distribution of reserves, and the monitoring related to LFC.

This document is a supporting document accompanying the LFC Proposal. It is structured as follows. The legal requirements for the LFC Proposal are presented in Chapter 2. Chapter 3 provides a description of the load-frequency control. Current LFC approach is presented in Chapter 4. Chapter 5 presents the selected approach and its justification. Chapter 6 describes the expected impact on the relevant objectives of the SO Regulation. Finally, Chapter 7 provides the timeline for implementation.

2. Legal obligations

The legal requirements for determination of the LFC blocks are set by Article 141(2) 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."

The load-frequency control block or the LFC block is defined by Article 3(18) of the SO Regulation as *"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 load-frequency control area or the LFC area is defined by Article 3(12) of the SO Regulation as *"a part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control"*.

The monitoring area is defined by Article 3(145) of the SO Regulation as "*a part of the synchronous area or the entire synchronous area, physically demarcated by points of measurement at interconnectors to other monitoring areas, operated by one or more TSOs fulfilling the obligations of a monitoring area*".

Article 141(11) allows TSOs of several LFC areas to form the LFC block if certain requirements are fulfilled:

"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."

According to this Article, firstly LFC areas have to be agreed between by all TSOs of the synchronous area and secondly, the requirements set in Article 141(5) have to be fulfilled:

"All TSOs of each LFC block shall:

(a) endeavour to fulfil the FRCE target parameters of the LFC block as defined in Article 128; and

(b) comply with the FRR dimensioning rules in accordance with Article 157 and the RR dimensioning rules in accordance with Article 160. "

Article 6(6) of the SO Regulation also requires that the LFC Proposal describes the expected impact on the objectives set in Article 4 of the SO Regulation as well as a proposed timescale for the implementation:

"*The proposal for terms and conditions or methodologies shall include a proposed timescale for their implementation and a description of their expected impact on the objectives of this Regulation. Proposals on terms and conditions or methodologies subject to the approval by several or all regulatory authorities shall be submitted to the Agency at the same time that they are submitted to regulatory authorities. Upon request by the competent regulatory authorities, the Agency shall issue an opinion within 3 months on the proposals for terms and conditions or methodologies*."

It is also relevant, when determining the LFC structure, to take into account the following additional provisions of the SO Regulation as determined LFC blocks, LFC areas and monitoring areas have effect on those articles and their obligations:

- Operational agreements (synchronous area operational agreement in accordance with Article 118, LFC block agreement in accordance with Article 119, LFC area operational agreement in accordance with Article 120)
- Frequency quality (Articles 127 – Article 138)
- Load-frequency control structure (Article 139 – Article 151)
- Operation of load-frequency control (Article 152)
- Frequency containment reserves (Article 153 – Article 156)
- Frequency restoration reserves (Article 157 – Article 159)
- Replacement reserves (Article 160 – Article 162)

In addition, when determining LFC blocks, the general principles of provision of information set in Article 15 of Regulation (EC) No 714/2009, shall be taken into account.

The LFC Proposal fulfils and takes into account the above mentioned requirements as presented in Chapter 6.

3. Load-frequency control (LFC) of the SO Regulation[1]

3.1 LFC principles

The SO Regulation sets an obligation for responsibility for LFC processes (frequency containment and frequency restoration processes) and the respective process quality to TSOs. At the same time, the SO Regulation recognizes the fact, that due to the physical properties of synchronously operated transmission systems, frequency is a common parameter for the synchronous area. For this reason, all TSOs operating in a synchronous area are obliged to cooperate, and they are dependent on this cooperation to keep the system frequency within acceptable ranges. The cooperation among TSOs requires a clear definition of responsibilities for LFC processes, organisation of reserve availability and assignment of individual quality targets.

The definition of these responsibilities are harmonized across synchronous areas by formulation of requirements for the LFC structure in the SO Regulation. The LFC structure includes control processes within process activation structure set in Article 140 of the SO Regulation and geographical responsibilities as process responsibility structure set in Article 141 of the SO Regulation.

The process activation structure defines (Article 140 of the SO Regulation):

- mandatory control processes which have to be implemented and operated by one or more TSOs in each synchronous area; and
- optional control processes which may be implemented and operated by the TSOs in each synchronous area.

Accordingly, the process responsibility structure defines (Article 141 of the SO Regulation):

- obligations for TSOs to operate and apply control processes for the respective geographical areas (monitoring area, LFC area, LFC block and synchronous area); and
- responsibilities and obligations related to the control processes applied for geographical areas.

LFC principles set responsibilities for each TSO in relations to other TSOs within a synchronous area to apply LFC processes as a member of LFC block, LFC area and monitoring area to maintain system frequency and its quality.

3.2 Responsibility for LFC process

The framework of the load-frequency control processes is in general (see also Figure 1):

- The frequency containment process (FCP) stabilizes the frequency after the disturbance at a steady-state value within the permissible maximum steady-state frequency deviation by a joint action of frequency containment reserves (FCR) within the synchronous area. This

[1] More information can be found at ENTSO-E document: Supporting Document for the Network Code on Load-Frequency Control and Reserves, dated 28.06.2013 (https://electricity.network-codes.eu/network_codes/)

action happens immediately after an incident having affect to balance between generation and demand in the synchronous area, i.e. causing deviation in the system frequency.

- The frequency restoration process (FRP) controls the frequency towards its setpoint value by activation of frequency restoration reserves (FRR) and replaces the activated FCR. The activation of FRP is triggered by the disturbed LFC area either automatically (by aFRR) or manually (by mFFR). FRR dimensioning rules are defined on the LFC block level.
- The reserve replacement process (RRP) replaces the activated FRR and/or supports the FRR activation by activation of replacement reserves (RR). The activation of RRP is triggered by the disturbed LFC area. RR dimensioning rules are defined on LFC block level.

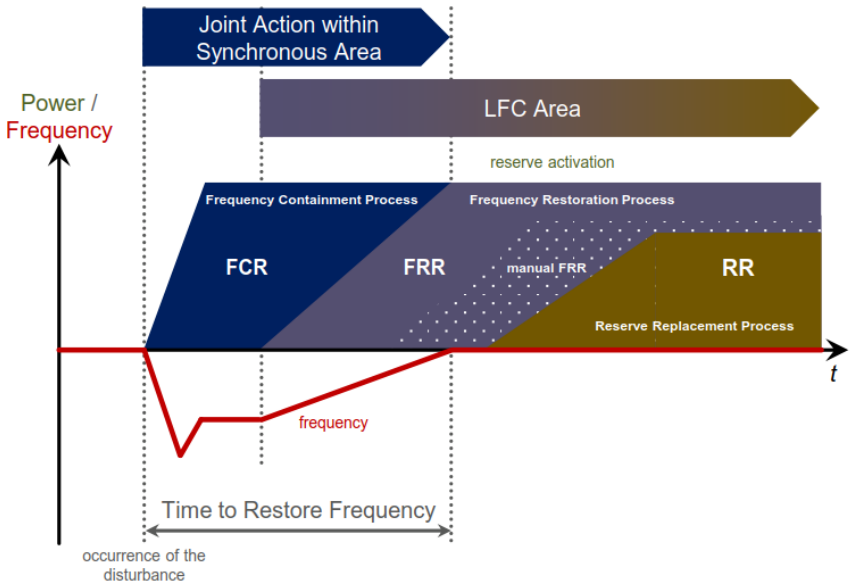

Figure 1. Activation of LFC processes and reserves (under assumption that FCR is fully replaced by FRR) as a function of time after a disturbance related to power deficiency.

The operation of LFC processes are attached to operational areas. The area hierarchy is illustrated in Figure 2. Each synchronous area consists of one or more LFC blocks, each LFC block consists of one or more LFC areas, and each LFC area consists of one or more monitoring areas. This hierarchy means that each network element within a synchronous area will belong only one monitoring area, one LFC area and one LFC block.

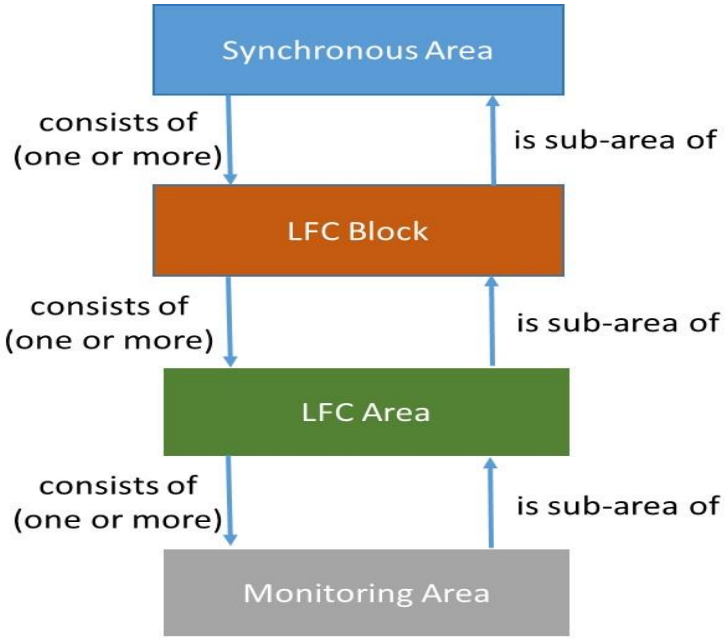

Figure 2. Types and hierarchy of geographical areas operated by TSOs for LFC.

These different area types are necessary to define responsibilities of single TSOs in the common task of system frequency quality and allowing a harmonised approach for all synchronous areas within EU. Table 1 summarises the different area process obligations defined in the SO Regulation.

For instance, a TSO operating an LFC area has the obligations:

- to measure and monitor the actual power exchange;
- to calculate and monitor the Frequency Restoration Control Error; and
- to operate a Frequency Restoration Process

At the same time, all TSOs operating LFC areas within the same LFC block have the obligation to cooperate with other TSOs of the LFC block to fulfil the area process obligations, e.g. to fulfil the Frequency Restoration Quality Target Parameters. Also TSOs in the LFC block have to organise the availability of a sufficient amount of FRR and RR according to dimensioning criteria (where an LFC block consists of more than one LFC area the TSOs shall agree on individual frequency restoration quality target parameters).

The TSO(s) within LFC area are responsible of frequency restoration process and monitoring the frequency restoration control error for the LFC area. If there are several LFC areas within a synchronous area, frequency control is managed by monitoring power flows over the LFC area borders: the actual power flows between LFC areas are compared to scheduled flows (calculated on the basis of exchanges in the day-ahead and intraday markets) to find out frequency control error in each LFC area. The frequency control happens thus by monitoring flows across LFC area borders and applying up- and down-regulation within the LFC area to decrease difference in scheduled and actual flows over LFC area borders. This control is called Area Control Error (ACE) regime. This regime is applied to frequency control, when several LFC areas exist within a synchronous area or within a LFC block.

Table 1. Obligations for LFC related to different areas.

Obligation	Monitoring Area	LFC Area	LFC Block	Synchronous Area
Online calculation and monitoring of actual power exchange	MANDATORY	MANDATORY	MANDATORY	MANDATORY
Calculation and monitoring of the Frequency Restoration Control Error	NA	MANDATORY	MANDATORY	MANDATORY
Frequency Restoration Process	NA	MANDATORY	MANDATORY	MANDATORY
Frequency Restoration Quality Target Parameters	NA	MANDATORY)	MANDATORY	MANDATORY
FRR Dimensioning	NA	NA	MANDATORY	MANDATORY
RR Dimensioning	NA	NA	MANDATORY	MANDATORY
Frequency Containment Process	NA	NA	NA	MANDATORY
FCR Dimensioning	NA	NA	NA	MANDATORY
Frequency Quality Target	NA	NA	NA	MANDATORY

When an area, whether it is a synchronous area, a LFC block, a LFC area or a monitoring area, is operated by more than one TSO, the TSOs involved shall define their cooperation with legally binding agreements. This agreement shall define responsibilities of each TSO with respect to the fulfilment of the LFC process obligations. For example, all TSOs of a synchronous area have to agree on issues related to the FCP, while all TSOs of the same LFC block have to agree on issues related to the FRP.

It has to be noted that some processes not listed in Table 1 are defined as optional from technical perspective of the SO Regulation, but may become mandatory according to provisions of another Network Code, such as Guideline on Electricity Balancing. Some of the not listed processes can also be mandatory for some TSOs if implementing them is a precondition for the fulfilment of the respective area process obligations: for example, if a TSO receives FRR from providers located in a different LFC area a cross-border FRR activation process is necessary and therefore mandatory for the involved TSOs. Following processes are defined as optional in the SO Regulation

- a replacement reserve process
- an imbalance netting process
- a cross-border FRR activation process
- a cross-border RR activation process
- a time control process for synchronous areas other than Continental Europe

The added value of different area types and area process obligations formulated in the SO Regulation can be summarized as follows:

- The different area process obligations provide clear responsibilities for TSOs operating different areas.
- The methodology of defining the area hierarchy and area process obligations is flexible and allows for a European harmonization of terms and procedures regardless of different physical characteristics of each synchronous area. At the same time, the best practices for the different synchronous areas within Europe are respected.
- The methodology allows flexibility with respect to changing requirements while providing strict principles.

Different area hierarchies are currently implemented in different synchronous areas (Figure 3). For example[2]:

- Great Britain (GB) and Ireland/North Ireland (IRE/NE) synchronous areas currently consist of exactly one LFC block and LFC area.
- Central-Europe (CE) currently consists of many LFC blocks as shown in Figure 3. Most of these LFC blocks consist of one LFC area, such as LFC blocks operated by RTE (France), ELIA (Belgium), TenneT NL (the Netherlands), and Terna (Italy) but there are also several examples of LFC blocks that consist of more than one LFC area such as
    - the LFC block of Spain and Portugal with LFC areas operated by REN and REE; and
    - the German LFC block with four LFC areas operated by 50HzT, Amprion, TenneT Germany (including Energinet.dk) and TransnetBW.

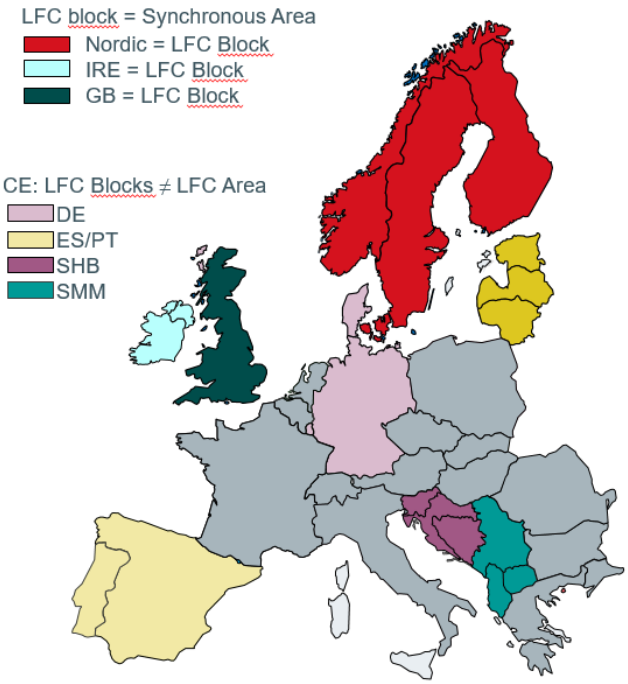

Figure 3. Currently applied European synchronous areas, LFC blocks and LFC areas.

4. Description of the current LFC structure

Nordic synchronous area (comprises Finland, Sweden, Norway and Eastern Denmark) is consisting of eleven monitoring areas, one LFC area and one LFC block as presented in the Figure 4. As the entire synchronous area corresponds to only one LFC area, the control target is frequency, which will be maintained within predefined frequency range. Two of the Nordic TSOs, Svenska kraftnät and

[2] ENTSO-E: Supporting Document for the Network Code on Load-Frequency Control and Reserves, dated 28.06.2013 (https://electricity.network-codes.eu/network_codes/

Statnett, has been given the task for taking actions[3] to balance Nordic power system whilst all Nordic TSOs are responsible to ensure sufficient upward and downward active power reserves to balance its control area. Each TSO is also responsible for operational security within its control area.

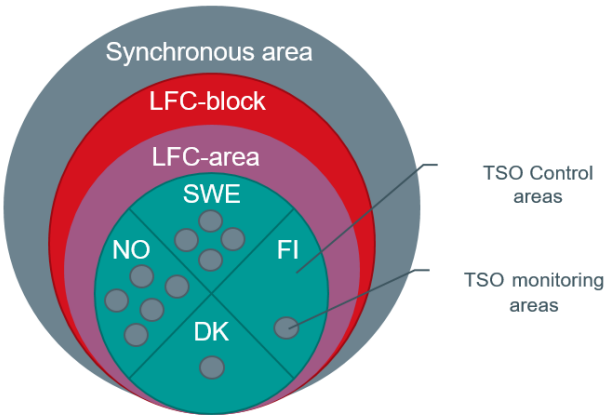

Figure 4. Current LFC structure in Nordic synchronous area

As the Nordic TSOs cooperate by using all available reserves in a region for common balancing arrangements, a prerequisite for the arrangements is that the TSOs are collectively responsible for making sufficient reserves available for regional balancing with minimum volumes agreed between the TSOs in the region. Location of the reserves may be considered from a regional perspective taking congestions in the grid into account. This does not reduce the individual TSO's responsibility but contribute to a more efficient use of the regional resources. To balance the Nordic power system the TSOs are collaborating to minimize the cost of balancing by utilizing the most efficient resources when this is technically and financially appropriate. A study[4] has been made where the common Nordic balancing market for mFRR were compared against national-only balancing markets showing 184 million euro savings for the common balancing market for the year 2011 due to efficient use of resources and imbalance netting.

5. Description of the selected approach

5.1 Options

Several options can be identified for LFC areas and LFC blocks in the Nordic synchronous area. These options can be evaluated against the objectives of the SO Regulation when selecting the best option for LFC structure. Possible options for Nordic synchronous area have been presented in Table 2.

A LFC block can cover whole of the Nordic synchronous area or only part of it i.e. one, two or three countries. The smallest coverage for a LFC block, but not feasible, could be one bidding zone. A LFC

[3] Nordic System Operation Agreement
https://www.entsoe.eu/Documents/Publications/SOC/Nordic/System_Operation_Agreement_English_translation.pdf#search=Nordic%20system%20operation%20agreement

[4] Mott MacDonald & Sweco: Impact Assessment on European Electricity Balancing Market, Final report, March 2013, Contract EC DG ENER/B2/524/2011

area can cover also whole of the Nordic synchronous area when the LFC block covers also the entire Nordic synchronous area. Other alternatives in this case are that a LFC area covers one bidding zone or TSO's control area. If there are several LFC blocks within Nordic synchronous area, a LFC area could cover a bidding zone or, at the most, all bidding zones or TSO's control area(s) of the LFC block. The monitoring area could be aligned with a bidding zone.

Table 2. Options for LFC hierarchy in Nordic synchronous area.

Option	Monitoring area	LFC area	LFC block
Option 1 (current)	bidding zone	synchronous area	synchronous area
Option 2	bidding zone	TSO control area	synchronous area
Option 3	bidding zone	bidding zone	synchronous area
Option 4	bidding zone	TSO control areas in each LFC block	synchronous area split in 2 LFC blocks
Option 5	bidding zone	bidding zone	synchronous area split in 2 LFC blocks
Option 6	bidding zone	TSO control area	TSO control area
Option 7	bidding zone	bidding zone	TSO control area
Option 8	bidding zone	bidding zone	bidding zone

The level of coordination and harmonisation depends on how many LFC blocks there are within a synchronous area and how many LFC areas each LFC block is divided into. The highest level of coordination and harmonisation is achieved with Option 1, where only one LFC block and one LFC area exist covering the entire Nordic synchronous area. This means that all obligations of the SO Regulation as described in Table 1 for LFC area and LFC block are valid across Nordic synchronous area. There will be the same rules within and between Nordic bidding zones for LFC. Frequency control is managed by controlling frequency directly by up- or down-regulation within the LFC area. Option 1 equals to the current approach applied in Nordic synchronous area and delivers the most integrated LFC approach within the Nordic synchronous area.

The LFC structure as prescribed by the SO Regulation affects the geographic scope of the balancing markets because it affects the size of areas for which the reserves quotas are defined. For example, if there are several LFC blocks in the Nordic region, a quota of reserves will be defined for each block, and limitations for the sharing and exchange of reserves will apply. Thus, compared to the current situation, an over-dimensioning of the reserves is a possible outcome. In addition, if individual bidding zones each comprise an LFC area, the goal of balancing is to regulate the physical flows on the bidding zones borders towards the scheduled flows (calculated on the basis of exchanges in the day-head and intraday markets) rather than to balance on the basis of the Nordic frequency deviations. This may lead in to non-optimal use of reserve resources. In contrast, if the LFC block and the LFC area equals the entire Nordic synchronous area, the balancing resources will be dimensioned from Nordic perspective and the balancing bids will be activated in accordance to a common merit order list for the whole region, taking into account congestions in the grid. In addition, if the balancing is based on frequency deviation, the imbalance netting between bidding areas or other sub areas can be carried out without separate real-time optimization. The LFC proposal that takes this approach thus promotes efficient acquisition and operation of reserves.

The level of coordination and harmonisation decreases when the number of LFC blocks and LFC areas increases. For example having one LFC block with several LFC areas in the Nordic synchronous

area implies that the LFC processes can differ for each LFC area and there is a need for additional rules between LFC areas to comply with LFC block requirements.

5.2 The LFC Proposal

Determination of LFC blocks and LFC areas is fundamental for functioning of markets for reserves needed for load-frequency control. When selecting the best option, it is important that

- well-functioning real-time market for LFC ensures cost efficiency and security of supply;
- flexibility resources are fully utilized in real-time market;
- there is available transparent and timely market information;
- the Nordic co-operation benefits the whole region.

The LFC Proposal shall be based on Option 1 (Table 2), where

- monitoring area corresponds to a bidding zone;
- LFC area corresponds to the Nordic synchronous area; and
- LFC block corresponds to the Nordic synchronous area.

It is the configuration currently applied in the Nordic synchronous area. This configuration has been in place since year 2002. The configuration based on several LFC blocks/areas with ACE model was applied before year 2002 in Nordic synchronous area. This ACE model was discarded when common Nordic balancing market was established to ensure efficient use of balancing resources in the Nordic synchronous area.

The LFC Proposal presented herein ensures the highest level of coordination and harmonization in LFC process and meets best the objectives set in the SO Regulation. This option also facilitates the goal of well-functioning real-time markets and issues addressed above. Especially, the LFC Proposal will deliver the following capabilities and benefits:

- The common dimensioning of frequency restoration reserves (FRR) enables sharing and exchange of reserves to the widest possible extent. This is an outcome of belonging to same LFC block.
- In the proposed LFC block determination, where all the balancing actions are coordinated throughout synchronous area, TSOs are able to minimize the amount of counter activation of frequency restoration reserves (FRR) and aim to activate the most efficient reserve resources to balance the system.
- A common balancing market ensures transparency among all the balance service providers (BSPs) in a synchronous area and ensures market-based mechanisms in the widest possible extent. This is the outcome when the Nordic TSOs belong to the same LFC block.
- Each TSO in the Nordic synchronous area has responsibility to monitor operational security on its own control area. This complies with the determination of monitoring area to cover a bidding zone
- Each TSO shall operate its control area with sufficient upward and downward active power reserves, which may include shared or exchanged reserves, to face imbalances between demand and supply within its control area as stated in Article 152(1) of the SO Regulation.

As the Nordic synchronous area, LFC block and LFC area as well are operated by more than one TSO, the TSOs involved shall specify the allocation of responsibilities on frequency containment and frequency restoration processes in accordance with Article 141(8), 141(9) and 141(10) of the SO Regulation. In addition, when a LFC area consists of more than one monitoring area, all TSOs of the

LFC block shall appoint one TSO responsible for the implementation and operation of the frequency restoration process as required in Article 143(4) of the SO Regulation.

Stakeholders shall be involved in the LFC development to ensure a level playing field for all parties involved. Thus, it is important to collect the views from stakeholders on best option(s) and how to develop the LFC Proposal further taking fully into account the consequences of the selected option to load-frequency control and markets to facilitate this. When doing this, a clear distinction shall be made between balancing and congestions management where balancing refers to actions and processes that are needed to maintain power system frequency whereas congestion occurs when a physical network element is unable to accommodate all physical flows resulting from electricity trade. As a general principle congestions shall be handled by capacity allocation procedures in accordance with CACM Regulation 2015/1222.

5.3 Future development for LFC block(s)/area(s)

The Nordic TSOs have recently expressed their concerns regarding the changing that are taking place in the Nordic power system[5]. Challenges will arise, for example, when the share of intermittent renewable electricity increases and the amount of conventional generation decreases. This will increase the need for new flexible resources for power system balancing to maintain sufficient frequency quality. Markets are efficient means to incentivise new solutions. Also the Nordic TSOs have highlighted that well-functioning markets are a key to cost-efficient transition to low-carbon power system[6]. To accommodate a stronger role of the markets in the balancing timeframe, the LFC structure needs to be sufficiently flexible.

In the long-run, to give correct locational and behavioral signals for investments, the balancing and imbalance prices should reflect the costs of balancing in a transparent way. This means, for instance, using a common merit order and applying the marginal pricing principle in the balancing price formation. In this way, the price formation in the integrated balancing markets would follow the same logic that is applied in the market coupling in the day-ahead markets. Moreover, the balancing and imbalance prices across bidding zones should converge if there is no congestion between them. Deviating from this principle would lead to different treatment of customers depending on their residence, which would violate the aims of the European Union. The LFC Proposal that stipulates keeping the Nordic LFC structure as integrated as possible ensures efficiency and price convergence in the Nordic balancing markets.

In order to take into account the foreseen changes taking place in the Nordic power system, this LFC Proposal includes the following obligation for further development of the LFC structure:

By 12 months after the approval of this LFC Proposal by competent NRAs, all TSOs in Nordic synchronous area shall jointly develop a report, subject to stakeholder involvement and consultation in accordance with Article 11 of the SO Regulation, assessing the future development of LFC structure. This report shall include the needed changes to the LFC structure with justification also taking into account the European platforms to be established for balancing purposes and a roadmap for implementation of such changes in the Nordic synchronous area.

[5] cf. the Nordic TSOs' report "Challenges and opportunities for the Nordic power system", August 2016.
[6] cf. the Nordic TSO's report "Generation Adequacy – market measures to secure it and methodology for assessment", August 2017.

6. Description of the expected impact of the LFC Proposal on the relevant objectives of the SO Regulation

The LFC Proposal contributes to the achievement of the objectives of Article 4 of the SO Regulation. The main purpose of LFC Proposal is to determine the configuration for LFC blocks and LFC areas aiming at common load-frequency control processes and control structure on a synchronous area level. These common control processes and structures are best achieved by having one LFC block and one LFC area within Nordic synchronous area.

In regard of the aim of the SO Regulation to ensure the conditions for maintaining a frequency quality level of all synchronous areas throughout the Union, this proposal has through the determination of LFC blocks, LFC areas and monitoring areas requested relevant TSOs to specify the allocation of responsibilities on frequency containment and frequency restoration processes. The relevant TSOs shall appoint one TSO responsible for the implementation and operation of the frequency restoration process. Besides, these TSOs define for configuration set in LFC Proposal the frequency quality defining parameters and the frequency quality target parameters for monitoring the frequency quality level of Nordic synchronous area.

The LFC Proposal ensures and enhances the transparency and reliability of information on transmission system operation by specifying each bidding zone as monitoring area. This configuration ensures that TSOs will continuously calculate and monitor the real-time active power exchange between the bidding areas. The LFC Proposal ensures transparency for all BSPs in the Nordic synchronous area by establishing a common balancing market and ensuring also application of market-based mechanisms in the widest possible extent.

The LFC Proposal contributes to the efficient operation and development of the electricity transmission system and electricity sector in the Union. The proposal allows the sharing and the exchange of FRR reserves to the widest possible extent. The involved TSOs are also able to minimize the amount of FRR counter activation and can activate the most efficient resources to balance the Nordic synchronous area.

The LFC Proposal facilitates the application of the principle of optimisation between the highest overall efficiency and lowest total cost for all parties involved by allowing sharing and exchange of FRR reserves to the widest possible extent, minimising the counter activation of FRR reserves and the activation the most efficient resources to balance the system.

The LFC Proposal ensures that the TSOs make use of the market-based mechanisms as far as possible to ensure network security and stability through a common balancing market ensuring application of market based mechanisms in the widest possible extent.

Finally, the LFC Proposal respects the responsibility assigned to the relevant TSO in order to ensure system security, including as required by national legislation. This implies that each TSO in Nordic synchronous area has responsibility to monitor operational security on its own control area. This is a result of determination of monitoring area to cover a bidding zone. Furthermore, each TSO shall operate its control area with the sufficient upward and downward active power reserves, which may include shared or exchanged reserves, to face imbalances between demand and supply within its control area and agreed within the LFC area.

7. Timescale for the implementation

The LFC Proposal is based on the current LFC block/area configuration in the Nordic synchronous area, so there is no need to delay the implementation of the LFC Proposal after the approval of the relevant NRAs. However, the LFC configuration shall take effect with the establishment of the Nordic synchronous area operational agreement, LFC block operational agreement and LFC area operational agreement.

The TSOs shall implement the LFC Proposal in Nordic synchronous area immediately when the Nordic synchronous area operational agreement concluded in accordance with Article 118 of the SO Regulation, LFC block operational agreement in accordance with Article 119 of the SO Regulation and LFC area operational agreement in accordance with Article 120 of the SO Regulation has entered into force.