Explanatory document for the Nordic synchronous area Proposal for the dimensioning rules for FCR in accordance with Article 153 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 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 determine a methodology for dimensioning Frequency Containment Reserves (FCR) for the Nordic synchronous area. Pursuant to Article 118(1)(a) of the SO Regulation, all Transmission System Operators in the Nordic Synchronous Area shall jointly develop common proposals for dimensioning rules for FCR in accordance with Article 153 of the SO Regulation.

According to Article 6(3)(d)(ii) of the SO Regulation the proposal for the dimensioning rules for FCR in accordance with Article 153 (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 synchronous area. 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 FCR. Chapter 4 provides an overview of the existing situation. The proposed dimensioning rules for FCR are described in Chapter 5. Chapter 6 describes the expected impact on the relevant objectives of the SO Regulation. Finally, Chapter 7 provides the timeline for implementation and Chapter 8 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 118(1)(c) and (2) of the SO Regulation constitutes the legal basis that the Proposal should take into account. Article 118 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:[…]*
>
> *(a) the dimensioning rules for FCR in accordance with Article 153; […]*
>
> *2. 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."*

(2) Article 153 of the SO Regulation has the following content:

> *"Article 153 FCR dimensioning*
>
> *1. All TSOs of each synchronous area shall determine, at least annually, the reserve capacity for FCR required for thesynchronous area and the initial FCR obligation of each TSO in accordance with paragraph 2.*

2. All TSOs of each synchronous area shall specify dimensioning rules in the synchronous area operational agreement in accordance with the following criteria:

(a) the reserve capacity for FCR required for the synchronous area shall cover at least the reference incident and, for the CE and Nordic synchronous areas, the results of the probabilistic dimensioning approach for FCR carried out pursuant to point (c);

(b) the size of the reference incident shall be determined in accordance with the following conditions:

(i) for the CE synchronous area, the reference incident shall be 3 000 MW in positive direction and 3 000 MW in negative direction;

(ii) for the GB, IE/NI, and Nordic synchronous areas, the reference incident shall be the largest imbalance that may result from an instantaneous change of active power such as that of a single power generating module, single demand facility, or single HVDC interconnector or from a tripping of an AC line, or it shall be the maximum instantaneous loss of active power consumption due to the tripping of one or two connection points. The reference incident shall be determined separately for positive and negative direction;

(c) for the CE and Nordic synchronous areas, all TSOs of the synchronous area shall have the right to define a probabilistic dimensioning approach for FCR taking into account the pattern of load, generation and inertia, including synthetic inertia as well as the available means to deploy minimum inertia in real-time in accordance with the methodology referred to in Article 39, with the aim of reducing the probability of insufficient FCR to below or equal to once in 20 years; and

(d) the shares of the reserve capacity on FCR required for each TSO as initial FCR obligation shall be based on the sum of the net generation and consumption of its control area divided by the sum of net generation and consumption of the synchronous area over a period of 1 year."

(3) Article 3(2)(58) of the SO Regulation defines the 'reference incident' as the *'maximum positive or negative power deviation occurring instantaneously between generation and demand in a synchronous area, considered in the FCR dimensioning'*.

(4) Article 39(3)(b) of the SO Regulation explains *"The methodology referred to in Article 39 "* (as referred to in Article 153(c)):

"Article 39 Dynamic stability management

[..]

3. In relation to the requirements on minimum inertia which are relevant for frequency stability at the synchronous area level:

(a) all TSOs of that synchronous area shall conduct, not later than 2 years after entry into force of this Regulation, a common study per synchronous area to identify whether the minimum required inertia needs to be established, taking into account the costs and benefits as well as potential alternatives. All TSOs shall notify their studies to their regulatory authorities. All TSOs shall conduct a periodic review and shall update those studies every 2 years;

(b) where the studies referred to in point (a) demonstrate the need to define minimum required inertia, all TSOs from the concerned synchronous area shall jointly develop a methodology for the definition of minimum inertia required to maintain operational security and to prevent violation of stability limits. That methodology shall respect the principles of efficiency and proportionality, be developed within 6 months after the completion of the studies referred to in

point (a) and shall be updated within 6 months after the studies are updated and become available;and

(c) each TSO shall deploy in real-time operation the minimum inertia in its own control area, according to the methodology defined and the results obtained in accordance with paragraph (b).

(5) Article 6(3)(d)(ii) 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: […]
(d) methodologies, conditions and values included in the synchronous area operational agreements in Article 118 concerning:
(ii) the dimensioning rules for FCR in accordance with Article 153;

2.2 Interpretation and scope of the Proposal

Article 153(2) of the SO Regulation includes two topics. Firstly, Article 153(2)(a)-(c) stipulates the dimensioning rules for FCR. Secondly, Article 153(2)(d) prescribes how the initial FCR obligation per TSO shall be calculated.

Where Article 153(2) only describes one type of FCR, the Nordic Frequency Containment Process (FCP) applies two types of FCR: FCR for normal operation (FCR-N) is used for continuous imbalances to keep the frequency within the ±100mHz range. For this reason, the purpose of FCR-N is not to mitigate the consequences of a disturbance such as a reference incident. The purpose of Frequency Containment Reserves for Disturbance situations (FCR-D) is to mitigate the impact of incidental disturbances, including the reference incident. Article 153(2)(b)(ii) of the SO Regulation refers to the *"reference incident"* which *"shall be the largest imbalance that may result from an instantaneous change of active power such as that of a single power generating module, single demand facility, or single HVDC interconnector [..]."*. This list clearly refers to incidents and therefore Article 153(2)(a)-(c) can only be applied to FCR-D. The scope of this Proposal with respect to Article 153(2)(a)-(c) shall therefore be limited to the dimensioning rules for FCR-D.

Article 153(2)(d) of the SO Regulation is about the initial FCR obligation per TSO. Also in this article there is no explicit differentiation between FCR-N and FCR-D. However, in the rules in Article 153(2)(d) can be applied to both FCR-N and FCR-D. For this reason, the TSOs consider Article 153(2)(d) of the SO Regulation applicable to both FCR-N and FCR-D.

3. Objective of FCR dimensioning

The Frequency Containment Process' (FCP) objective is to stop the frequency increase or decrease before the instantaneous frequency deviation reached the maximum instantaneous frequency deviation and consequently to stabilise the frequency deviation at a steady-state value not more than the permissible Maximum Steady-State Frequency Deviation[1]. The objective shall be met by a joint action of FCR within the whole synchronous area.

The objective of FCR-D dimensioning is to specify - for the situation that a reference incident takes place - the amount of FCR-D that is required to:

[1] A more detailed explanation of what happens in case of an incident is included in textbox 1 of the 'Explanatory document for the Nordic synchronous area proposal for frequency quality defining parameters and the frequency quality target parameter in accordance with Article 127 of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation.'

- limit the instantaneous frequency deviation to less than the maximum instantaneous frequency deviation (1000 mHz in accordance with Aricle 127 of the SO Regulation) and accordingly prevent for load shedding or generation shedding;
- limit the steady-state frequency deviation to less than the maximum steady-state frequency deviation (500 mHz in accordance with Aricle 127 of the SO Regulation).

4. The existing situation

In this chapter, the current procedure for the dimensioning of FCR is presented, together with the procedures for how the 'reference incidents' are being defined. Since the Nordic TSOs define two types of FCR, section 4.1 addresses FCR-N and section 4.2 addressed FCR-D.

4.1 Frequency Containment Reserves for Normal operation (FCR-N)

At the moment the volume for FCR-N is at least 600 MW for the synchronous system[2]. The distribution between subsystems is revised each year before 1st March on the basis of annual consumption in the previous year (annual consumption is given in TWh at an accuracy of one decimal). The share of each subsystem is rounded to closest integer given in MW and this will enter into force on 1st April.

4.2 Frequency Containment Reserves for Disturbance situations (FCR-D)

At the moment the required FCR-D capacity is equal to the largest possible imbalance caused by the loss of individual major components (production units, lines, transformers, bus bars etc.) from all fault events that have been taken into account, deducted by 200 MW due to the estimated load frequency dependency (see Textbox 1). It should also be noticed that, at the moment, FCR-D is required only for low frequencies (49.5…49.9 Hz), which are caused by a loss of generation or import via an HVDC interconnector to another synchronous area.

The current dimensioning rules do not explicitly consider the additional network losses that may result from changing flows after a disturbance. E.g. if a nuclear plant in Sweden trips, the flows from both northern Sweden and Norway may increase which may increase the network losses which would result in a larger imbalance on a synchronous area level.

The current method for distribution of the requirements for FCR-D between the subsystems in Nordic power system is carried out in proportion to the largest possible imbalance caused by the loss of individual major components within the respective subsystem. Distribution of the requirement is updated once per week or more often if needed. Control centers of each Nordic TSO are responsible of defining the largest possible imbalance caused by the loss of individual major components on Thursday or Friday on previous week, separately for each hour. The TSO's Nordic Operational Information System NOIS automatically calculates the amount of needed FCR-D for each TSO.

Textbox 1: Frequency dependency of load

Frequency dependency of load

Load in the synchronous area automatically and immediately reacts on an instantaneous change of the system frequency. This is called the 'frequency dependency of load' and means in practice that an imbalance is partly mitigated by the response of load.

Unfortunately, there is little actual knowledge about the impact of frequency dependency of load in the Nordic synchronous area. The latest TSO study is from 1995 and gives a figure for the frequency dependency of load 0.7 % / 0.5Hz for a low load situation. Currently, a large Nordic investigation on load

[2] The value of ± 600MW is based on historic assumptions of a load random variation of ± 1% of 60GW.

modelling is being performed. The project started in 2015 and is expected to provide results by Q3 of 2019.

5. Proposal for dimensinoning rules for FCR-D

Article 153(2)(a) of the SO Regulation states that *"the reserve capacity for FCR required for the synchronous area shall cover at least the reference incident and [..] the results of the probabilistic dimensioning approach for FCR carried out pursuant to point (c);"*. Section 5.1 explains how the required FCR-D will be dimensioned in order to cover the reference incident. Section 5.2 defines the reference incident. The TSOs will not apply *"a probabilistic dimensioning approach for FCR"*, which is explained in section 5.3.

5.1 FCR-D dimensioning based on reference incident (Article 153(2)(a))

In accordance with Article 153(2)(b)(ii) of the SO Regulation, "*the reference incident shall be determined separately for positive direction negative direction"*. The Nordic TSOs define the positive direction as a power surplus in the synchronous area, caused by e.g. tripping of a load or an exporting HVDC interconnector. The negative direction is defined by a power shortage and can be caused by e.g. tripping of a production unit or an importing HVDC interconnector. In accordance with Article 153(2)(a) of the SO Regulation, FCR-D shall cover at least the reference incident. This is interpreted as that downward FCR-D shall cover at least the reference incident in positive direction and that upward FCR-D shall cover at least the reference incident in negative direction. This is reflected by article 3(3) and 3(4) of the Proposal.

5.2 Definition of the reference incident (Article 153(2)(b)(ii))

This section 5.2 further elaborates on the definition of the reference incident as proposed in Article 3 of the Proposal in accordance with Article 153(2)(b)(ii) of the SO Regulation. In section 5.2.1, general guidance and reflections are given on the reference incident, in section 5.2.2-5.2.6 some detailed aspects for determining the size of 'reference incident' is presented, and in section 5.2.7 the daily process is presented.

5.2.1 'Reference incidents' considered for dimensioning of FCR-D

Article 153(2)(b)(ii) of the SO Regulation mentions that *the reference incident shall be the largest imbalance that may result from an instantaneous change of active power such as that of a single power generating module, single demand facility, or single HVDC interconnector or from a tripping of an AC line, or it shall be the maximum instantaneous loss of active power consumption due to the tripping of one or two connection points. The reference incident shall be determined separately for positive and negative direction;"*. The words "*such as"* in this article provide the TSOs with the task to define a more concrete list that shall be applicable to the Nordic system.

From the elements listed up in Article 153(2)(b)(ii), the following ones are considered in the FCR-D dimensioning process:

- *Single power generating module*[3] - e.g. tripping of Oskarshamn 3, Sweden.
- *Single demand facility* - e.g. tripping of one aluminum smelter hall in Norway.
- *Single HVDC interconnector*- e.g. tripping of Baltic Cable in import/export situation, Sweden.
- *Tripping of an AC-line*- e.g. tripping of line(s) Hasle-Halden resulting in system protection scheme (SPS) activation in Norway, and by this tripping of production units within the system protection scheme. Could also be tripping of one line resulting in loss of a regional part of the system.

[3] Power generating module: Either a Synchronous Power Generating Module or a Power Park Module. Synchronous Power Generating module: An indivisible set of installations which can generate electrical energy such that the frequency of the generated voltage, the generator speed and the frequency of network voltage are in a constant ratio and thus in synchronism.

The *"the maximum instantaneous loss of active power consumption due to the tripping of one or two connection points"* is considered to be much less relevant for the Nordic system. The TSOs concluded that it, at the time being, is not relevant to set a 'reference incident' based on tripping of *two* connection points. The reason for this is that the TSOs do not consider the probability for two simultaneous outages of demand facilities significant. Tripping of one connection point has already been covered by a *single power generating module* and a *single demand facility* which are listed above.

In addition to the list in Article 153(2)(b)(ii), the TSOs consider that tripping of *one busbar* shall be evaluated as a reasonable N-1 disturbance. This may be relevant during especially longer outages for maintenance on a busbar. See example in **Error! Reference source not found.**. Per today, this scenario is considered in the normal outage planning within each of the Nordic TSOs to ensure that any planned outage does not result in too large installed production capacity connected to a single busbar. As such, - in practice - tripping of single bus bars will not likely have an impact on the dimensioning of FCR-D in the system.

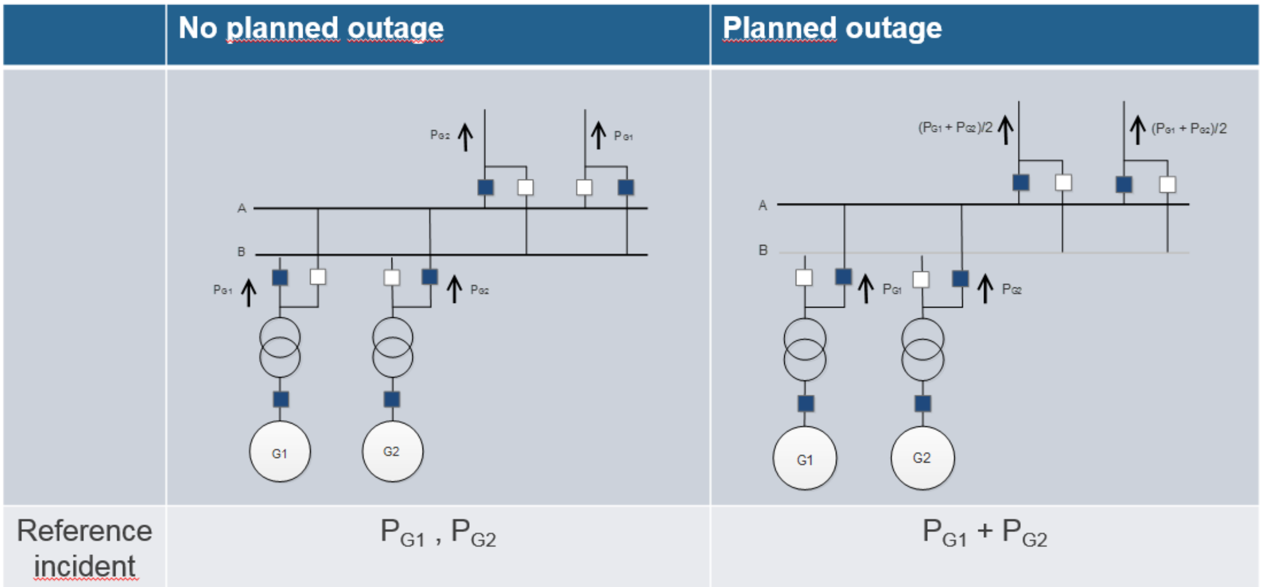


Figure 1: Left figure: 'incident considered' is the trip of busbar B, assuming $P_{G1} > P_{G2}$. Right: The 'incident considered' becomes the sum of P_{G1} and P_{G2}

5.2.2 House load/auxiliary systems to be considered

When assessing the instantaneous loss of active power generation for power generating modules, the real value for expected loss shall be taken into account. This means that for example, for thermal units with significant house load consumption (due to auxiliary systems), the total loss of active power as seen from the grid shall be used as basis for the definition of reference incident. This in turn means that the gross power generation of a unit should be taken into account. The reason for this can be seen in Figure 2. In this example the unit generator breaker is tripped instead of the breaker connecting to the main grid busbar.

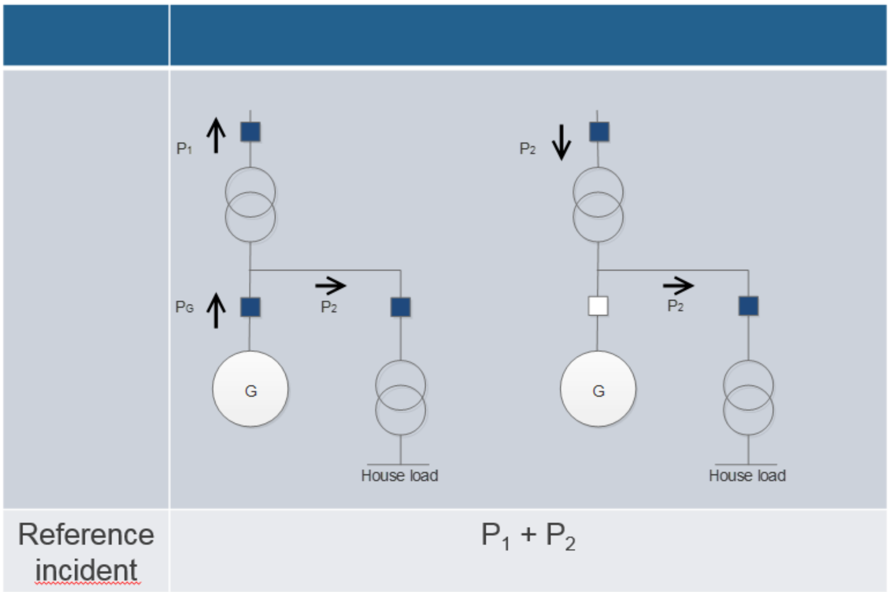


Figure 2: The 'incident considered' is the actual change of power after the trip of a generator unit. The house load shall be taken into account. 'Reference incident' equals the sum of $P_1 + P_2$ (= P_G)

5.2.3 Frequency dependency of load

Article 153(2) states that the FCR dimensioning rules (interpreted as applicable to FCR-D for the Nordic situation) shall be specified in accordance with a number of criteria. The first 'criterion' is that "the reserve capacity for FCR required for the synchronous area shall cover at least the reference incident [..]". Article 153(2)(ii) defines that "the reference incident shall be the largest imbalance that may result from an instantaneous change of active power such as that of a single power generating module [..]" . The definition of the 'reference incident' in SO GL art. 3(2)[4] implicitly suggests that the imbalance caused by the reference incident shall be seen on the synchronous area level and therefore implicitly take the frequency dependency of load into account. This approach is consistent with the existing approach (see section 4.2). However, as argued in Textbox 1, there is no actual knowledge on the size and variation of the frequency dependency of load since the latest TSOs study in 1995. For this reason, the TSOs will not take into account any frequency dependency of load in the dimensioning for FCR-D, at least until they have gained more knowledge on this. If sufficient evidence about the size and variation of the frequency dependency of load is provided, the TSOs may decide to correct the reference incident for the frequency dependency of load in the Nordic system at a later stage. A potential implementation of this correction, will require an amendment of the proposed methodology for FCR-D dimensioning.

5.2.4 Change of losses due to flow changes after disturbances

The imbalance that is caused by large incident may also be influenced by the change in network losses due to changed flows (see section 4.2). This effect is however very much dependent on the specific situation, including the location of the incident, the location of the FCR-D providing units and the flows just before the incident. The effect can result in both increased or decreased network losses and can therefore both increase

[4] "reference incident: the maximum positive or negative power deviation occurring instantaneously between generation and demand in a synchronous area, considered in the FCR dimensioning"

or decrease the resulting imbalance on a synchronous area level. The TSO will not include this effect either in the dimensioning of FCR-D.

5.2.5 Not considered for FCR-D dimensioning: Single disturbances with very low probability

Single failures with very low probability can occur in power system. This is the case for incidents leading to e.g. transmission tower collapse and certain less likely short circuits resulting in multiple bus bar tripping. These failures can in some cases lead to larger instantaneous imbalances than the incidents referred to in section 5.2.1.

However, taking these failures with very low probability into account would result in inefficient FCR-D dimensioning since the probability that the total amount of FCR-D would be activated is very small. Consequently, failures such as transmission tower collapse, trip of multiple bus bars etc. shall not set the 'reference incidents'.

5.2.6 Variation of active power output of a power generating module, HVDC facility

The size of the 'reference incident' depends on the actual operating point of a unit, which can differ from the nominal size of the unit. For example, a nuclear unit might

- run on "coast down" which mean reduced output in the end of its operational cycle;
- run with one generator synchronised to the main grid, in case outage on the other one (only applicable for two-turbine units like Ringhals nuclear power station).

The actual size depending on the actual operating point shall be the basis for FCR-D dimensioning in the Nordic system for each operational hour. The process for the continuous definition of 'reference incident' is defined in section 5.2.7.

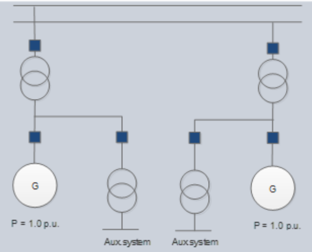
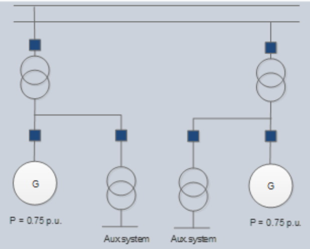
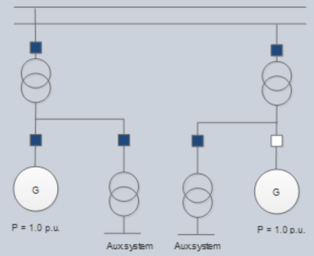
	1. Nominal operating point	2. Actual operating point	3. One SG out of service
			
Reference incident	2x1.0 p.u + house load	2x0.75 p.u + house load	1x1.0 p.u + house load

Figure 3: Size of 'reference incident' taking into account the actual operating point of a unit.

5.2.7 *Daily process for defining 'reference incident'*

The daily process to define the reference incident can utilize the already existing procedures. I.e. the continuous definition can be kept as a responsibility to control centers of each Nordic TSO. IT tool NOIS includes already now the possibility to define reference incident separately for each hour. However, NOIS does not, at the moment, include the possibility to define reference incident for both directions (up/down). This feature should be added to NOIS.

5.3 Probabilistic dimensioning approach for Frequency Containment Reserves (FCR) (Article 153.2(c))

Article 153.2(c) of the SO Regulation state that the *"TSOs of the synchronous area shall have the right to define a probabilistic dimensioning approach for FCR […]"*

The TSOs conducted a joint project and have discussed a probabilistic methodology that can be used for a probabilistic dimensioning approach for FCR-D as mentioned in Article 153(2) of the SO Regulation. The methodology estimates the risk for insufficient FCR based on inputs including frequency distribution during normal situation, probability and size of faults, inertia in the system and amount of FCR-D. The results of the methodology provide an indication if in the considered situation the *"probability of insufficient FCR of at most once in 20 years."*.

The TSOs however, together decided not using this methodology at the moment because the process for how to translate a certain risk level, inertia level, the actual probability for incidents and other inputs to a suitable measures, including FCR-D dimensioning needs to be further defined. For this reason, the TSOs do not use *"the right to define a probabilistic dimensioning approach for FCR"* in accordance with Article 153(2)(c) of the SO Regulation.

5.4 Calculation of the initial obligation per TSO (Article 153(2)(d))

In Article 153(2)(d) states that *"the shares of the reserve capacity on FCR required for each TSO as initial FCR obligation shall be based on the sum of the net generation and consumption of its control area divided by the sum of net generation and consumption of the synchronous area over a period of 1 year*."

The share of FCR for TSO A is then

$$FCRshare_{TSO\ A} = \frac{Generation_{TSO\ A} + Consumption_{TSO\ A}}{\sum_{i=1}^{4}(Generation_{TSOi} + Consumption_{TSOi})} \quad \text{(eq.1)}$$

The sharing key according to Article 153(2)(d) of the SO Regulation has been calculated for years 2013…2016 to get an understanding of its impact. The results are shown in Table 1. In this table, a comparison against 2016 values for FCR-D and FCR-N obligation is also included.

Table 1 The sharing key calculated with production and consumption data for 2013-2016. The column "SOA" reflects to the current obligation per country.

Country/%	Calculation according to SO GL					SOA FCR-D		SOA FCR-N	
	2013	2014	2015	2016	Avg.2013-2016	%	% change	%	% change
NO	36	37	37	38	37	29	26 %	35	6 %
SE	40	39	40	39	40	34	15 %	38	3 %
FI	21	20	20	20	20	22	-6 %	23	-12 %
DK2	3	3	3	3	3	15	-79 %	4	-18 %
sum	*100*	*100*	*100*	*100*	*100*	*100*		*100*	

As seen from the table the new sharing key seems quite constant between different years. In order to see if the sharing key would change between hours, hourly sharing keys were calculated with data for 2016. The results can be seen in Figure 5.

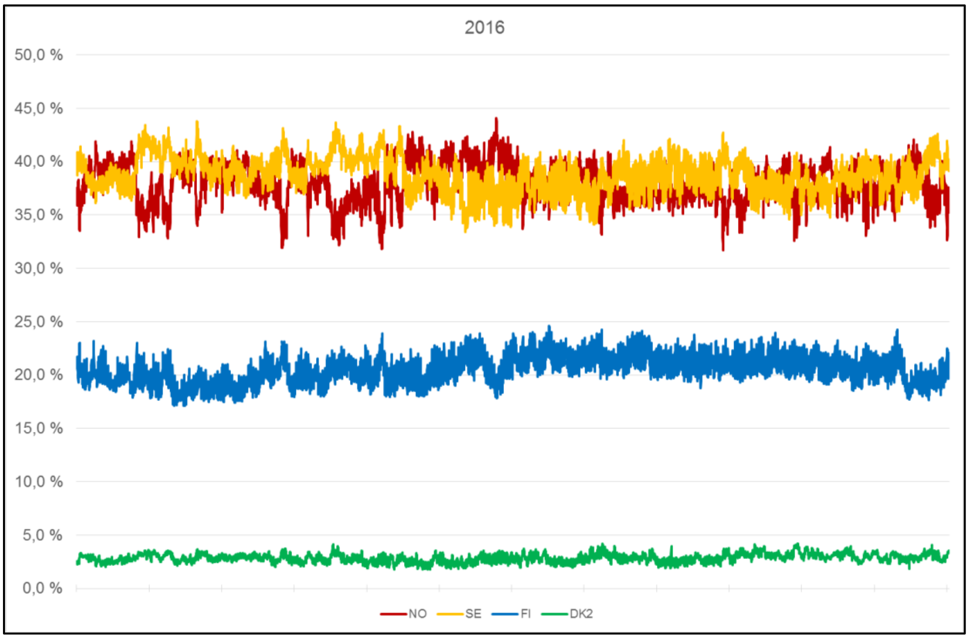


Figure 1 Calculation of sharing keys, based on hourly values, 2016.

The new sharing key seems to be stable also between hours during the year so the yearly value can be used for defining the share for each Nordic TSO.

The shares shall be revised each year before 1 October of year *y-1* on the basis of net consumption and net generation in year *y-2* and the new shares will enter into force on 1 January of year *y*.

5.5 Summary

The arguments in section 5.2 result in the rules for FCR-D dimensioning as included in Article 3 of the Proposal:

1. Following the dimensioning rules in this article, the Nordic TSOs will dimension FCR-D daily, separately for upward FCR-D and downward FCR-D.

2. The input to the dimensioning process of FCR-D shall be:
   a. Planned network topology, considering maintenance of relevant network components;
   b. Estimated (gross) generation of large generation modules;
   c. Estimated demand of large connected consumers;
   d. Estimated flows on HVDC interconnectors;
   e. .

3. The total reserve capacity for upward FCR-D required for the Nordic synchronous area shall be dimensioned at least equally to the imbalance caused by the reference incident in negative direction.

4. The total reserve capacity for downward FCR-D required for the Nordic synchronous area shall be dimensioned at least equally to the imbalance caused by the reference incident in positive direction.

5. The reference incident shall be defined as the largest imbalance that may result from an instantaneous change of active power of:
   a. *A single power generating module:*
   b. *A single demand facility;*
   c. *A single HVDC interconnector;*
   d. *Tripping of an AC-line:* This may result in i) system protection scheme (SPS) activation which may trip one or more power generating units or ii) loss of a regional part of the system.
   e. Single failure on a busbar tripping more than one generation module or demand facility.

6. The imbalance volume of the ‘instantaneous change of active power’ mentioned in item 5 of this article shall be determined by the net loss of active power as seen from the grid. I.e. it should be taken into account that auxiliaries load of the generation module may still consume power in the case that the unit generator breaker is tripped. Furthermore, the imbalance volume of the reference incident is determined by the maximum production, import, consumption or export that has been scheduled for the period for which the reference incident is determined.

The arguments in section 5.4 result in the rules for calculating the initial FCR-D Calculation the initial distribution as included in Article 4 of the Proposal:

1. In accordance with article 152(2)(d) of the SO Regulation, FCR-D and FCR-N shall be distributed to the TSOs pro-rata to the shares defined below.
2. The input to the calculation of the initial distribution are:

   a. net generation per control area for calendar year *y-2* in which net generation of a unit is defined as the generation level less than the total gross power generation of a unit, due to internal auxiliary power consumption of the unit;

   b. net consumption per control area for calendar year *y-2* in which ‘net’ means that the consumption of power plants’ auxiliaries is excluded, but network losses are included.

3. The shares of the reserve capacity on FCR required for each TSO as initial FCR obligation shall be based on the sum of the net generation and consumption of its control area divided by the sum of net generation and consumption of the synchronous area over a period of one year.
4. The shares shall be revised each year before 1 October of year *y-1* and the new shares will enter into force on 1 January of year *y*.

6. 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
- Article 4(1)(h) contributing to the efficient operation and development of the electricity transmission system and electricity sector in the Union.

The Proposal contributes to these objectives by specifying the dimensioning rules for FCR-D, which is one of the key reserves that is used in the common Nordic load-frequency control processes. Sufficient FCR-D guarantees the right frequency quality level and consequently maintains 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. The dimensioning rules balance the impact of both cost for FCR-D and outage risk and therefore ensure efficient operation of the electricity transmission system.

7. Timescale for the implementation

For upward FCR-D, the Proposal (article 3(4)) is similar to the methodology that is currently applied in the Nordic synchronous area. Consequently, procedures, the IT systems, procurement mechanisms and cost-recovery mechanisms are in place for upward FCR-D. Therefore, the TSOs shall implement the dimensioning rules for upward FCR-D not later than when Nordic synchronous area operational agreement enters into force in accordance with Article 118 of the SO Regulation.

Also the rules for the initial distribution of FCR (article 4 of the Proposal) could be implemented by adapting existing processes. Therefore, the TSOs shall also implement rules for the initial distribution for FCR not later than when Nordic synchronous area operational agreement enters into force in accordance with Article 118 of the SO Regulation.

However, since downward FCR-D are currently not procured, the implementation of downward FCR-D requires an implementation project that includes tasks like product specification, prequalification, (IT) implementation at TSO and FCR-D provider, procurement mechanisms etc. This project needs to be scheduled in line with the TSOs' priorities. Therefore, the TSOs shall agree on the implementation date for downward FCR-D in the Nordic synchronous area, taking into account the priorities for the Nordic synchronous areas. The implementation of the dimensioning rules for downward FCR-D (article 3(4) of the Proposal) will therefore be postponed.

8. 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 June to 1 July 2018.