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All CE TSOs' agreement on frequency restoration control error target parameters in accordance with Article 128 of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

08.08.2018

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronuous area CE (hereafter referred to as "TSOs") regarding the calculation of FRCE target parameters (hereafter referred to as "FRCE target parameters") in accordance with Article 128 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The CE TSOs Agreement on FRCE target parameters takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It requires for this purpose FRCE quality target parameters for each LFC block of the synchronous area CE, which need to be kept during operation.

(3) Where a LFC block consists of more than one LFC area, all TSOs of the LFC block shall specify in the LFC block operational agreement the values of the FRCE target parameters for each LFC area.

(4) The goal of the CE TSOs Agreement on FRCE target parameters is to define the FRCE target parameters for the LFC blocks of synchronous area CE.

(5) Article 118 of the SO GL requires all TSOs of synchronous area CE to specify the FRCE target parameters within the Synchronous Area operational agreement. According to Article 8 the FRCE target parameters needs to be published on internet.

(6) The CE TSOs Agreement on FRCE target parameters gives an overview of calculated FRCE target parameters for the individual LFC blocks of synchronuous area CE. The methodology for the calculation will be described in the supporting document of the agreement.

Article 1
Subject matter and scope

The FRCE target parameters as determined in this proposal shall be considered as the common agreement of all TSOs of CE in accordance with Article 128(1) of SO GL.

Article 2
Definitions and interpretation

1. For the purposes of the CE TSOs Agreement on FRCE target parameters, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this CE TSOs Agreement on FRCE target parameters, unless the context requires otherwise:

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a) ACE: The ACE represents the individual remaining imbalance the LFC area is responsible for. In case of coordinated FRR activation the ACE may differ to the LFC input and be recalculated in coordinated manner. Without coordinated FRCE calculation, the ACE corresponds to the opposite of the LFC input.
b) the singular indicates the plural and vice versa;
c) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this LFC blocks determination proposal; and
d) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Frequency Restoration Control Error Target Parameters

The mandatory assessment of the load-frequency control performance of the LFC blocks shall be based on the ACE target parameters and Frequency quality evaluation criteria according to the Article 128 and 131 of the SO GL.

The objective behind the level 1 and level 2 parameters is to provide quality targets for the individual ACE quality of each LFC block. Since it is the responsibility of each TSO in its LFC block to keep ACE as low as possible, the level 1 and level 2 parameters must not be exploited in order to reduce reserves or reserves activation. These parameters should rather be interpreted as an absolute warning limit that shows that quality of ACE is below the required standard and that respective countermeasures have been reported and will be implemented urgently.

The level 1 and level 2 Frequency Restoration Control Error Target Parameters for the LFC blocks within CE are provided in Table 1. The values will be calculated annually. The methodology to calculate these target parameters is described in the explanatory note.

LFC-Block	belonging LFC-Areas	Level 1	Level 2
OST	OST	25,285	47,817
APG	APG	78,234	147,954
SHB	NOS BiH, HOPS, ELES	64,015	121,062
Elia	Elia	87,887	166,208
ESO	ESO	62,775	118,717
SG	SG	76,883	145,398
CEPS	CEPS	86,080	162,790
TNG+TTG+AMP+50HZT+EN+CREOS	TNG+TTG+AMP+50HZT+EN+CREOS	247,631	468,311
REE	REE	187,236	354,093
RTE	RTE	225,851	427,120
IPTO	IPTO	63,851	120,752
MAVIR	MAVIR	52,000	98,340
TERNA	TERNA	158,993	300,682
SMM	CGES, MEPSO, EMS	69,358	131,167
TTB	TTB	102,579	193,993
PSE	PSE, Western WPS	124,964	236,326
REN	REN	73,253	138,533
TEL	TEL	76,336	144,363
SEPS	SEPS	49,310	93,253
TEIAS	TEIAS	161,771	305,934

Table 1: FRCE target parameters for the LFC blocks of Continental Europe

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Article 4
Publication and implementation of the CE TSOs Agreement on FRCE target parameters

1. The TSOs of CE shall publish the FRCE Target Parameters at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the FRCE Target Parameters immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this FRCE target parameters proposal shall be English. For the avoidance of doubt, where TSOs need to translate this FRCE target parameters proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the FRCE target parameters proposal.

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Explanatory note for the calculation of Frequency Restoration Control Error Target Parameter for LFC blocks of synchronous area Continental Europe

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Explanatory Note

The SO GL according to Article 118 requires the TSOs of CE to specify in their Synchronous Area Operational Agreement the Frequency Restoration Control Error Target Parameters (hereafter referred to as FRCE target parameters) of the individual LFC block of synchronous area CE. If a LFC block consist of more than one LFC area, all TSOs of the LFC block shall specify in their LFC block Operational Agreement the FRCE target parameters of the individual LFC areas.

These target parameters shall allow a regular check of the control performance of the individual areas, by themselves. The calculation of level 1 and level 2 will provide concrete values, which are the limit values for the ACE. The ACE shall not exceed these values for more than:

- level 1: 30 % of the time intervals of the year respectively
- level 2: 5 % of the time intervals of the year.

Furthermore, according to Article 8 the FRCE target parameters per LFC block need to be published on internet.

The following table will give an impression of these values per LFC block:

LFC-Block	belonging LFC-Areas	Level 1	Level 2
OST	OST	25,285	47,817
APG	APG	78,234	147,954
SHB	NOS BiH, HOPS, ELES	64,015	121,062
Elia	Elia	87,887	166,208
ESO	ESO	62,775	118,717
SG	SG	76,883	145,398
CEPS	CEPS	86,080	162,790
TNG+TTG+AMP+50HZT+EN+CREOS	TNG+TTG+AMP+50HZT+EN+CREOS	247,631	468,311
REE	REE	187,236	354,093
RTE	RTE	225,851	427,120
IPTO	IPTO	63,851	120,752
MAVIR	MAVIR	52,000	98,340
TERNA	TERNA	158,993	300,682
SMM	CGES, MEPSO, EMS	69,358	131,167
TTB	TTB	102,579	193,993
PSE	PSE, Western WPS	124,964	236,326
REN	REN	73,253	138,533
TEL	TEL	76,336	144,363
SEPS	SEPS	49,310	93,253
TEIAS	TEIAS	161,771	305,934

Table 1: FRCE target parameters for each LFC block of Synchronous Area Continental Europe

The calculation is performed based on the following description and formulas. The yearly process will be performed by Subgroup Systemfrequency (SG SF), in the same time as the calculation of FCR (C_i, P_{pi} and K_{ri}), as the K-Factors will act as basis for the calculation of level 1 and level 2.

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The methodology is based on the following simplifying assumptions:

(1) The frequency behaviour can be considered as a sum of two uncorrelated components, the quarter-hourly frequency average (fqh) and the deviation from this average, the frequency noise (Δfnoise).

(2) Both signals, fqh and Δfnoise, can be approximately modelled as normal distributions with mean value equal to zero.

(3) The sum of ACE values of the Synchronous Area is equal to the frequency deviation multiplied with the total K-Factor of the Synchronous Area.

(4) The ACE behaviour of the LFC Blocks is not correlated.

(5) The ACE of a LFC Block can be approximately modelled as a normal distribution with mean value equal to zero.

The main steps for the calculation of level 1 and level 2 ACE targets for the individual LFC Blocks are the following:

- Calculate the distribution of frequency noise;
- Calculate the distribution of quarter-hourly frequency average values which after convolution with the frequency noise distribution will fulfil the frequency quality target parameter (15000 minutes outside ±50 mHz).
- Calculate the frequency deviations for the probabilities defined by level 1 and level 2.
- Calculate the shares of each LFC Block proportional to the square root of the respective K-Factor.

The determination of ACE target parameters is based on frequency data for at least one year with a measurement period equal to or shorter than one second (Instantaneous Frequency Data according to SO GL).

In the first step, the average frequency fqh for each quarter of an hour[1] is calculated from the Instantaneous Frequency Data.

In order to obtain the frequency deviation noise Δfnoise, fqh is subtracted from the frequency f, which is based on the Instantaneous Frequency Data, i.e.

$$\Delta f_{noise} = f - f_{qh} \qquad (7)$$

SO GL Article 127(3) and Article 127(4) require that the range of ±50 mHz must not be exceeded for more than 15000 minutes per year. Therefore, in the second step, the range of ±rnoise, which must not be exceeded for more than 15000 minutes a year, is estimated based on the assumption of a normal distribution.

The probability p_m of exceeding the 15000 minutes per year is calculated based on the following equation:

$$p = 1 - \left(\frac{\text{time intervals per year outside the range}}{\text{total time intervals per year}}\right) \qquad (8)$$

$$p_m = 1 - \left(\frac{7500}{525600}\right) = 0{,}9857 \qquad (9)$$

In order to calculate r_{noise}, the standard deviation of Δfnoise (σnoise) is estimated from the data and multiplied with the inverse cumulative probability value of p_m. (see Table 2).

$$r_{noise} = \sigma_{noise} \cdot 2.1898 \qquad (10)$$

[1]To be calculated between minutes 0:00-14:59, 15:00-29:59, 30:00-44:59, 45:00-59:59 of each hour of the day.

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SO GL parameters	minutes per year	Probability p_m	inverse cumulative probability value as c σ
minutes outside standard frequency range (for deviations in one of the directions)	75002	0.9857	2.1898 σ

Table 2: Minutes per year with the corresponding probability and the inverse cumulative probability as a function of standard deviation.

In the third step, the value rqh, which represents the same range for an allowed normal distribution of the quarter-hourly average frequency deviation, is calculated based on the assumption that the two signals are not correlated:

$$r_{qh}[\mathrm{Hz}] = \sqrt{(0.05)^2 - r_{noise}^2} \tag{11}$$

In the fourth step, the ranges which correspond to the probabilities required by SO GL Article 128(3) are calculated taking rqh as basis. The probabilities are calculated as follows:

$$p_{qh,\mathrm{Level\ 1}} = 1 - \left(\frac{5256}{35040}\right) = 0{,}85 \tag{12}$$

$$p_{qh,\mathrm{Level\ 2}} = 1 - \left(\frac{876}{35040}\right) = 0{,}975 \tag{13}$$

For the calculation of the ranges, the inverse cumulative probabilities of $p_{qh,\mathrm{Level\ 1}}$ and $p_{qh,\mathrm{Level\ 2}}$ will be used.

SO GL Parameters	qh per year	Probability p_{qh}	inverse cumulative probability value as c σ
qh outside level 1 ACE range	5256	0.85	1.0364 σ
qh outside level 2 ACE range	876	0.975	1.96 σ

Table 3: Values outside the ranges.

$$r_1[\mathrm{Hz}] = r_{qh}\frac{1{,}0364}{2{,}1898} \text{ and } r_2[\mathrm{Hz}] = r_{qh}\frac{1{,}96}{2{,}1898} \tag{14}$$

In the last step, the level 1 and level 2 ranges (L1 and L2) are calculated for each LFC Block. With KSA as K-Factor of the Synchronous Area expressed in MW/Hz, K_{FCR} as the total FCR of the Synchronous Area and KFCR,i as initial FCR obligation of LFC block i, the targets are given by:

$$L_1[\mathrm{MW}] = K_{SA} \cdot r_1 \cdot \sqrt{\frac{K_{FCR,i}}{K_{FCR}}} \tag{15}$$

[2] It is half of the 15000 minutes defined in SO GL as it only refers to the Standard Frequency Range of 50 mHz.

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$$L_2[MW] = K_{SA} \cdot r_2 \cdot \sqrt{\frac{K_{FCR,i}}{K_{FCR}}} \quad (16)$$

Consideration of imbalance netting and Cross-Border Activation of Reserves

In case of a cross-border activation of reserves, the TSOs of the participating LFC Blocks can agree to take the effect of the cross-border activation into account for their level 1 and level 2 target values according to the B-1.

The definition of level 1 and level 2 target values derived above relies on the assumption that the disturbances of a LFC Block increase with the size of its generation and consumption. This assumption may not be valid for LFC Blocks with altered FRR or RR activation requests due to the implementation of Exchange of Reserves, Sharing of Reserves or Cross-Border Activation of Reserves. In this case, the participating LFC Blocks may agree to take the effect of the Cross-Border Activation of Reserves or Imbalance Netting into account for the calculation of FRCE target parameters for the evaluation of the ACE quality.

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All CE TSOs' agreement on the methodology to assess the risk and evolution of the risk of exhaustion of FCR in accordance with Article 131(2) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of a proposal for methodology to assess risk and evolution of the risk of exhaustion of FCR (hereafter referred to as "FCR exhaustion risk proposal") in accordance with Article 131(2) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The FCR exhaustion risk proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose a methodology to assess the risk and the evolution of the risk of exhaustion of FCR of the synchronous area CE.

(3) The goal of this proposal is to define a methodology based on a probabilistic approach, to evaluate the risk and evolution of the risk of FCR exhaution for the FCR dimensioning value set in synchronous area CE.

(4) Article 118 of the SO GL requires all TSOs of synchronous area CE to specify the methodology to assess the risk and the evolution of the risk of exhaustion of FCR of the synchronous area. According to Article 131(2) of the SO GL this methodology shall be performed at least annually and shall be based at least on historical instantaneous system frequency data for not less than 1 year. The input for this calculation shall be provided by all TSOs of synchronous area CE.

(5) According to Article 6 of the SO GL, the expected impact of the methodology to assess the risk and evolution of the risk of exhaustion of FCR on the objectives of the SO GL has to be described. It is presented below. The proposed methodology to assess the risk and evolution of the risk of exhaustion of FCR proposal generally contributes to the achievement of the objectives of the Article 4(1) of the SO GL.

(6) In particular, the FCR exhaustion risk proposal responds to the objectives of SO GL pursuant to Article 4(1) to determine common operational security requirements, and to ensure the conditions for maintaining operational security and frequency quality level throughout the Union, by establishing a methodology that evaluates if the FCR dimensioning value set in synchronous area CE is enough to ensure that the probability of insufficient FCR is below or equal to once in 20 years.

(7) In conclusion, the FCR exhaustion risk proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

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The methodology to assess risk and evolution of the risk as determined in this proposal shall be considered as the common proposal of all TSOs of CE in accordance with Article 131(2) of SO GL.

Article 2
Definitions and interpretation

1. For the purposes of the FCR exhaustion risk proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In thisFCR exhaustion risk proposal , unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this FCR exhaustion risk proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Methodology to Assess Risk and Evolution of the Risk of Exhaustion of FCR

The methodology to assess the risk of exhaustion of FCR proposed for RG CE is based on a probabilistic approach and takes into account the probability of FCR deployment due to the following operational situations:

- Forced instantaneous outages of generation modules, HVDC interconnectors between two synchronous areas and substations/bus bars which connect two generation units/blocks: modelled by a probability density function, calculated by using a one-minute sequential Monte Carlo simulation.
- Imbalances due to changes in demand, renewable generation, long lasting frequency deviations events or the market-induced imbalances: modelled by a probability density function calculated using the worst 15-seconds average frequency deviation data (15-seconds is equal half time of FAT for FCR) for every minute of the last year.

The probability density function of the total amount of FCR needed is the convolution of the previous probability density functions. Therefore, the risk of exhaustion of FCR will be the number of events in 20 years (10.512.000 minutes) in which the FCR need is larger than the FCR dimensioned.
This methodology is fully described in the following paragraphs.

STEP 1. Calculation of the probability density function of FCR required due to generation tripping
This calculation shall be carried out using a probabilistic assessment with the aim of determining which is the largest expected FCR spent due to generation/in-feed loss for a certain number of years.
Starting from a generation scenario and the trip probability of each unit, a Monte Carlo simulation shall be performed for every minute in the period considered in order to calculate the amount of FCR required due to generation trips. This simulation is time sequential, since it is essential to model that the FCR used in one minute to counteract an imbalance in the previous minute will not be instantly recovered, and there is a probability for another unit to trip before the FCR has been replaced by the Frequency Restoration Reserves (FRR).
The following assumptions shall be taken into account:

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- A peak hour generation scenario modelled, considering exclusively units larger than 600 MW, operating at full capacity. Consequently a generation trip is equivalent to the full loss of the generation capacity of one single unit;
- The generation trips occur independently from each other, except for generating units located in the same plant or that are connected to the network on the same node;
- The reconnection time of the units that have tripped is assumed to be at least larger than 30 minutes. This is based on the consideration that the unit that tripped will not be reconnected and partially compensate the imbalance it has caused within the time of deployment of FRR;
- The trip probability of each generation unit is constant in time and is assumed to follow a Poisson distribution:

$$p(\lambda) = 1 - e^{\frac{-\lambda}{525600}}$$

  Where p is the probability of tripping of the unit in a certain minute and λ is the number of trips per year of the unit. The number of trips per year must be divided by the number of minutes in a year (525.600 for a non-leap year) as the probability to be calculated is the probability in each minute;
- The used probability of failure of generating units will be based on historical data provided by each LFC block, and yearly updated. Also, the expected rate of relevant simultaneous outages (i.e. simultaneous tripping of large units due to cooling issues, bus-bar or substation trips affecting several units, etc.) is provided according to historical values;
- The FRR deployment is approximated to a first order linear system with a full activation time (FAT) based on historical values. The deployment of FRR replaces, for each minute, the correspondent part of the deployed FCR in the previous minute;
- The time-sequential Monte Carlo simulation shall be performed considering at least 10^8 minutes (≈ 190 years) with a granularity of 1 minute.

STEP 2. Calculation of the probability density function of FCR required due to other causes than generation tripping

The expected FCR in use when the generation trip occurs due to fast demand changes, RES or – mainly – deterministic frequency deviations shall be modelled, and taken into account in order to calculate the total risk of exhaustion of FCR.

The following assumptions will be taken into account:

- The deployment of FCR shall be proportional to the frequency deviation in quasi-steady state after the dynamic effects of the imbalance have disappeared. Since the minimum available FCR at all times is 3000 MW and the quasi-steady state frequency deviation is 0.2 Hz, then the proportional constant between the FCR used and frequency deviations is 15000 MW/Hz;

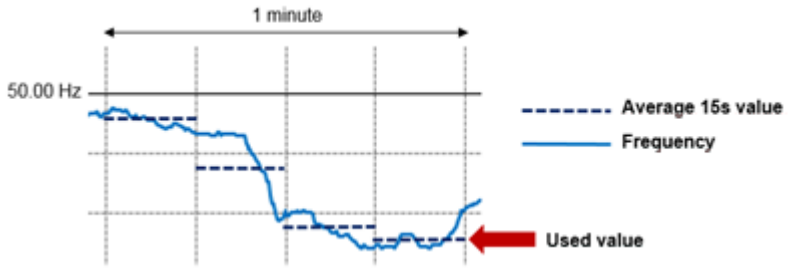

Figure 1: Worst 15-seconds average frequency deviation

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- The data used to calculate this expected use of FCR shall consider the worst 15-seconds average frequency deviations for each minute of the last year. In order to avoid taking into account deviations due to large generation trips twice, the 15 minutes after a generation loss recorded according to observation of outages shall be discarded

STEP 3. Calculation of the total required FCR

The probability density function of the total FCR required shall be calculated as the convolution of the probability distribution of FCR demanddue to generation tripping, and the probability distribution of FCR in use due to previous imbalances.

Therefore, the number of events in which the FCR demand is larger than the FCR dimensioned (i.e. the risk of FCR exhaustion) is given by the following expression:

$$risk\ of\ FCR\ exhaustion = F_{FCR}(x) \cdot 10.512.000$$

Where $F_{FCR}(x)$ is the cumulative distribution function of the previous convoluted function where the FCR demand is larger than the FCR dimensioned, i.e.

$$F_{FCR}(x) = \int_{x}^{\infty} f$$

f being the probability distribution of the total FCR needed.

Values larger than 1 means a risk of FCR exhaustion higher than once in twenty years.

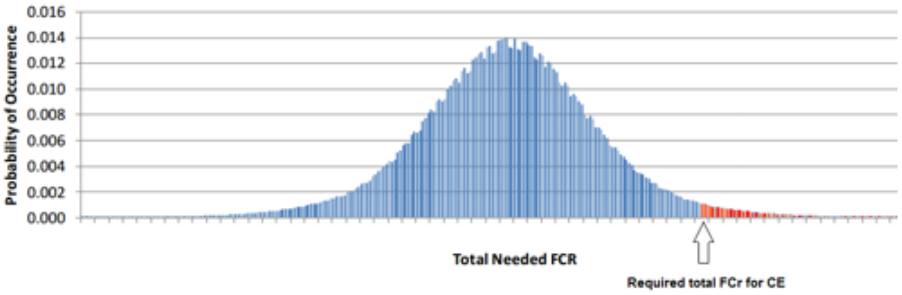

Figure 2: Probability distribution of the total FCR

Article 4
Publication and implementation of the FCR exhaustion risk proposal

1. The TSOs of CE shall publish the FCR exhaustion risk proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the FCR exhaustion risk proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this FCR exhaustion risk proposal shall be English. For the avoidance of doubt, where TSOs need to translate this FCR exhaustion risk proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation,

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provide the relevant national regulatory authorities with an updated translation of the FCR exhaustion risk proposal.

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All CE TSOs' agreement on the nomination of the synchronous area monitor in accordance with Article 118(1)(f) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of a proposal for the nomination of the synchronous area monitor (hereafter referred to as "nomination of a synchronous area monitor proposal") in accordance with Article 118(1)(f) of Commission Regulation (EU) 2017/1485 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The nomination of the synchronous area monitor proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose the requirement of the nomination of the synchronous area monitor of CE.

(3) Article 118(1)(f) of the SO GL requires all TSOs of CE to develop a proposal regarding the nomination of a synchronous area monitor.

(4) According to Article 6 of the SO GL, the expected impact of the Nomination of the synchronous area monitor on the objectives of the SO GL has to be described. It is presented below. The proposed nomination of the synchronous area monitor generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(5) In particular, the nomination of the synchronous area monitor proposal responds to the objectives of SO GL to determine common operational security requirements, and to ensure the conditions for maintaining operational security and frequency quality level throughout the Union.

(6) In conclusion, the nomination of the synchronous area monitor proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The nomination of the synchronous area monitor as determined in this proposal shall be considered as the common proposal of all TSOs of CE in accordance with Article 118(1)(f) of SO GL.

Article 2
Definitions and interpretation

1. For the purposes of the nomination of the synchronous area monitor proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

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2. In this nomination of the synchronous area monitor proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this nomination of the synchronous area monitor proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Nomination of the synchronous area monitor

The Coordination Centres shall fulfil the obligations of the synchronous area monitor according to Article 133 of the SO GL by assigning specific tasks to the SG SF. Such tasks shall be jointly specificied between the synchronous area monitor and SG SF.

Article 4
Publication and implementation of the nomination of the synchronous area monitor proposal

1. The TSOs of CE shall publish the nomination of synchronous area monitor proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the nomination of synchronous area monitor proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this nomination of a synchronous area monitor proposal shall be English. For the avoidance of doubt, where TSOs need to translate this nomination of a synchronous area monitor proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the nomination of a synchronous area monitor proposal.

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All CE TSOs' agreement on the calculation of the control program in accordance with Article 136 of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

08.08.2018

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of the synchronous area Continental Europe (hereafter referred to as "TSOs") regarding the development of a proposal for the calculation of the control program (hereafter referred to as "calculation of the control program proposal") in accordance with Article 136 of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The calculation of the control program proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose requirements to define a common ramping period of aggregated netted schedules between the LFC areas in the synchronous area. The calculation of the control program from the netted area AC position for ACE calculation shall be performed with the common ramping period.

(3) Article 136 of SO GL requires all TSOs to develop a calculation of the control program proposal.

(4) This proposal aims at defining a common ramping period of aggregated netted schedules between the LFC areas in the synchronous area. The calculation of the control program from the netted area AC position for ACE calculation shall be performed with the common ramping period.

(5) According to Article 136 of the SO GL, the expected impact of the calculation of the control program proposal on the objectives of the SO GL has to be described. It is presented below. The proposed method for calculation of the control program generally contributes to the achievement of the objectives of Article 136 of the SO GL.

(6) In particular, the calculation of the control program proposal responds to the objectives of SO GL to determine common operational security requirements, and to ensure the conditions for maintaining operational security and frequency quality level throughout the Union.

(7) In conclusion, the calculation of the control program proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The calculation of the control program as determined in this proposal shall be considered as the common proposal of all TSOs of CE in accordance with Article 136 of SO GL.

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Article 2
Definitions and interpretation

1. For the purposes of this calculation of the control program proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this calculation of the control program proposal , unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
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Article 3
Calculation of the Control Program

In accordance with Article 136 of SO GL, the ramping period for ACE calculation in synchronous area CE is defined as follows:

- The starting point of the ramping period of the control program is 5 minutes before the control program changes;
- The ending point of the ramping period of the control program is 5 minutes after the control program changes;
- The length of the ramping period is 10 minutes, the ramping is linear.

The control program (e.g. for power exchanges and frequency set-points) must be entered into the LFC input and ACE calculation as time-dependant set-point values of the netted area AC position of the LFC area. An example for an hourly exchange schedule is given in Figure 1.

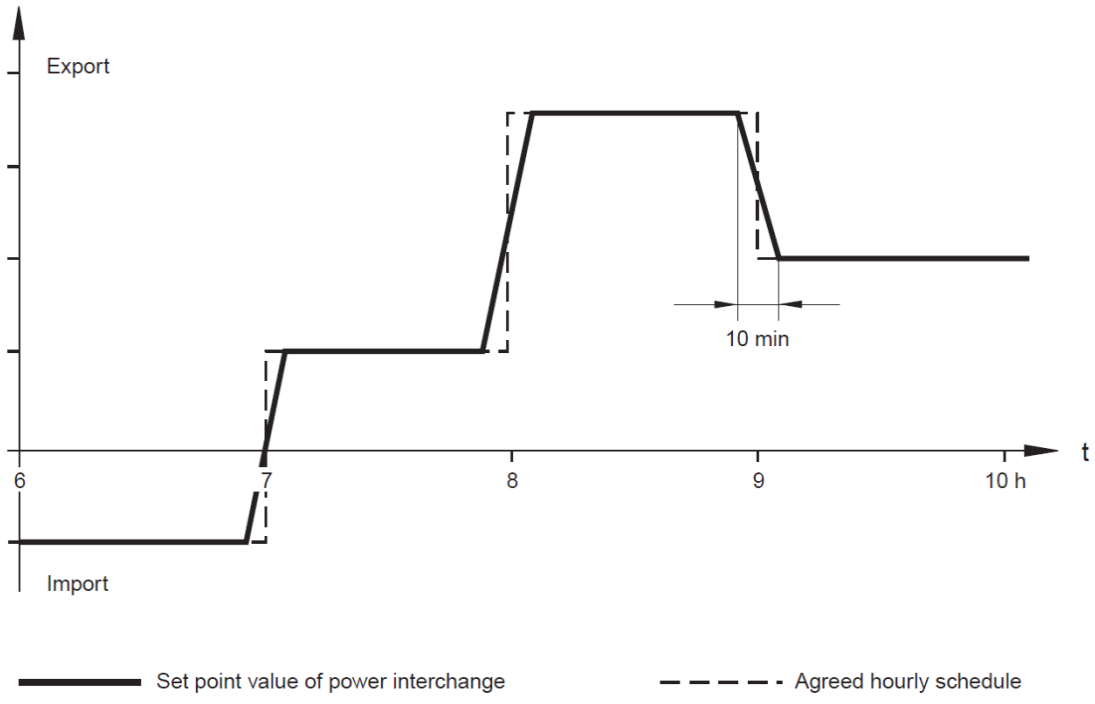

Figure 1: Example for an hourly control program

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For avoidance of doubts, the ramping period shall apply to any change of control program: market, countertrading, cross-border redispatch, balancing program interchange, offset in case of application of extraordinary procedure.
In order to prevent unintentional frequency deviations and major control actions under undisturbed conditions, TSOs are required to maintain careful compliance with times for program changes, particularly where changes in the exchange programs of several hundred MW are involved. In particular, care must be taken to ensure that generating capacity is brought on line or disconnected on a staggered basis.
Ramping should be considered by each TSO of a LFC area in order to minimize the activation of active power reserves, the magnitude of the ACE and the corresponding frequency deviation. This could be reflected, for example, with financial incentives or operational requirements provided by TSO to generating units to follow the defined ramping requirements.

Article 4
Publication and implementation of the calculation of the control program proposal

1. The TSOs of CE shall publish the calculation of the control program proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the calculation of the control program proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this calculation of the control program proposal shall be English. For the avoidance of doubt, where TSOs need to translate this calculation of the control program proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of this calculation of the control program proposal.

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All CE TSOs' agreement on the load-frequency-control structure in accordance with Article 139 of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

08.08.2018

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of the load-frequency-control structure (hereafter referred to as "load-frequency-control structure proposal") in accordance with Article 139 of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The load-frequency-control structure proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose of the load-frequency-control structure.

(3) The goal of this proposal is to define a load-frequency control structure. It includes a process activation structure in accordance with Article 140 of SO GL and process responsibility structure in accordance with Article 141 of SO GL in synchronous area CE.

(4) Article 139 of the SO GL requires that all TSOs of synchronous area CE shall specify the load-frequency-control structure for the synchronous area.

(5) In particular, the load-frequency-control structure proposal responds to the objectives of SO GL pursuant to Article 4(1) to determine common operational security requirements, and to ensure the conditions for maintaining operational security level throughout the Union by establishing the common structure of the main tools to ensure a system security regarding to frequency restoration

(6) In conclusion, the load-frequency-control structure proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The load-frequency-control structure as determined in this proposal shall be considered as the common proposal of all TSOs of CE in accordance with Article 139 of SO GL.

Article 2
Definitions and interpretation

1. For the purposes of the load-frequency-control structure proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this load-frequency-control structure proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;

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b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this load-frequency-control structure; and
c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Load-frequency-control structure

Load-frequency-control structure according to Article 118(1)(i) SO GL (mandatory)

In accordance with Article 139 of the SO GL all TSOs of the synchronous area CE hereby define:

- the Process Responsibility Structure; and
- the Process Activation Structure.

Process responsibility structure

List of Monitoring Areas, LFC Areas and LFC Blocks

The current Process Responsibility Structure according to Article 141 of the SO GL is defined in Article *A-7 LFC Block Determination*.
The operation of Load-Frequency Control processes is based on operational areas, where every area has their own responsibilities in the LFC structure. The overall body is the Synchronous Area in which frequency and phase are the same for the whole area. The Synchronous Area CE consists of several LFC Blocks, each LFC Block consists of one or more LFC Areas. A LFC Area itself consists of one or more Monitoring Areas, which also consist of one or more Scheduling Areas.

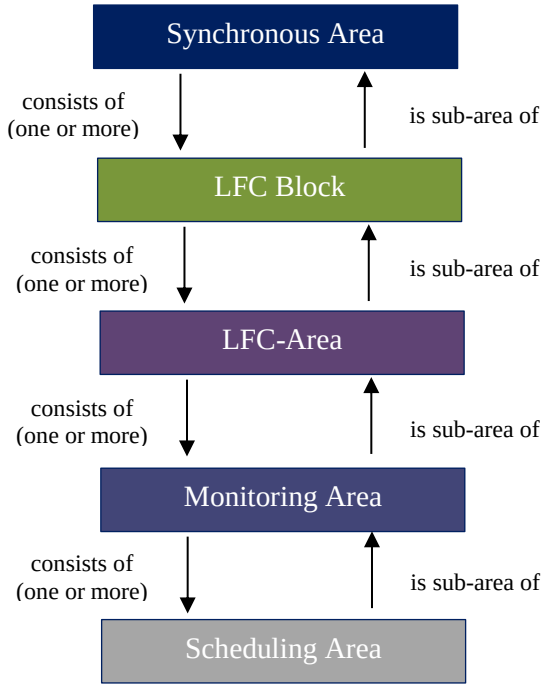

Figure 1: Hierarchy of operational areas

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The above described hierarchy is illustrated in Figure 1: Hierarchy of operational areas. Each of these operational areas have their own obligations. A Scheduling Area is responsible for the scheduling process in that area. A Monitoring Area has in addition to the scheduling the obligation to calculate and measure the active power interchange in real-time in that area. A LFC Area has the additional obligation to fulfil the Frequency Restoration Control Error Target Parameters by using the Frequency Restoration Process. A LFC Block is additionally responsible for the dimensioning of FRR and RR. The Synchronous Area has the obligation to fulfil the Frequency Restoration Control Error Target Parameters by using the Frequency Containment Process.

Demarcation of Scheduling Areas, Monitoring Areas, LFC Areas and LFC Blocks

Each TSO operating a Monitoring Area, a LFC Area or a LFC Block shall cooperate with TSOs of neighbouring Monitoring Areas, LFC Areas and LFC Blocks

- to demarcate its areas by the position of physical points of measurement of the interchanged power over Tie-Lines and Virtual Tie-Lines;
- the TSOs operating a Tie-Line shall agree on one physical measurement point which serves as the common point of control for both TSOs;
- the TSOs operating a Tie-Line shall agree on a fall-back physical measurement point;
- to declare the list of Tie-Lines and Virtual Tie-Lines of each Monitoring Area, LFC Area and LFC Block in operation (including transmission lines and transformers of the different voltage levels between the areas) to the SG CSO and
- to maintain and update the list of Tie-Lines and Virtual Tie-Lines.

Connection of Power Generating Modules and Demand Facilities via Virtual Tie-Lines

Two or more TSOs of more than one LFC Areas shall have the right to agree on cross-border operation of Power Generating Modules or Demand Facilities through Virtual Tie-Lines. In this case, a share of the respective Active Power output is transferred via the Virtual Tie-Line.

Process Activation Structure

The Process Activation Structure of the synchronous area CE according to Article 140 of the SO GL includes mandatory processes:

- the Frequency Containment Process (FCP);
- the Frequency Restoration Process (FRP) and
- the Time Control Process.

Furthermore, there are optional processes:

- the Reserve Replacement Process (RRP);
- the Imbalance Netting Process;
- the Cross-Border FRR Activation Processes and
- the Cross-Border RR Activation Process.

In case of cross-border process, the FRCE might be recalculated in a coordinated manner in order to correspond to the remaining imbalance the LFC area is responsible for. The recalculation of FRCE is using optionally as inputs: the Virtual Tie-Line(s) involved in the cross-border process, the set-points of FRR activation and the effective FRR activation.

In any case, the calculation of FRCE is mandatory for an LFC Area. When there is no coordinated calculation of FRCE, the ACE for an LFC Area is directly determined as equal to the opposite of the LFC input according to Figure 2.

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The Process Activation Structure of the synchronous area CE is implemented in each LFC Area according to the control process in

- The control error, i.e. input, of the FCP is the frequency deviation;
- The control error, i.e. input, of aFRP is the LFC input of a LFC Area;
- The mFRP and RRP are manually triggered by the TSO in order to release or to supplement aFRP based on observed or expected imbalances;
- Optionally, optimization of local aFRP may be introduced leading to additional aFRR activation (e.g. predictive aFRR activation).

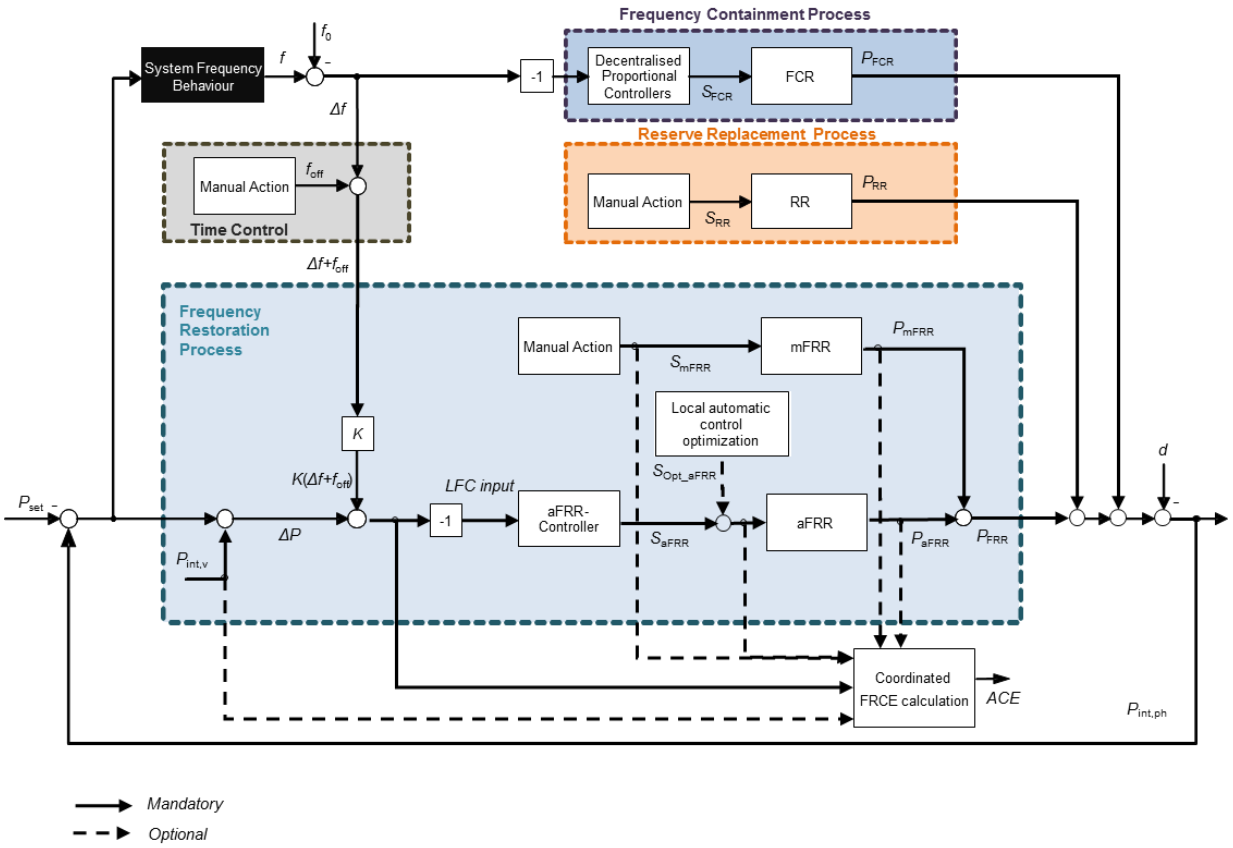

Figure 2: Control Process[1]

Variable	Short Description and Sign Conventions
ACE	The ACE represents the individual remaining imbalance the LFC area is responsible for. In case of coordinated FRR activation the ACE may differ to the LFC input and be recalculated in coordinated manner. Without coordinated FRCE calculation, the ACE corresponds to the opposite of the LFC input.
FRCE	see ACE (only for RG CE).
d	Disturbance.

[1] The mandatory ACE arrow leading to the box of this coordinated calculation is only mandatory when there is no coordinated FRCE calculation.

f_0	Nominal Frequency of the synchronous area. The Nominal Frequency is equal to 50 Hz.
f	System Frequency of the Synchronous Area measured in Hz.
$\Delta f = f - f_0$	Frequency Deviation.
f_{off}	Frequency Offset used for Time Control. Positive if the Synchronous Time is behind UTC.
$f_{set} = f_0 + f_{off}$	Reference frequency set of the synchronous area in Hz equal to the sum of nominal frequency of the Synchronous Area and the frequency Offset used for Time Control.
K	The K-Factor defined in MW/Hz is an estimation for the change of Active Power output of a LFC Area resulting from a Frequency Deviation, i.e. including FCR, self-regulation, etc.
$K(\Delta f + f_{off})$	The Frequency Control Error is the estimation for the actual amount of Active Power which is adjusted in the LFC Area in response to the System Frequency to $f_{set}=f_0+f_{off}$.
$LFC\ Input = -(\Delta P + K(\Delta f + f_{off}))$	The LFC Input is the opposite of the sum of the Power Control Error and the Frequency Control Error. The LFC Input is the input of the aFRR controller.
P_{set}	Set-point power interchange of a LFC Area calculated from the ramped Control Program, positive in case of export.
$P_{int,ph}$	Sum of the active power flows over physical Tie-Lines (P_{T_ph}) of the LFC Area (positive in case of export).
$P_{int,v}$	Sum of the active power flows over Virtual Tie-Lines of the LFC Area (positive in case of export) including correction signals from common optimization platforms for imbalance netting and aFRR energy exchange
$\Delta P = (P_{int,ph} + P_{int,v}) - P_{set}$	The Power Control Error is the deviation between the set-point power interchange of the LFC Area and the sum of the active power flows over Tie-Lines (physical and virtual).
S_{FCR}	Set-point for activation of Frequency Containment Reserves
S_{RR}	Set-point for activation of RR sent to the RR provider.
S_{mFRR}	Set-point for activation of mFRR sent to the mFRR provider.
S_{aFRR}	Set-point for activation of aFRR sent to the aFRR provider.
S_{Opt_aFRR}	Set-point for local optimization of aFRR activation.
P_{FCR}	Activated FCR.
P_{RR}	Activated Replacement Reserves
P_{FRR}	Activated Frequency Restoration Reserves.
P_{aFRR}	Activated aFRR.
P_{mFRR}	Activated mFRR.

Table 1: Short Descriptions and Sign Conventions

120 *Frequency Containment Process (FCP)*

121 *Implementation of the Control Function*

122 Each TSO of each LFC Area shall implement the Frequency Containment Process and organise the
123 availability of the corresponding reserves, according to Article 142 of the SO GL.

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Implementation of the Frequency Restoration Process (FRP)

Implementation of the Control Function

Each TSO of each LFC Area shall implement the Frequency Restoration Process (FRP) with a respective Frequency Restoration Controller and organise the availability of the respective reserves. The FRR shall be used for the Frequency Restoration Process, according to Article 143 of SO GL, in order to regulate the ACE to zero, other purposes, for example, the minimisation of unintentional energy exchange, are not allowed.

Frequency Restoration Controller:

The Frequency Restoration Controller shall have proportional-integral behaviour. The controller parameter shall reflect the dynamic properties of the aFRR. The typical values for the Frequency Restoration Controller parameters are:

- 0 % to 50 % for the proportional term;
- 50 s to 200 s for the integral term; and
- 1 s to 5 s for the controller cycle time.

All TSOs shall provide the Frequency Restoration Controller parameters to the synchronous area monitor on a yearly basis or if the parameters significantly change.

Accuracy of Measurements:

To ensure consistent calculations of the ACE:

- Accuracy and sensitivity of frequency measurement shall be at least 1 mHz;
- the accuracy of the active power measurements on each Tie-Line must be better than 1.5 % of its highest rated value (the complete measurement range, including discretisation);
- The controller cycle, i.e. refresh rate, shall not exceed 5 s;
- It is recommended that the transmission latency from measurement equipment of the tie-lines to the SCADA system does not exceed 1 s.

Frequency Restoration Controller Clock:

Each TSO shall implement a synchronisation of the Frequency Restoration Controller clock to a reference time.

Operation Modes of the Frequency Restoration Controller:

The Frequency Restoration Controller implementation shall include the following operation modes:

1. Normal Operation Mode: In Normal Operation Mode the LFC input of the LFC Area i is calculated as the sum of the power control error and the frequency control error.

$$LFC\ input_i = -\left(\sum_{j\in\Omega_i}(P^j_{T_{ph},i}) - P_{set} + K_i(f - f_{set})\right) \quad (1)$$

where Ω_i corresponds to the set of the tie lines of the LFC area i

2. Frequency Control Mode: In Frequency Control Mode the LFC input of the LFC Area is equal to the Frequency Control Error (the Power Control Error is omitted).

$$LFC\ input_i = -K_i(f - f_{set}) \quad (2)$$

3. Tie-Line Control Mode: In Tie-Line Control Mode the LFC input of the LFC Area i is equal to the Power Control Error (the Frequency Control Error is omitted).

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$$LFC\ input_i = -\left(\sum_{j\in\Omega_i}\left(P^j_{T_{ph},i}\right) - P_{set}\right) \quad (3)$$

4. Frozen Control Mode: In Frozen Control Mode the output of the Frequency Restoration Controller of the LFC Area i, and thus the set-point for the activation of aFRR, remains constant (ACE is not controlled).

$$S_{aFRR,i} = const. \quad (4)$$

5. Stopped Control Mode: In Stopped Control Mode the Frequency Restoration Controller of the LFC Area i is deactivated meaning that there is no set-point for activation of aFRR.

$$S_{aFRR,i} = 0 \quad (5)$$

6. Manual Control Mode: In Manual Control Mode one or more Tie-Line measurements, Power Control Error, Frequency Control Error and/or the output of the Frequency Restoration Controller of the LFC Area i is overwritten by a manually defined value.
Controller is deactivated meaning that there is a fixed set-point for activation of aFRR. This fixed set point and the actual value of this set point should be able to ramp up or down to another value. A possible value can be zero.

$$LFC\ input_i(t) = -\left(\Delta P_i^{manual}(t) + \Delta f^{manual}(t)\right) \quad (6)$$

aFRR minimum amount recommendation:

The amount of aFRR is the range of adjustment within which the Frequency Restoration Controller can operate automatically, in both directions (positive and negative) at the time concerned, from the working point of the Frequency Restoration Reserves.

The amount of the aFRR that is needed typically depends on the size of load variations, schedule changes and generating units. In this respect, the recommended minimum amount of aFRR has to ensure

- that the positive aFRR is larger than the 1st percentile of the difference[2] of the 1-minute average ACEol[3] and the 15 minute average ACEol of the LFC Block of the corresponding quarter of hour[4], and
- that the negative aFRR is larger than the 99th percentile of the difference of the 1-minute average ACEol and the 15 minute average ACEol of the LFC Block of the corresponding quarter of hour.

This recommended statistical approach is based on historical data.

[2] Difference to be calculated on 1-minute resolution
[3] **ACEol** means remaining ACE open loop without contribution of mFRR and RR activations.
[4] To be calculated between minutes 0:00-14:59, 15:00-29:59, 30:00-44:59, 45:00-59:59 of each hour of the day.

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An alternative approach based on empiric noise management (recommended in the former UCTE) may also be taken into account leading to recommended minimum amount of aFRR given in the following Figure 3:

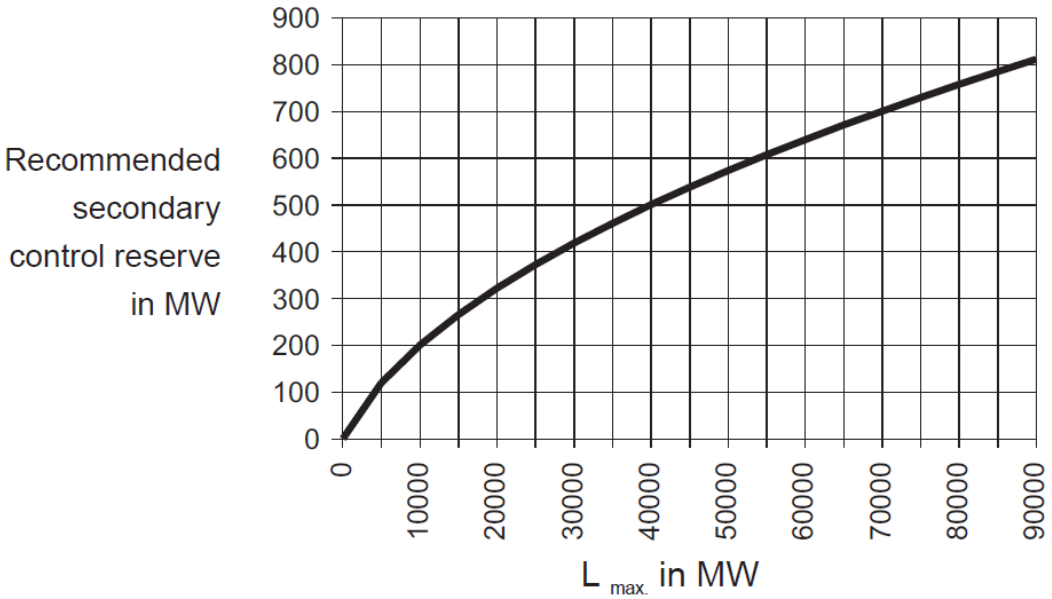

Figure 3: Recommended minimum aFRR reserve in the former UCTE.

With L_{max} being the maximum anticipated consumer load for a LFC Area over the period considered. A comparison between the new and the legacy recommendation for data between 2010 and 2014 resulted in comparable amounts per LFC Block; however, the new recommendation is considered more future-proof as it implicitly considers not only peak load, but all imbalances. Both approaches may also be combined.

Article 4
Publication and implementation of the the load-frequency-control structure proposal

1. The TSOs of CE shall publish the load-frequency-control structure proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the load-frequency-control structure proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this load-frequency-control structure proposal shall be English. For the avoidance of doubt, where TSOs need to translate this load-frequency-control structure proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the load-frequency-control structure proposal.

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All CE TSOs' agreement on the methodology to reduce the electrical time deviation in accordance with Article 181 of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

08.08.2018

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of a methodology to reduce the electrical time deviation (hereafter referred to as "methodology to reduce the electrical time deviation proposal") in accordance with Article 181 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The methodology to reduce the electrical time deviation proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose a procedure to control time.

(3) The purpose of the methodology is to reduce the electrical time deviation.

(4) The electrical time deviation is the difference between electrical time and the time reference, Coordinated Universal Time (UTC).

(5) According to Article 181(2) of the SO GL, all TSOs shall develop a methodology to correct the electrical time deviation, when applicable.

(6) In conclusion, the methodology to reduce the electrical time deviation proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The methodology to reduce the electrical time deviation as determined in this proposal shall be considered as the common proposal of all TSOs in accordance with Article 181 of the SO GL.

Article 2
Definitions and interpretation

1. For the purposes of the methodology to reduce the electrical time deviation proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this methodology to reduce the electrical time deviation proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;

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b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this methodology to reduce the electrical time deviation proposal; and
c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Methodology to Reduce the Electrical Time Deviation

At the synchronous area level, the electrical system operation is based on Active Power control with the aim of maintaining continuously the equilibrium between consumption and generation. In this process, the global parameter controlled is the system frequency meaning the number of times that the repeated event (voltage wave cycle) occurs per unit time (1 second). Whichever is the adopted control process structure for the repeated phenomena (frequency or time of voltage wave cycle) the performance for a long term period is the deviation of the electrical time from a time reference. In this sense, the final evaluation and control refers at the same values: time as integration of period of voltage wave and time etalon as Universal Time Control (UTC). The integration of frequency / voltage time period is considered the electrical time or the synchronous time (the electrical time of the synchronous area). If the nominal frequency is 50 Hz, the voltage time period represents 1/50 Hz-1 or 20 ms.

The responsibilities of the synchronous area monitor according to Article 181(3) are fulfilled by the Time Monitor that shall act as a service provider for the synchronous area monitor.

A long term integration of nominal frequency is absolute interval of astronomical time, while that same time integration of real voltage time period (frequency) has a different value. This difference serves in the majorities of synchronous area as a performance indicator for the real time operating of the structure of control and maintaining the system power equilibrium.

During the normal operation, the average system frequency usually deviates from its nominal value. These deviations can be the consequences of different events which occur in system operation and typically controlled by the Frequency Restoration Process. Even in normal operation due to the fact that the Frequency Deviation cannot be controlled exactly to zero, especially in presence of imbalances pointing in one direction. Thus, electrical time deviations cannot be avoided and have to be controlled. This task will be done by the Time Monitor, which has the obligation to monitor the electrical time deviation and based on that to calculate the new frequency set point for the synchronous area.

The electrical time control is both a final frequency control process as long-term frequency stability and a service given by the TSOs of a synchronous area to its users which have internal processes based on electrical time.

In this last category are devices which dependent on electrical time:

- meters of electrical energy which calculate different tariff periods in a precise time measurement based on frequency as input value,
- power plants control energy;
- power quality devices;
- old industries processes;
- customers in textile industries, and
- synchronous motors.

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Moreover, significant electrical time deviations are proportional to the energy amount delivered due to FCR activation.

Implementation of Time Control

Frequency Set-Point:

The actual frequency set-point value for Time Control shall be used within the Frequency Restoration Controller for the calculation of the Frequency Deviation in order to limit the deviation between Synchronous Time and UTC.

Frequency Set-point Value:
The frequency set-point value has to be calculated by the Time Monitor[1] out of the sum of the nominal frequency 50 Hz and the time correction Frequency Offset and is valid for all hours of the next day, starting at 00:00 or as agreed otherwise by the Synchronous Area Monitor. All TSOs have to apply the transmitted frequency set-point value in their Frequency Restoration Controller for the full next day.

Mean Frequency Value:

The Time Monitor measures the deviation between UTC time and grid time; The Time Monitor establishes and distributes accordingly the frequency set-point to all synchronous area LFC blocks. In case of an exceptional range of discrepancy as described below, the time monitor should trigger the appropriate escalation process.

Range of Discrepancy:

Tolerated Range of Discrepancy:
A discrepancy between Synchronous Time and UTC is tolerated within the range of ±20 s (without need for time control actions).

Correction Range of Discrepancy:
The discrepancy between Synchronous Time and UTC is within the range of ±20 s and ±60 s for which time control actions are applied.

Exceptional Range Of Discrepancy:
Under exceptional conditions the discrepancy between Synchronous Time and UTC is beyond the range of ±60 s and exceptional time correction frequency offsets may be applied as stipulated below.

Time Deviation Calculation:

The Time Deviation between Synchronous Time and UTC has to be calculated for 10 a.m. each day by the Time Monitor. The relevant time zone is the Central European Time (CET = GMT+1) with daylight saving.

Time Correction Frequency Offset:

The Frequency Offset is determined by the Time Monitor with respect to the ranges of discrepancy:

- If the Time Deviation is within the Tolerated Range of Discrepancy, the Frequency Offset for time correction has to be set to zero.
- If the deviation is outside of the Tolerated Range of Discrepancy and Synchronous Time is behind UTC, the Frequency Offset has to be set to +10 mHz.

[1] **Time Monitor** is a TSO that continuously monitors the deviation between Synchronous Time and universal coordinated time (UTC) and is nominated by an agreement of all Transmission System Operators of synchronous area Continental Europe

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- If the deviation is out of the Tolerated Range of Discrepancy and Synchronous Time is ahead of UTC, the Frequency Offset has to be set to –10 mHz.

Exceptional Time Correction Frequency Offsets:

Only under exceptional conditions outside the Exceptional Range Of Discrepancy, Frequency Offsets larger than 10 mHz for the time correction of the Synchronous Time may be used. These Frequency Offsets are set by the Time Monitor.
The Time Monitor may in this case investigate the cause of the discrepancy and provide a report to the respective governance body for further actions.

Time Correction Notice:

The information for the time correction has to be forwarded by the Time monitor to all LFC Blocks of the synchronous area every day by 10:15 a.m. UCT or as agreed otherwise by the Synchronous Area Monitor. The LFC Blocks forward this information to their underlying LFC Areas without delay.

Content of Notice:
Each notice has to contain the time deviation, the time correction Frequency Offset, and the date and duration for the time correction.

Notice Transmission:
This notice has to be transmitted using secure and reliable electronic communication that allows a half-automated procedure.

Outstanding Notice:
In case the Time Deviation and correction notice is missing, the TSO shall apply the nominal frequency of 50 Hz as frequency set-point value for aFRP until it receives the outstanding notice. In parallel, the TSO shall take action to receive the correct information from the Time Monitor.

Article 4
Publication and implementation of the methodology to reduce the electrical time deviation proposal

1. The TSOs of CE shall publish the methodology to reduce the electrical time deviation proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the methodology to reduce the electrical time deviation proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this methodology to reduce the electrical time deviation proposal shall be English. For the avoidance of doubt, where TSOs need to translate this methodology to reduce the electrical time deviation proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the methodology to reduce the electrical time deviation proposal.

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All CE TSOs' agreement on the allocation of responsibilities between the TSOs in accordance with Article 141 of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

08.08.2018

Contents

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of a proposal for the allocation of responsibilities between TSOs (hereafter referred to as "allocation of responsibilities between TSOs proposal") in accordance with Article 141 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The allocation of responsibilities between TSOs proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose the requirement to allocate responsibilities between TSOs.

(3) Article 141 of the SO GL requires all TSOs of CE to develop a proposal for the allocation of responsibilities between TSOs.

(4) This proposal allocates the responsibilities between TSOs according to Article 141 of SO GL.

(5) According to Article 6 of the SO GL, the expected impact of the allocation of responsibilities between TSOs on the objectives of the SO GL has to be described. It is presented below. The proposed allocation of responsibilities between TSOs generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(6) In particular, the allocation of responsibilities between TSOs proposal responds to the objectives of SO GL to determine common operational security requirements, and to ensure the conditions for maintaining operational security and frequency quality level throughout the Union.

(7) In conclusion, the allocation of responsibilities between TSOs proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The allocation of responsibilities between TSOs as determined in this proposal shall be considered as the common proposal of all TSOs of CE in accordance with Article 141 of SO GL.

Article 2
Definitions and interpretation

1. For the purposes of the allocation of responsibilities between TSOs proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of

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Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this allocation of responsibilities between TSOs proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this allocation of responsibilities between TSOs proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Allocation of Responsibilities between TSOs

Each TSO shall be responsible for the operation of the FCP for its initial FCR obligation according to SO GL Article 153(2)(d).
Each TSO shall be responsible for the activation and availability of its initial FCR obligation according to SO GL Article 153(2)(d).
Each TSO shall endeavour to fulfil the frequency quality target parameters in accordance with SO GL Article 127.

Article 4
Publication and implementation of the allocation of responsibilities between TSOs proposal

1. The TSOs of CE shall publish the allocation of responsibities between TSOs proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the allocation of responsibities between TSOs proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this allocation of responsibilities between TSOs proposal shall be English. For the avoidance of doubt, where TSOs need to translate this allocation of responsibilities between TSOs proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the allocation of responsibilities between TSOs proposal.

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All CE TSOs' agreement on the operational procedures to reduce frequency deviation in accordance with Article 152(10) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

08.08.2018

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of a proposal for operational procedures to reduce frequency deviation (hereafter referred to as "operational procedure to reduce frequency deviations proposal") in accordance with Article 152(10) of the Commission Regulation (EU) 2017/1485 of August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The operational procedure to reduce frequency deviations proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose requirements to determine operational procedures to reduce frequency deviations.

(3) Frequency deviations in certain ranges endanger the system security and can trigger automatically implemented load shedding and generator tripping. To prevent such events and not exhaust FCR, FRR and RR operational procedures shall be implemented to reduce frequency deviations as soon as they extent a certain range.

(4) Article 118(1)(n) of the SO GL requires all TSOs to develop a operational procedure to reduce frequency deviations proposal.

(5) The scope of the operational procedure to reduce frequency deviations proposal covers procedure to reduce frequency deviation within normal and alert state, i.e. within a range of +/- 200mHz.

(6) According to Article 6 of SO GL, the expected impact of the operational procedure to reduce frequency deviations proposal on the objectives of the SO GL has to be described. It is presented below. The proposed operational procedure to reduce frequency deviations proposal generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(7) In conclusion, the operational procedure to reduce frequency deviations proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The operational procedure to reduce frequency deviations proposal as determined in this proposal shall be considered as the common proposal of all TSOs of CE in accordance with Article 152(10) of SO GL.

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Article 2
Definitions and interpretation

1. For the purposes of the operational procedure to reduce frequency deviations proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this operational procedure to reduce frequency deviations proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this operational procedure to reduce frequency deviations proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Operational Procedures to Reduce Frequency Deviation

Extraordinary Procedure in case of Alert State due to a Violation of System Frequency Limits

Goal of the procedure

According to Article 118(1)(n) of the SO GL, the procedure for long-lasting deviations from nominal frequency (as defined in Article *B-6 Load-Frequency Control Structure*) regarded as Alert State[1] due to a violation of System Frequency limits shall guarantee

- The mandatory sharing of relevant operational information between the TSOs in case of significant steady-state frequency deviations which are considered to be a risk for operational security because of imminent potential cascading effects like load shedding or generation disconnection, and
- The reduction of respective frequency deviations with predefined/pre-prepared and coordinated countermeasures.

Remedial Actions in the scope of this procedure

Any Remedial Action to significantly reduce the ACE, i.e. frequency deviation, in order to return to Normal State shall encompass measures compliant with security rules according to the SO GL Part II Operational Security.

Declaration of Alert State

The Coordination Centres shall monitor the System Frequency and determine the Stages according to the limits defined in Figure 1 which are based on the System States defined in Article 152 of the SO GL.

Determined stages:

The following stages both correspond to Alert State according to Article 18 of the SO GL:

- Stage 1: Continuous frequency deviation of more than 100 mHz over a time period of more than 5 minutes or a continuous frequency deviation of more than 50 mHz over a time period of more than 15 minutes.

[1] This procedure does not directly refer to the local Alert State of a TSO with respect to Article 18 of the SO GL. Nevertheless, it can be derived from this requirement that a respective local Alert State of at least one Impacting TSO correlates with the synchronous area wide Alert State considered in the SO GL Part IV LFC&R and in this procedure.

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- Stage 2: Continuing frequency deviation of more than 100 mHz over a time period of more than 10 minutes or a continuous frequency deviation of more than 50 mHz over a time period of 20 minutes or manually triggered after Stage 1 took place. Each LFC area can ask for this manual trigger by contacting the responsible Coordination Centre. In case there are contradicting requests from TSOs, the Coordination Centre shall decide on appropriate actions and trigger of Stage 2.

In case of a long lasting remarkable imbalance of a TSO which does not (yet) trigger Stage 1 or Stage 2, but is not expected to be compensated in the foreseeable future or in case of detection of an expected risky imbalance situation, the TSO with long lasting remarkable imbalance or any TSO affected that has serious concerns regarding its own system by this long lasting imbalance has the right to ask for a manual trigger at any time by contacting the responsible Coordination Centre. The Coordination Centre shall decide on appropriate actions and trigger of Stage 1 or Stage 2.

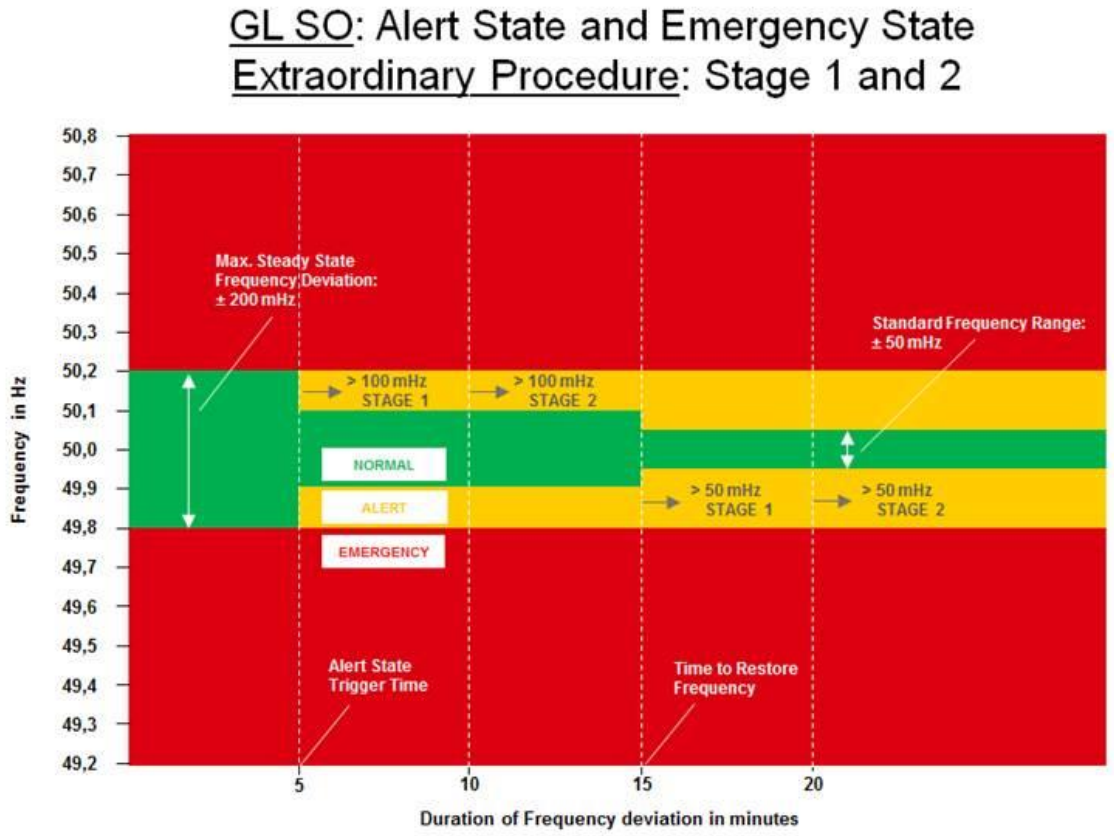

Figure 1: Illustration of Stage 1 and Stage 2 based on the System States of the SO GL.

Actions to be taken in Stage 1:

In case a frequency deviation of more than 200 mHz occurs, Emergency State is reached. Any corresponding actions and procedures are described in Policy on Emergency and Restoration.
In case of Stage 1 the Coordination Centres shall identify the Impacting TSOs based on the ACE and contact immediately their control rooms by phone or teleconference.

The responsibility for launching the teleconferences through the Coordination Centres changes according to a monthly rotation.

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Identification of Impacting TSOs:

A TSO shall be identified as Impacting TSO[2] in case the following conditions are fulfilled in EAS[3]:

- The TSOs with an ACE exceeding the threshold of 375 MW[4] and
- The TSO has declared Alert State.

In case the threshold is exceeded by a TSO that has not declared Alert State the Coordination Centre shall contact the TSO asking for respective confirmation.

Alternatively, a TSO may declare to be an Impacting TSO by proactively contacting a Coordination Centre.

In case the EAS is not available, the Coordination Centre shall identify the Impacting TSOs based on the online observation data or any other available information.

Information provided by the Impacting TSOs:

The Impacting TSOs shall inform the Coordination Centre about:

- The estimated reason for the imbalance
- The Remedial Actions that have already been taken;
- The time period when these actions are expected to become effective;
- If these actions are expected to be sufficient to solve the frequency deviation and
- Which further actions are planned.

This first contact aims at clarifying from each Impacting TSO if some actions have been already set up, the delay for these actions and if these actions are expected to be sufficient in order to solve the frequency deviation. The Impacting TSOs are expected to set up all the measures that are possible regarding their own rules (market and security) in order to avoid the second step of this procedure as much as possible.

Taking note of Information in Stage 1:

The Coordination Centre shall take note of the information as described in the chapter on *Identification of Impacting TSOs* and *Information provided by the Impacting TSOs* above and send a respective e-mail to the Impacting TSO, the Supporting TSOs[5] and the other Coordination Centre as soon as possible.

Manual triggering of Stage 2:

In case the Impacting TSO(s) expect(s) its/their taken and planned Remedial Actions not to be sufficient and an improvement of the System Frequency cannot be observed the Coordination Centre shall start the measures corresponding to Stage 2 without delay. Alternatively, the Impacting TSOs may ask the Coordination Centre for the immediate initiation of Stage 2.

Actions to be taken in Stage 2:

Phone Conference:

In case of Stage 2 the Coordination Centre shall immediately start a phone conference with all relevant Supporting TSOs. If necessary, the Impacting TSOs may join the conference.

[2] **Impacting TSO** means a TSO which is predominantly responsible for a frequency deviation that triggers Stage 1 or Stage 2 of the Extraordinary Procedure in case of Alert State according to the determined criteria.

[3] **ENTSO-E Awareness System (EAS)** is an IT tool for real time data exchanges for pan-European use within ENTSO-E set up to increase the knowledge of the state of the system and accordingly to launch alarms.

[4] Threshold calculated as 1/8 of the reference incident of the synchronous area for more than 30 consecutive minutes

[5] **Supporting TSO** means a TSO that activates remedial actions as part of the Extraordinary Procedure in case of Alert State.

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The phone conference shall be possible without prior scheduling or prior connection request.

Further Remedial Actions:

As a result of the phone conference, further Remedial Actions shall be agreed which are to be activated in order to return to Normal State such as:

- Activation of additional[6] aFRR by means of enforcing the Frequency Restoration Controller to activate additional reserves, i.e. manually overwriting / adjusting the exchange program while – for example – using virtual tie-lines or cross-border schedules;
- Activation of additional mFRR or RR;
- Mutual emergency assistance services

For this evaluation the following aspects shall be taken into account:

- imbalance and expected duration of the imbalance;
- the amount of available Active Power Reserves in the different locations;
- the expected activation time;
- impacts on the load flows based on simulations within the related observability areas or the last available merged snapshots (every 15 minutes) and on the expected location of generation units or loads which are planned to be used to compensate the imbalance;
- specific boundary conditions, e.g. risk of Emergency State due to tripping of solar power generation, etc.

Documentation of Stage 2:

The Coordination Centre shall document the agreed Remedial Actions and send a respective e-mail to the Impacting TSO, the Supporting TSOs, the other Coordination Centre as well as to further TSOs for information as soon as possible.

Ex post analysis:

The Coordination Centre shall distribute a report in case of Stage 2 events latest one week after the events. Furthermore, the synchronous area monitor performs a detailed analysis in the internal Quarterly Reports.

Data provision:

All TSOs shall provide:

- Real-time input of LFC
- Available remaining aFRR and mFRR
- Available RR (amount and activation time)

Article 4
Publication and implementation of the operational procedure to reduce frequency deviations proposal

1. The TSOs of CE shall publish the operational procedures to reduce frequency deviations proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the operational procedures to reduce frequency deviations proposal immediately after entry into force of the Synchronous Area Operational Agreement.

[6] Additional means in addition to the Active Power Reserves activation used for the compensation of the LFC Blocks of the Supporting TSOs.

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Article 5
Language

The reference language for this operational procedure to reduce frequency deviations proposal shall be English. For the avoidance of doubt, where TSOs need to translate this operational procedure to reduce frequency deviations proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the operational procedure to reduce frequency deviations proposal.

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All CE TSOs' agreement on the roles and responsibilities of the TSOs implementing an imbalance netting process, a cross-border FRR activation process or a cross-border RR activation process in accordance with Article 149(2) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

08.08.2018

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all transmission system operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of a proposal for roles and responsibilities of the TSOs implementing an imbalance netting process, a cross-border FRR activation process or a cross-border RR (hereafter referred to as "roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal") in accordance with Article 149(2) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose requirements to define roles and responsibilities of the TSOs when participating on an imbalance netting process, a cross-border FRR activation process or a cross-border RR. It also introduces trial phase of each process.

(3) Article 149(2) of the SO GL requires all TSOs of CE to develop a common proposal on roles and responsibilities of Imbalance Netting and cross-border FRR and RR.

(4) This proposal aims to specify roles of TSOs involved in one of the processes of Imbalance Netting, cross-border FRR activation or cross-border RR activation. Following, the responsibilities of the TSOs are commonly defined to reach full advantage of the process implementation without risk of jeopardising the network security.

(5) According to Article 149(2) of the SO GL, the expected impact of roles and responsibilities of Imbalance Netting and cross-border FRR and RR on the objectives of the SO GL has to be described. It is presented below. The proposed roles and responsibilities of Imbalance Netting and cross-border FRR and RR generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(6) In conclusion, the definition of roles and responsibilities of Imbalance Netting and cross-border FRR and RR contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The roles and responsibilities of Imbalance Netting and cross-border FRR and RR as determined in this proposal shall be considered as the common proposal of all TSOs of CE in accordance with Article 149(2) of SO GL.

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Article 2
Definitions and interpretation

1. For the purposes of the roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Roles and Responsibilities of the TSOs Implementing an Imbalance Netting Process, a Cross-Border FRR Activiation Process or a Cross-Border RR Activation Process

Roles Related to Imbalance netting, Cross-Border Activation of Reserves, Exchange of Reserves and Sharing of Reserves

In accordance with Article 118(1)(o, u, v, w) of SO GL, all TSOs of CE hereby define the roles of TSOs implementing or affected by an Imbalance Netting Process, a Cross-Border FRR Activation Process, a Cross-Border RR Activation Process, an Exchange of Reserves or Sharing of Reserves.

Implementing TSOs:

TSOs implementing an Imbalance Netting Process, a Cross-Border aFRR or mFRR Activation, a Cross-Border RR Activation Process, Exchange of Reserves or Sharing of Reserves shall commonly develop the process platforms and sign an operational procedure agreement per process. According to Article 118(1)(u), the reserve receiving and the reserve connecting TSO as well as according to Article 118(1)(v, w) the control capability receiving and control capability providing TSO is also defined as Implementing TSO. A TSO shall have the right to join the existing Imbalance Netting Process, a Cross-Border aFRR or mFRR Activation, a Cross-Border RR Activation Process, Exchange of Reserves or Sharing of Reserves when the TSO:

- fulfils requirements of the process platform
- signs the operational procedure agreement per process and
- notifies the process according to the *Notification Process* described below

Affected TSOs:

A TSO may declare itself as affected based on Operational Security Analysis as defined in Article 3(2)(50) of SO GL in line with Article 150(2) delivered to the SG CSO within one month after notification in accordance with Article 150(2) of SO GL.

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Responsibilities Related to Imbalance netting, Cross-Border Activation of Reserves, Exchange of Reserves and Sharing of Reserves

In accordance with Article 118(1)(o, u, v, w) of SO GL, all TSOs of CE hereby define the responsibilities of TSOs implementing or affected by an Imbalance Netting Process, a Cross-Border FRR Activation Process, a Cross-Border RR Activation Process, an Exchange of Reserves or Sharing of Reserves.

Notification Process:

Notification

All TSOs of CE willing to implement an Imbalance Netting Process, a Cross-Border aFRR or mFRR Activation, a Cross-Border RR Activation Process, Exchange of Reserves or Sharing of Reserves shall send a notification to the SG CSO at least three months in advance in accordance with Article 150(1) of the SO GL.

Notification of Additional Processes

All TSOs of CE willing to implement a new additional process (different from processes in accordance with Article 118(1)(o, u, v, w)) according to with cross-border implications which is in line with the SO GL shall:

- Perform a study to investigate the impacts of the new process on the Operational Security of the synchronous area CE.
- Send the study report to SG CSO and RG CE Plenary in order to request a trial phase for the new process, at least three month in advance and the additional restrictions (see chapter on *Trial Phase* below).
- The RG CE Plenary shall decide on the trial phase and the additional restrictions (see chapter on *Trial Phase* below).

Implementation of Operational Procedures for Limitation of Imbalance netting and Cross-Border Activation of Reserves:

Agreement on Operational Procedures

In accordance with Article 150(3) of SO GL, upon the request of the Affected TSO the TSOs implementing Imbalance Netting or cross-border activation of reserves and the Affected TSO shall agree on Operational Procedures enabling the Affected TSO:

- to perform Operational Security Analysis in real-time; and
- to limit Imbalance Netting Power Interchange, Frequency Restoration Power Interchange and Replacement Power Interchange.

The agreed Operational Procedures shall include the rules for possible limitations and reasons for the limitations which shall be provided by the Affected TSO.

The TSOs implementing Imbalance Netting or cross-border activation of reserves and the affected TSOs shall notify the SG CSO about their operational procedure agreement and possible adaptations to the originally notified process.

Limits for Exchange and Sharing of Reserves:

Each Affected TSO has the right to request tighter limits because of:

- Exchange of FCR within or between the synchronous area;
- Exchange of aFRR, mFRR or RR within or between the synchronous area;
- Sharing of aFRR, mFRR or RR within or between the synchronous area.

In this case the TSO shall notify the Synchronous Area Monitor about these limits.

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Trial Phase

A Trial Phase is only required for processes that have potential impact on system security. In case one or more TSOs submit a new process proposal every proposing TSO is obliged to perform an assessment on potential impact on system security. In case where system security impact is detrimental, RG CE Plenary or SOC (for inter synchronous area impacts) shall decide if a Trial Phase shall be performed.

Trial Phase for Imbalance Netting, Cross-Border Activation of Reserves, Exchange of Reserves and Sharing of Reserves processes:

The relevant TSO involved in an Imbalance Netting Process, a Cross-Border aFRR or mFRR Activation, a Cross-Border RR Activation Process, an Exchange or Sharing of Reserves between LFC Blocks within or between Synchronous Areas shall foresee a trial phase of at least one year.
The trial phase shall include a regular reporting. The regular report shall be delivered each 6 months (or as otherwise agreed by CSO SG) and provided to the SG CSO with at least the statistical evaluation of ACE, cross-border power interchange, possible impact on the frequency quality as well as evaluation of operational procedures.
The SG CSO shall decide about the successful completion of the trial phase based on the evaluations provided by the regular report.

Trial Phase for Additional processes:

In case a trial phase for an additional process has been approved by the RG CE Plenary according to the *Notification of additional Processes*, the SG CSO shall

- report every three months to the RG CE Plenary
- evaluate the impact of the process on Operational Security at the end of the trial phase
- inform the RG CE Plenary about the final results and recommend a final decision to the RG CE Plenary.

The RG CE Plenary shall decide on the implementation of the process.

Article 4
Publication and implementation of the roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal

1. The TSOs of CE shall publish the roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal shall be English. For the avoidance of doubt, where TSOs need to translate this roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the roles and responsibilities of Imbalance Netting and cross-border FRR and RR proposal.

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All CE TSOs' agreement on the requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal in accordance with Article 151(2) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

08.08.2017

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of the synchronous area CE (hereafter referred to as "TSOs") regarding the development of the requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal (hereafter referred to as "requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal") in accordance with Article 151(2) of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It requires for this purpose the definition of minimum requirements for the availability, reliability and redundancy of the technical infrastructure neccessary to implement and operate the different processes regarding load-frequency-control.

(3) This proposal aims at defining minimum requirements for the availability, reliability and redundancy of the technical infrastructure neccessary to implement and operate the different processes regarding load-frequency-control.

(4) Article 151(2) of the SO GL requires all TSOs to develop requirements concerning the availability, reliability and redundancy of the technical infrastructure.

(5) According to Article 151(2) of the SO GL, the expected impact of the requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal on the objectives of the SO GL has to be described. It is presented below. This proposal generally contributes to the achievement of the objectives of Article 151(2) of the SO GL.

(6) In conclusion, the requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The requirements concerning the availability, reliability and redundancy of the technical infrastructure as determined in this proposal shall be considered as the common proposalof all TSOs of CE in accordance with Article 151(2) of SO GL.

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Article 2
Definitions and interpretation

1. For the purposes of the requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Requirements concerning the availability, reliability and redundancy of the technical infrastructure

Reliability

The Frequency Restoration Controller of aFRR shall be operated on-line and shall have a very high reliability. The tools for activation of mFRR and RR shall be operated on-line and shall have a very high reliability as well. A hot-stand-by-backup system must be available to take over the control function in case of an outage or fault of the main system. This requirement applies as well for all European Platforms performing cross-border imbalance netting or a cross-border FRR and RR activation process.

Reliability of Measurements

Measurements must be transmitted in a reliable manner, i.e. redundant/parallel data links, to the Frequency Restoration Controller. The used communication protocols must allow detecting invalid values and missing or invalid measurement values shall cause an alarm.
For each LFC Area of CE synchronous Area, the related TSO shall have frequency measurements from at least two different geographical locations available within this LFC Area.

Redundancy

TSO Control Rooms Redundancy

The control room functions shall be backed up to face any damage to the main installations. This shall be activated within less than three hours and tested at least once a year.

Manual Control Capability

In case of deficiency of the automatic Frequency Restoration Controller, manual control of reserves must be possible.

Metering and Measurement Transmission to Opposite Side

Usage and provision of alternative measurement from neighbouring LFC areas for comparison or backup are required. Substitute measurements and reserve equipment shall be available in parallel to the primary

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measurement. Substitute measurements are obligatory for all tie-lines with significant impact on the automatic frequency restauration process. Accuracy and cycle times for the substitute tie-line measurements must fulfil the same characteristics as the main measurements.

Availability

Data Recording

Each TSO of CE shall perform continuous recordings with a measurement period equal to or shorter than 10 s of all values needed for monitoring of the input and response of Frequency Restoration Controller and for analysis of normal operation and incidents in the synchronous area. These values include:

- the frequency measurement,
- the total active power flow measurement and
- the power exchange set-point value.

Sharing of information

The TSO shall inform in real-time all TSOs within ENTSO-E RGCE about its Wide Area System State. In case of not being in Normal State TSO shall provide more details on critical operational conditions and at minimum to the interconnected TSOs, expected time to come back to Normal State and shall call for help if needed (refer to bi-multilateral TSOs agreements). The constrained TSO shall communicate the information via the following ways:

- EAS,
- Preformatted messages (Fax, e-mail, web-based, etc.),
- Phone calls to complement messages.

Inter-TSO Contact lists for system operation

Inter-TSO agreements shall include a list of functional positions directly involved in the system operation to be contacted at any time with phone numbers, fax numbers and e-mail addresses that shall be provided by all TSOs of CE and regularly updated. This list includes desks of control rooms and the relevant staff. All critical information about real-time operation shall be sent to these TSO counterparts.

Article 4
Publication and implementation of the the requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal

1. The TSOs of CE shall publish the requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal shall be English. For the avoidance of doubt, where TSOs need to translate this the requirements concerning the availability, reliability and redundancy of the technical infrastructure

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proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL Regulation and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the requirements concerning the availability, reliability and redundancy of the technical infrastructure proposal.

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All CE TSOs' agreement on the common rules for the operation in normal state and alert state in accordance with Article 152(6) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of common rules for the operation in normal state and alert state (hereafter referred to as "common rules for the operation in normal state and alert state proposal") in accordance with Article 152(6) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The common rules for the operation in normal state and alert state proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose requirements to determine common rules for the operation in normal state and alert state.

(3) Frequency deviations in normal and alert state can endanger the system security and can trigger automatically implemented load shedding and generator tripping. To prevent such events and not exhaust FCR, FRR and RR common rules shall be implemented for the operation in normal state and alert state.

(4) Article 118(1)(q) of the SO GL requires all TSOs to develop a common rules for the operation in normal state and alert state proposal.

(5) The scope of the common rules for the operation in normal state and alert state proposal covers common rules to reduce frequency deviation within normal and alert state, i.e. within a range of +/- 200mHz

(6) According to Article 6 of the SO GL, the expected impact of the common rules for the operation in normal state and alert state proposal on the objectives of the SO GL has to be described. It is presented below. The proposed common rules for the operation in normal state and alert state proposal generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(7) In conclusion, the common rules for the operation in normal state and alert state proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The common rules for the operation in normal state and alert state as determined in this proposal shall be considered as the common proposal of all TSOs in accordance with Article 152(6) of SO GL.

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Article 2
Definitions and interpretation

1. For the purposes of the common rules for the operation in normal state and alert state proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this common rules for the operation in normal state and alert state proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this common rules for the operation in normal state and alert state proposal ; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Common Rules for the Operation in Normal State and Alert State

As all common rules for the operation in Normal State and Alert State reflect the target of load-frequency-control to reduce frequency deviations. Those rules refer to the rules for operational procedures to reduce frequency deviation according to *B-9 Operational Procedures to Reduce Frequency Deviation*.
Additionally and to prevent entering Emergency State, the TSO shall endeavour to conclude Mutual Emergency Service Agreements. These agreements should not be limited to TSO agreements within the synchronous area but also between synchronous areas.
In case of a long lasting remarkable imbalance of a TSO which does not (yet) trigger Stage 1 or Stage 2, but is not expected to be compensated in the foreseeable future or in case of detection of an expected risky imbalance situation, the TSO with long lasting remarkable imbalance or any TSO affected by this long lasting imbalance has the right to ask for a manual trigger at any time by contacting the responsible Coordination Centre. The Coordination Centre shall decide on appropriate actions and trigger of Stage 1 or Stage 2.
In case a frequency deviation of more than 200 mHz occurs, Emergency State is reached. Any corresponding actions and procedures are described in Policy on Emergency and Restoration.

Article 4
Publication and implementation of the common rules for the operation in normal state and alert state proposal

1. The TSOs of CE shall publish the common rules for the operation in normal state and alert state proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the common rules for the operation in normal state and alert state proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this common rules for the operation in normal state and alert state proposal shall be English. For the avoidance of doubt, where TSOs need to translate this common rules for the operation

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in normal state and alert state proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the common rules for the operation in normal state and alert state proposal.

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All CE TSOs' agreement on the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO as regarding the exchange of FRR and RR in accordance with Article 165(1) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of a proposal for the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR (hereafter referred to as "roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal") in accordance with Article 118(1)(f) of Commission Regulation (EU) 2017/1485 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose the requirement to dermine roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR.

(3) Article 165(1) of the SO GL requires all TSOs of CE to develop a proposal regarding the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR.

(4) This proposal determines the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR.

(5) According to Article 6 of the SO GL, the expected impact of the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR on the objectives of the SO GL has to be described. It is presented below. The proposed roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(6) In particular, the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal responds to the objectives of SO GL to determine common operational security requirements, and to ensure the conditions for maintaining operational security and frequency quality level throughout the Union.

(7) In conclusion, the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

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Article 1
Subject matter and scope

The roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR as determined in this proposal shall be considered as the common proposal of all TSOs of CE in accordance with Article 165(1) of SO GL:

Article 2
Definitions and interpretation

1. For the purposes of the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this proposal regaring the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Roles and Responsibilities of the Reserve Connecting TSO, the Reserve Receiving TSO and the Affected TSO regarding the Exchange of FRR and RR proposal

In accordance with Article 165(1) of SO GL all TSOs of the RG CE hereby define the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of FRR and/or RR. The roles and responsibilities as well as the notification processes and operational procedures are described in *B-10 Roles and Responsibilities of the TSOs implementing an Imbalance Netting Process, a cross-border FRR activation process or a cross-border RR activation process*.

Article 4
Publication and implementation of the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal

1. The TSOs of CE shall publish the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal immediately after entry into force of the Synchronous Area Operational Agreement.

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Article 5
Language

The reference language for this roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal shall be English. For the avoidance of doubt, where TSOs need to translate this roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO regarding the exchange of FRR and RR proposal.

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All CE TSOs' agreement on the roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of FRR and RR in accordance with Article 166(1) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of FRR and RR (hereafter referred to as "roles and responsibilities of the control capability providing TSO proposal") in accordance with Article 166(1) of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The proposal on the roles and responsibilities of the control capability providing TSO takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose an proposal on the roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of FRR and RR.

(3) Article 166(1) of the SO GL requires all TSOs to develop common proposal on the roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of FRR and RR.

(4) This proposal determines the roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of FRR and RR.

(5) According to Article 166(1) of the SO GL the expected impact of the roles and responsibilities of the control capability providing TSO proposal on the objectives of the SO GL has to be described. It is presented below. The proposed roles and responsibilities of the control capability providing TSO proposal generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(6) In particular, the roles and responsibilities of the control capability providing TSO proposal responds to the objectives of SO GL to determine common operational security requirements, and to ensure the conditions for maintaining operational security and frequency quality level throughout the Union.

(7) In conclusion, the roles and responsibilities of the control capability providing TSO proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

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Article 1
Subject matter and scope

The roles and responsibilities of the control capability providing TSO as determined in this proposal shall be considered as the common proposal of all TSOs in accordance with Article 166(1) of SO GL.

Article 2
Definitions and interpretation

1. For the purposes of the roles and responsibilities of the control capability providing TSO proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this roles and responsibilities of the control capability providing TSO proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this roles and responsibilities of the control capability providing TSO proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Roles and Responsibilities of the Control Capability Providing TSO, the Control Capability Receiving TSO and the Affected TSO for the Sharing of FRR and RR

In accordance with Article 166(1) of SO GL, all TSOs of the RG CE hereby define the roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for sharing FRR/RR. The roles and responsibilities as well as the notification processes and operational procedures are described in *B-10 Roles and Responsibilities of the TSOs implementing an Imbalance Netting Process, a cross-border FRR activation process or a cross-border RR activation process*.

Article 4
Publication and implementation of the agreement on the roles and responsibilities of the control capability providing TSO proposal

1. The TSOs of CE shall publish the roles and responsibilities of the control capability providing TSO proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the roles and responsibilities of the control capability providing TSO proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this roles and responsibilities of the control capability providing TSO proposal shall be English. For the avoidance of doubt, where TSOs need to translate this roles and responsibilities of

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the control capability providing TSO proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL Regulation and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the roles and responsibilities of the control capability providing TSO proposal.

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All CE TSOs' agreement on the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves in accordance with Article 171(2) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of a proposal for the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves (hereafter referred to as "roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal") in accordance with Article 171(2) of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves .

(3) Article 171(2) of the SO GL requires all TSOs of Continental Europe to develop a proposal regarding the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves.

(4) This proposal determines the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves.

(5) According to Article 6 of the SO GL, the expected impact of the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves on the objectives of the

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SO GL has to be described. It is presented below. The proposed roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(6) In particular, the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal responds to the objectives of SO GL to determine common operational security requirements, and to ensure the conditions for maintaining operational security and frequency quality level throughout the Union.

(7) In conclusion, the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves as determined in this proposal shall be considered as the common proposal of all TSOs of Continental Europe in accordance with Article 171(2) of SO GL.

Article 2
Definitions and interpretation

1. For the purposes of the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this proposal regaring the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas

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and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves; and

c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Roles and Responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal

In accordance with Article 171(2) of SO GL all TSOs of the RG CE hereby define the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves as well as for the control capability providing TSO, control capability receiving TSO and affected TSO for the sharing of active power reserves between synchronous areas. The roles and responsibilities as well as the notification processes and operational procedures are described in *B-10 Roles and Responsibilities of the TSOs implementing an Imbalance Netting Process, a cross-border FRR activation process or a cross-border RR activation process.*

Article 4
Publication and implementation of the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal

1. The TSOs of CE shall publish roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchron areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchron areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal shall be English. For the avoidance of doubt, where TSOs need to translate this roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control

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capability receiving TSO and the affected TSO for the sharing of reserves proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves proposal.

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All CE TSOs' agreement on the technical design of the frequency coupling process in accordance with Article 172(2) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the technical design of the frequency coupling process in the synchronous area CE (hereafter referred to as "technical design of the frequency coupling process") in accordance with Article 172(2) of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The technical design of the frequency coupling process takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose the design of the frequency coupling process in the synchronous area.

(3) Article 172(2) of the SO GL requires all TSOs to specify the technical design of the frequency coupling process.

(4) According to Article 6 of the SO GL, the expected impact of the technical design of the frequency coupling process on the objectives of the SO GL Regulation has to be described. It is presented below. The technical design of the frequency coupling process generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(5) In conclusion, the technical design of the frequency coupling process contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The technical design of the frequency coupling process as determined in this agreement shall be considered as the common proposal of all TSOs in accordance with Article 172(2) of SO GL.

Article 2
Definitions and interpretation

1. For the purposes of the technical design of the frequency coupling process, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this technical design of the frequency coupling process, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this technical design of the frequency coupling process; and

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c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Technical Design of the Frequency Coupling Process

All TSOs of each synchronous area jointly define three classes of frequency services, namely FCR exchange, frequency netting and frequency optimisation.

FCR exchange

FCR exchange is a process agreed between two synchronous areas where one synchronous area delivers FCR to the other. In such a case it shall be fulfilled that:

- the providing synchronous area shall provide the FCR subject to FCR exchange in addition to its own initial FCR dimensioning obligation according to SO GL Article 173(3) and
- the receiving synchronous area (via the TSO or via the sourced BSPs) shall have a back-up process in case the service fails.

Frequency netting

Frequency netting is a process agreed between two or more synchronous areas that reduces counter-activations of FCR only when the synchronous areas have frequency deviations which have an opposite sign. Frequency netting hence always improves the instantaneous frequency quality of all participating synchronous areas in case there are frequency deviations with opposite signs.

Frequency optimisation

Frequency optimisation is a process agreed between two or more synchronous areas that improves overall frequency quality by mutual FCR support between synchronous areas. This is arranged such that the frequency in all synchronous areas are used and optimised to ensure that the sum of the absolute frequency deviations is minimised. The objective function of Frequency optimisation applies different weights to the synchronous areas, with no synchronous areas having a zero weight and the weightings being agreed by all synchronous areas. Frequency optimisation hence improves the average frequency quality of those synchronous areas involved.

All synchronous areas willing to implement any of those services with RG CE shall send a notification to the SG CSO three months in advance in accordance with Article 150(1) of the SO GL.

Article 4
Publication and implementation of the technical design of the frequency coupling process

1. The TSOs of CE shall publish the technical design of the frequency coupling process proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the technical design of the frequency coupling process proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this technical design of the frequency coupling process shall be English. For the avoidance of doubt, where TSOs need to translate this technical design of the frequency coupling process into their national language(s), in the event of inconsistencies between the English version published by

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89 TSOs in accordance with Article 8 of the SO GL Regulation and any version in another language, the
90 relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory
91 authorities with an updated translation of the technical design of the frequency coupling process.

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All CE TSOs' agreement on the methodology to determine limits on the amount of exchange and sharing of FCR between synchronous areas in accordance with Article 173(4) and Article 118(1)(x) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

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All Transmission System Operators of synchronous area Continental Europe are taking into account the following;

Whereas

(1) This document is developed by all Transmission System Operators of synchronous area CE (hereafter referred to as "TSOs") regarding the development of limits on the amount of exchange and sharing of FCR between synchronous areas (hereafter referred to as "limits on the amount of exchange and sharing of FCR between synchronous areas proposal") in accordance with Article 118(1)(x) and Article 173(4) of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO GL").

(2) The limits on the amount of exchange and sharing of FCR between synchronous areas proposal takes into account the general principles and goals set in the SO GL as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"). The goal of the SO GL is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. It sets for this purpose the limits on the amount of exchange and sharing of FCR between synchronous areas proposal.

(3) Article 118(1)(x) and Article 173(4) of the SO GL requires all TSOs of Continental Europe to develop limits on the amount of exchange and sharing of FCR between synchronous areas.

(4) This proposal sets the limits on the amount of exchange and sharing of FCR between synchronous areas.

(5) According to Article 6 of the SO GL, the expected impact of the limits on the amount of exchange and sharing of FCR between synchronous areas on the objectives of the SO GL has to be described. It is presented below. The proposed limits on the amount of exchange and sharing of FCR between synchronous areas generally contributes to the achievement of the objectives of Article 4(1) of the SO GL.

(6) In particular, the limits on the amount of exchange and sharing of FCR between synchronous areas proposal responds to the objectives of SO GL to determine common operational security requirements, and to ensure the conditions for maintaining operational security and frequency quality level throughout the Union.

(7) In conclusion, the limits on the amount of exchange and sharing of FCR between synchronous areas proposal contributes to the general objectives of the SO GL to the benefit of all market participants and electricity end consumers.

Article 1
Subject matter and scope

The limits on the amount of exchange and sharing of FCR between synchronous areas proposal as determined in this proposal shall be considered as the common proposal of all TSOs of CE in accordance with Article 118(1)(x) and Article 173(4) of SO GL.

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Article 2
Definitions and interpretation

1. For the purposes of the limits on the amount of exchange and sharing of FCR between synchronous areas proposal, terms used in this document shall have the meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009, Article 2 of Directive 2009/72/EC and Article 2 of Commission Regulation (EU) 543/2013.

2. In this proposal regaring the limits on the amount of exchange and sharing of FCR between synchronous areas, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this limits on the amount of exchange and sharing of FCR between synchronous areas proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Limits on the amount of exchange and sharing of FCR between synchronous areas

Exchange of FCR between synchronous areas

In accordance with Article 173(4) of SO GL all TSOs of the synchronous area CE hereby establish the limits on the amount of Exchange of FCR between synchronous areas.

*Exchange of FCR between synchronous areas where the **synchronous area CE** is the Reserve **Connecting** synchronous area*

The maximum total exchanged FCR amount between synchronous area CE and the other synchronous areas shall not exceed the following security limits for CE:

- Aggregated FCR activation of all FCR Units or Groups subject to the exchange with adjacent synchronous areas induces a disturbing frequency deviation that is limited to a maximum of 10 mHz, which corresponds to a limit in power according to the K-factor of the synchronous area CE. The SG SF shall calculate this limit on a yearly basis.

*Exchange of FCR between synchronous areas where the **synchronous area CE** is the Reserve **Receiving** synchronous area*

The exchange of FCR between synchronous areas where the synchronous area CE serves as the Reserve Receiving synchronous area shall consider the following constrains:

- All Reserve Receiving TSOs of a LFC Block involved in an Exchange of FCR between synchronous areas shall ensure that at least 30 % of their total combined Initial FCR Obligations are physically provided inside their LFC Block.
- FCR exchange is limited to a maximum of 5 % of the FCR dimensioning amount (according to Article 156(6) of the SO GL) of the receiving synchronous area for each Reserve Transfer HVDC Link.

Sharing of FCR between synchronous areas

In accordance with Article 118(1)(x) of SO GL all TSOs of the synchronous area CE hereby establish the limits on the amount of sharing of FCR between synchronous areas.

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*Sharing of FCR between synchronous areas where the **synchronous area CE** is the Reserve **Connecting** synchronous area*

The maximum total shared FCR amount between synchronous area CE and the other synchronous areass shall not exceed the following security limits for CE:

- Total activated shared FCR with an adjacent synchronous area induces a disturbing frequency deviation that is limited to a maximum of 10 mHz, which corresponds to a limit in power according to the K-factor of the synchronous area CE. The SG SF shall calculate this limit on a yearly basis.

*Sharing of FCR between synchronous areas where the **synchronous area CE** is the Reserve **Receiving** synchronous area*

Sharing of FCR Capacity where synchronous area CE is the Reserve Receiving synchronous area shall not be allowed.

Article 4
Publication and implementation of the limits on the amount of exchange and sharing of FCR between synchronous areas proposal

1. The TSOs of CE shall publish the limits on the amount of exchange and sharing of FCR between synchronous areas proposal at least 3 months before entry into force of the Synchronous Area Operational Agreement.

2. The TSOs of CE shall apply the limits on the amount of exchange and sharing of FCR between synchronous areas proposal immediately after entry into force of the Synchronous Area Operational Agreement.

Article 5
Language

The reference language for this limits on the amount of exchange and sharing of FCR between synchronous areas proposal shall be English. For the avoidance of doubt, where TSOs need to translate this limits on the amount of exchange and sharing of FCR between synchronous areas proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8 of the SO GL and any version in another language, the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the limits on the amount of exchange and sharing of FCR between synchronous areas proposal.

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Explanatory note for the methodology to determine limits on the amount of exchange and sharing of FCR between synchronous areas

08.08.2018

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Explanatory note

To determine the limits on sharing and exchanging FCR between synchronous areas it is required to distinct 4 different scenarios:

- Exchange of FCR where CE is the providing synchronous area (FCR units or groups are physically connected to CE)
- Exchange of FCR where CE is the receiving synchronous area (FCR units or groups are physically connected in other synchronous areas than CE)
- Sharing of FCR where CE is the providing synchronous area (FCR units or groups are physically connected to CE)
- Sharing of FCR where CE is the receiving synchronous area (FCR units or groups are physically connected in other synchronous areas than CE)

CE providing

For the scenarios (exchange and sharing) of FCR where CE is the providing synchronous area, the limit is determined by means of a maximum frequency deviation of 10 mHz, which is caused by a simultaneous activation of FCR units or groups subject to exchange and sharing. It is equivalent to a limit on a maximum amount of FCR power under the consideration of the total K-Factor of CE, calculated by Sub-Group System Frequency for each year. The determination of the total K-Factor takes into account the total amount of FCR in CE, the self-regulation of loads as well as the surplus-control of generating units. In 2017 for instance these three components led to a total K-Factor of 27000 MW/Hz for the synchronous area of CE.

Hence, the exemplarily limits of FCR subject to an exchange or sharing for 2017 can be calculated by the following formula:

$$FCR_{exchange,2017} = K_{total,CE} * f_{disturb} = 27000 \frac{MW}{Hz} * 10\,mHz = 270\,MW$$

$$FCR_{sharing,2017} = K_{total,CE} * f_{disturb} = 27000 \frac{MW}{Hz} * 10\,mHz = 270\,MW$$

For the avoidance of doubt, it should be emphasized that the total K-Factor is recalculated every year and does therefore influence the limit of FCR exchange and FCR sharing between synchronous areas.

CE receiving

On the other hand, if CE is the receiving synchronous area, following security limits have been established:

For the exchange of FCR, the Reserve Receiving TSOs of a LFC Block have to ensure that at least 30% of their total combined initial FCR obligations are physically connected within their LFC block. This requirement is derived from the conditions for exchange of FCR within a synchronous area according to Article 163(2) SO GL. Moreover, the FCR exchange is limited to a maximum of 5 % of the FCR dimensioning amount (according to Article 156(6) of the SO GL) of the receiving synchronous area for each Reserve Transfer HVDC Link.

Sharing of FCR while synchronous area of CE taking the role of the receiving synchronous area is not allowed, justified by the fact that the priority access for the activation of FCR providing units or groups subject to the sharing process is held by the providing synchronous area.

Legal Background Information

It should be noted that similar requirements regarding the exchange and sharing of FRR and RR according to Article 118(1)(z) and 118(1)(aa) of SO GL are subject to NRA approval according to Article 6(3)(d) of SO GL, but the limitations set in this Article for the exchange and sharing of FCR are not.

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