ENTSO-E Network Code Text		Commentary
ENTSO-E Draft Network Code on Load-Frequency Control and Reserves		
17-Jan-13		
Disclaimer		
By using this document you understand that the Network Code text and interpretation/commentary are DRAFT		
It is a current interpretation of the Operational Security Network Code - and it is likely to change.		
Therefore, this document should **not** be taken as legal advice and should be used only as a guide, to aid the reading of the Network Code.		
THE EUROPEAN COMMISSION,		
Having regard to the Treaty on the Functioning of the European Union,		
Having regard to Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC,		
Having regard to Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators (ACER),		
Having regard to Regulation (EC) 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 and repealing Regulation (EC) No 1228/2003 and especially Article 6,		
Having regard to the priority list issued by the European Commission on 22 December 2010,		
Having regard to the Framework Guidelines on Electricity System Operation issued by the Agency for the Coordination of Energy Regulators on 2 December 2011,		
Whereas:		
(1) Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC and Regulation (EC) N° 714/2009 of the European parliament and of the Council of 13 July 2009 underline the need for an increased cooperation and coordination among Transmission System Operators within a European Network of Transmission System Operators for Electricity (ENTSO-E) to create Network Codes for providing and managing effective and transparent access to the Transmission Systems across borders, and to ensure coordinated and sufficiently forward-looking planning and sound technical evolution of the Transmission System in the European Union, including the creation of Interconnection capacities, with due regard to the environment;		
(2) Directive 2009/72/EC stresses that a secure supply of electricity is of vital importance for the development of European society, the implementation of a sustainable climate change policy, and the fostering of competitiveness within the internal market;		
(3) Transmission System Operators (TSOs) are according to Article 12 of Directive 2009/72/EC responsible for providing and operating high and extra-high voltage networks for long-distance transmission of electricity. Besides this transmission and supply task it is also the TSOs' responsibility to ensure the Operational Security of their LFC Areas and together in the whole Synchronous Areas and the European Union, with a high level of reliability and quality;		
(4) One of the most critical processes to ensure the Transmission System Operational Security with a high level of reliability and quality is the Load-Frequency Control (LFC). Effective Load-Frequency Control can be made possible only if there is an obligation for the TSOs, Reserve Connecting Distribution System Operators (DSOs), Providers' Power Generating Facilities and Demand Facilities to cooperate and to meet the relevant minimum technical requirements for the operation of the interconnected Transmission Systems as one entity;		
(5) ENTSO-E has drafted this Network Code for Load-Frequency Control and Reserves aiming at setting out clear, objective and harmonised requirements for TSOs, Reserve Connecting DSOs, Providers' Power Generating Facilities and Demand Facilities in order to ensure system security and to contribute to non-discrimination effective competition and the efficient functioning of the internal electricity market;		
(6) To ensure the Operational Security of the interconnected Transmission Systems and to provide a common frequency quality level it is essential that a common set of minimum requirements for European-Union-wide load-frequency control and reserves principles are defined as a basis for both the cross-border cooperation between the TSOs and, where relevant, for utilising characteristics of the connected generation, consumption and distribution systems. The requirements address following aspects of LFC process: LFC structure and operational rules, quality criteria and targets, reserve dimensioning, reserve exchange, sharing and distribution and monitoring;		
(7) Close cooperation between TSOs should take place in due compliance with the principle of confidentiality as established in Article 16(1) of Directive 2009/72/EC;		
(8) In terms of LFC structure and operational rules, this Network Code introduces rules regarding FCR, FRR and RR control processes that shall set a basis for an efficient and effective Load-Frequency Control in the European Union. FCR shall aim at containing the frequency drop after an incident within a pre-defined range. FRR shall aim at restoring the frequency to its Nominal Frequency of 50 Hz. RR replace the activated reserves to restore the available reserves in the system or for economic optimisation;		
(9) The establishment of Load-Frequency Control Structure shall allow the efficient and effective load-frequency control in each Synchronous Area. The frequency quality target is defined at the level of the Synchronous Area, as the frequency is common parameter for a whole Synchronous Area. The Synchronous Area comprises of one or, in case of large Synchronous Area, more LFC Blocks. The frequency restoration quality is defined at the level of the LFC Block. In order to achieve maximum efficiency each LFC Block comprises of one or more LFC Areas. This control structure design allows to establish clear rules for TSO responsibilities and to create incentives for cooperation at LFC Block or Synchronous Area level. The choice of Load-Frequency Control Structure per Synchronous Area should be based on the number of TSOs involved and on the level of complexity congestion management on the transmission system;		
(10) The common frequency quality target defined at the Synchronous Area level shall contain Frequency Quality Target Parameters and Frequency Quality Evaluation Criteria. The FCP shall be established at Synchronous Area level as a common process. A list of the total amount of reserves needed per Synchronous Area and the share of reserves that each TSO of the Synchronous Area shall be able to provide should be defined on Synchronous Area level;		
(11) The FRP and the RRP shall be established at LFC Block level and shall contain the amount of reserves needed per LFC Block. The quality target values per TSO for the frequency restoration shall be defined per LFC Block and derived from the common frequency quality target established per Synchronous Area;		
(12) The operation of load-frequency control, as a core TSO responsibility, shall be defined at the level of the LFC Area in form of automatic and manual control;		
(13) This Network Code delivers the basis to determine the amount of reserves needed per FCP, FRP and RRP with respect to the required quality;		
(14) The efficiency of load-frequency control shall be enhanced by cross-border exchange, sharing and activation of reserves and imbalance netting. This exchange relates to the FCP, the FRP, and the RRP as well as to the Imbalance Netting Process. The cross-border exchange shall be treated within a Synchronous Area or between Synchronous Areas. The Network Code shall establish restrictions to the cross-border exchanges where needed from a technical point of view.		
(15) This Network Code has been drafted in accordance with the Article 8(7) of Regulation (EC) No 714/2009 according to which the Network Codes shall be developed for cross-border network issues and market integration issues and shall be without prejudice to the Member States' right to establish national Network Codes which do not affect cross-border trade.		
HAS ADOPTED THIS NETWORK CODE:		

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Chapter 1		
GENERAL PROVISIONS		
Article 1		
SUBJECT MATTER AND SCOPE		
1. This Network Code defines the requirements and principles for load-frequency control and reserves applicable to all TSOs, Reserve Connecting DSOs and Providers.		
2. This Network Code aims at:		
a) achieving and maintaining a satisfactory level of frequency quality and efficient utilisation of the power system and resources;		
b) ensuring coherent and coordinated behaviour of the transmission networks and power systems in real-time operation;		
c) determining common requirements and principles for FCR, FRR and RR; determining common requirements for cross-border exchange, sharing and activation of reserves		
3. In accordance with the Article 8(7) of Regulation (EC) N° 714/2009, this network code shall not apply to small isolated systems and to micro isolated systems.		
4. Power systems operating under synchronous mode in the area, in which not all the systems are bound by the EU legislation, the provisions of this Network Code shall apply only to the extent they could be duly applied and implemented within the entire Synchronous Area as long as these power systems are operating therein, taking into account the physical and technical nature of frequency regulation implemented in the whole Synchronous Area.		The equivalent current GB codes which cover these matters are operating codes, connection codes and SQSS located on the National Grid Electricity Codes web-site: http://www.nationalgrid.com/uk/Electricity/Codes/
Article 2		
DEFINITIONS		
1. For the purpose of this Network Code, the definitions contained in Article 2 of Directive 2009/72/EC and in Article 2 of Regulation (EC) N°714/2009 apply. The definitions contained in the Article [2] of the [NC RfG], [NC CACM], [NC DCC], [NC OS] and [NC OPS] shall also apply.		
2. The following definitions shall apply in addition:		
1-minute Average Frequency Data means the set of data consisting of the average values of the recorded Instantaneous Frequency Data over a period of 1 minute each;		
1-minute Average Frequency Deviation Data means the set of data consisting of the average values of the difference between the Nominal Frequency and the recorded Instantaneous Frequency Data over a period of 1 minute each;		
Activation deviation for FCR means the rated value of Frequency Deviation at which the FCR activation starts;		
Adjacent LFC Blocks means LFC Blocks having a common electrical border;		
Adjacent Monitoring Areas means Monitoring Areas having a common electrical border;		
Affected TSO means the TSO for which the impact in case of a cross-border exchange and/or sharing agreement of reserves and/or Imbalance Netting Process and/or cross-border activation processes in terms of electricity flows within its LFC Area exceeds a certain threshold;		
Anti-Windup Logic means a control algorithm which prevents the integral term of a proportional-integral controller from accumulating the control error and overshooting;		A control structure used in automatic processes to prevent in-appropriate feedback in the control logic
Area Control Error (ACE) means the he sum of the instantaneous difference between the actual and the set-point value (measured total power value and Control Program including Virtual Tie-Lines) for the power interchange of a LFC Area or a LFC Block and the frequency bias given by the product of the K-Factor of the LFC Area or the LFC Block and the Frequency Deviation**;**		A mechanism widely used to apportion controls where control responsabilities in a synchronous area are split between various actors. K-factor (a synchronous area specific value which shows relationship between MW imbalance and frequency deviation).
Area Control Error open loop (ACEol) means the sum of ACE, Imbalance Netting Power Interchange, internal FRR activation, internal RR activation, cross-border FRR activations and cross-border RR activations of a LFC Area or LFC Block;		
Automatic FRR means FRR that can be activated by an automatic control device;		Automatic FRR - the definition of automatic being something which works without human intervention based on pre-programmed criteria - nominally a frequency set-point. The fact it is FRR means that it is activated beyond the criteria for FCR full activation and rather than 'Containment' is used to help 'Restore' the frequency back to its 50Hz nominal value.
Automatic FRR Activation Delay means the period of time between the set point change and the commencement of Automatic FRR delivery;		
Automatic FRR Full Activation Time means the time period between the set point change and the corresponding full activation of Automatic FRR;		
Automatic FRR Full Activation Time means the time period between the set point change and the corresponding full activation of Automatic FRR;		
Available Transmission Capacity (ATC) means the transmission capacity which can be used for Imbalance Netting Power, Frequency Restoration Power and Replacement Power interchange without endangering the Operational Security;		
Average Frequency Restoration Control Error Data means the Set of data consisting of the average value of the recorded instantaneous Frequency Restoration Control Error of a LFC Area or a LFC Block within a given measurement period time;		
Control Program means the set-point value (schedule) for the netted power interchange of a LFC Area over Tie-Lines;		
Criteria Application Process means the process of calculation of the target parameters for the Synchronous Area, the LFC Block and the LFC Area based on the data obtained in the Data Collection and Delivery Process;		
Cross-Border FRR Activation Process means a process agreed between the TSOs participating in the process that allows for activation of FRR connected in a different LFC Area by correcting the input of the involved FRPs accordingly;		
Cross-Border RR Activation Process means a process agreed between the TSOs participating in the process that allows for activation of RR connected in a different LFC Area by correcting the input of the involved RRP accordingly;		
Data Collection and Delivery Process means the Process of collection of the set of data necessary in order to perform the Frequency Quality Evaluation Criteria;		
Deterministic Frequency Deviation (DFD) means a frequency deviation that belongs to a regularly repeating pattern within normal system operation.		When looking at the frequency trace for any given synchronous area there is a general pattern of oscillation with a standard period. The period of the background frequency oscillation in GB varies slightly according to generation/load type and the level of demand (between 10 and 20 minutes).
Dimensioning Incident means the highest expected instantaneously occurring imbalance within a LFC Block in both positive and negative direction;		This relates to the largest loss criteria applied in GB currently. That is either largest generation loss or largest demand loss.
Electrical Time Deviation means the time discrepancy between synchronous time and Universal Time Coordinated (UTC);		
Elevated Synchronous Area State means the Synchronous Area alert state; active if High Synchronous Area State is not active and the 1 Minute Moving Average of the Frequency Deviation is outside 75 % of the Maximum Steady State Frequency Deviation for at least the Time to Restore Frequency;		A value used to communicate between TSOs within a synchronous area. This value is currently tuned to Continental Europe's requirements.
Exchange of Reserves means a concept for reserves connected in one LFC Area, LFC Block, or Synchronous Area but exclusively taken into account in the Dimensioning Process by to a single TSO responsible for another LFC Area, LFC Block or Synchronous Area;		The reserve provider and the reserve providing units are physically located in one Area but the reserves are made available exclusively to a TSO in another area to enable them to meet their own FCR, FRR or RR needs.

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FCR Full Activation Frequency Deviation means the rated value of Frequency Deviation at which the FCR in a Synchronous Area is fully activated;		
FCR Full Activation Time means the time period between the occurrence of the Reference Incident and the corresponding full activation of the FCR;		Within GB this is the criteria in Table 1
FCR Obligation means the part of all of the FCR that falls under the responsibility of a TSO;		For GB all FCR is under the observation/control of a single TSO. Large embedded generation may also be included.
Frequency Containment Process (FCP) means a process that aims at stabilizing the frequency by compensating imbalances by means of appropriate reserves;		
Frequency Containment Reserves (FCR) means the Operational reserves activated to contain System Frequency after the occurrence of an imbalance;		It is important to note that this definition is for a "Reserve Criteria" and not a specific product. Thus all reserve which help provide stabalisation of the frequency trace or contain the frequency in the case of losses. These reserves may be either dynamic (providing continuously and monotonically increasing support along a curve associated with a Hz deviation as per synchronous generation or dynamic services from inverter/converters) or static services which deliver fixed MW contributions when a frequency Hz deviation is reached.
Frequency Deviation means the difference between the actual System Frequency and the Nominal Frequency of the Synchronous Area which can be negative or positive;		The Delta deviation. Within this code, usually refered to as a value in milli-Herz
Frequency Quality Defining Parameters means the main System Frequency variables that define the principles of Frequency Quality. These parameters reflect the system behaviour in normal operation by design;		
Frequency Quality Evaluation Criteria means the criteria set determined in order to evaluate the Frequency Quality with reference to the Frequency Quality Target Parameters;		Target paramters within the synchrnous are to which all TSOs must work towards in order to maintain frequency quality.
Frequency Quality Evaluation Data means the set of data used to evaluate the Frequency Quality Evaluation Criteria;		
Frequency Quality Target Parameter means the main System Frequency target variables on basis of which the behaviour of the FRR and RR of the LFC Block is evaluated in Normal State;		
Frequency Range within Time to Recover Frequency means the System Frequency range to which the System Frequency is expected to return after the occurrence of an imbalance equal to or less than the Reference Incident within the Time To Recover Frequency		
Frequency Range within Time to Restore Frequency means the System Frequency range to which the System Frequency is expected to return after the occurrence of an imbalance equal to or less than the Reference Incident within the Time To Restore Frequency;		
Frequency Restoration Control Error means the control error for the FRP which is equal to the ACE of a LFC Area or is equal to the Frequency Deviation where the LFC Area geographically corresponds to the Synchronous Area		A further set of quality parameters used in the management of the system. These concepts are principally for use in a Synchronous Area comprised of multiple LFC Blocks and multiple TSOs to ensure appropriate contribution and behaviour of each member of the collective.
Frequency Restoration Controller means an automatic control device that aims at reducing the Frequency Restoration Control Error to zero;		
Frequency Restoration Control Error Target Parameters means the main LFC Block variables on basis of which the state and dimensioning criteria for FRR and RR of the LFC Block are determined and evaluated. These parameters reflect the LFC Block behaviour in normal operation.		
Frequency Restoration Power Interchange means the Power which is interchanged between one or more LFC Areas within the Cross-Border FRR Activation Process;		
Frequency Restoration Process (FRP) means a process that aims at restoring frequency to the Nominal Frequency and for Synchronous Area consisting of more than one LFC Area power balance to the scheduled value;		
Frequency Restoration Reserves (FRR) means the Operational Reserves activated to restore System Frequency to the Nominal Frequency and for Synchronous Area consisting of more than one LFC Area power balance to the scheduled value;		To aleviate the FCR category products which have been activated to contain a frequency deviation, it is necessary to activate FRR to restore the frequency to 50Hz and also to aleviate the FCR. Within GB and Ireland there is the concept of products or services from reserve providers which straddle the boundaries. It is possible thus for an FCR provide to continue to assist beyond the minimum delivery period criteria and also assist in restoration; equally it is possible for FRR providers and RR providers to come from the same Reserve Providing Units. The destinction is more important to the TSO or LFC Block which must ensure enough capability/holding (or dimensioning) within each category.
FRR Availability Requirements means a set of requirements defined by the TSOs of a LFC Block regarding the availability of FRR;		
FRR Dimensioning Rules means the specifications of the FRR dimensioning process of a LFC Block;		The process/approach used by the LFC Block TSOs to ensure appropriate levels of RR are held to manage the number of dimensioned incidents in a given period.
FRR Prequalification Process means the process in which the Reserve Connecting TSO qualifies a single generating or demand facility or a conglomeration of these as a FRR Providing Unit;		
High Synchronous Area State means the Synchronous Area alert state; active if the 1 Minute Moving Average of the Frequency Deviation is above 90 % of the Maximum Steady State Frequency Deviation for at least one third of the Time to Restore Frequency;		
Imbalance Netting Power Interchange means the power which is interchanged between one or more LFC Areas within the Imbalance Netting Process;		
Imbalance Netting Process means a process agreed between TSOs of two or more LFC Areas within one or more than one Synchronous Areas that allows for avoidance of simultaneous FRR activation in opposite directions by taking into account the respective Frequency Restoration Control Errors as well as activated FRR and correcting the input of the involved FRPs accordingly;		For GB this Imbalance Netting Process could theoretically apply to FCR, FRR or RR reserve categories. Netting requires a common controller which monitors imbalance in connected areas and prevents unnecessary activation of reserves in opposing directions by permitting (on AC) or programming (on DC) a change in transfers between those areas, there by partially or fully cancelling-out the imbalance between the two or more areas.
Initial FCR Obligation means the amount of FCR allocated to a TSO on the basis of a general sharing key;		Not currently an issue for GB with a single NETSO. For synchonous areas with more than one LFC Block/TSO the k-sharing factor is calculated on a regular basis and each TSO/LFC Block must ensure they meet their portion of the overall requirement.
Instantaneous Frequency Data means a set of data measurements of the overall System Frequency for the Synchronous Area with a very small measurement period used for System Frequency quality evaluation purposes;		
Instantaneous Frequency Restoration Control Error Data means a set of data of the Frequency Restoration Control Error for a LFC Block with a with a very small measurement period used for System Frequency quality evaluation purposes;		
K-Factor means a factor used to calculate the frequency bias component of the ACE of a LFC Area or a LFC Block;		The sensitivity factor of the synchronous area - this is the standardised relationship between Hz deviation and MW.
Level 1 LFC Block Threshold means a threshold which is exceeded if the 1-minute average of the Frequency Restoration Control Error is above the Level 1 Frequency Restoration Control Error Range for at least the Time To Restore Frequency;		
Level 2 LFC Block Threshold means a threshold which is exceeded if the 1-minute average of the Frequency Restoration Control Error is above the Level 2 Frequency Restoration Control Error Range for at least the Time To Restore Frequency;		
Level 1 Frequency Restoration Control Error Range means a Frequency Restoration Control Error Defining Parameter used for System Frequency quality evaluation purposes;		For GB the intention is to make this equivalent to the "Maximum Steady State Frequency Devliation" (operational limit)
Level 2 Frequency Restoration Control Error Range means a Frequency Restoration Control Error Defining Parameter used for System Frequency quality evaluation purposes;		For GB the intention is to make this equivalent to the "Maximum Steady State Devliation" (statutory limit)
LFC Block Imbalances means the sum of the Frequency Restoration Control Error, FRR Activation and RR Activation of a LFC Block;		
LFC Block Monitor means a TSO responsible for collecting the Frequency Quality Evaluation Criteria Data and applying the Frequency Quality Evaluation Criteria for the LFC Block;		

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Load-Frequency Control Structure means the basic structure considering all relevant aspects of Load- Frequency Control in particular concerning respective responsibilities and obligations (Process Responsibility Structure) as well as types and purposes of Operational Reserves (Process Activation Structure);		
Load-Frequency Control Area (LFC Area) means a part of a Synchronous Area or an entire Synchronous Area, physically demarcated by points of measurement of Tie-Lines to other LFC Areas, operated by one or more TSOs fulfilling the obligations of a LFC Area;		
Load-Frequency Control Block (LFC Block) means a part of a Synchronous Area or an entire Synchronous Area, physically demarcated by points of measurement of Tie-Lines to other LFC Blocks, consisting of one or more LFC Areas, operated by one or more TSOs fulfilling the obligations of a LFC Block;		
Manual FRR Full Activation Time means the time period between the set point change and the corresponding full activation of Manual FRR;		This is reserve which responds to despatch instructions from the SO. The 'set point change' is the time the instruction issued for a new target MW level. The 'Full Activation Time' is the time to achieve target MW. This is roughly equivalent to the the Notice to Bid or Notice to Offer added to the total ramping time under current GB BM rules.
Maximum Electrical Time Deviation means the maximum deviation of the system time (the time integral of the System Frequency) from UCT, agreed by TSOs of the Synchronous Area;		
Maximum Instantaneous Frequency Deviation means the maximum expected absolute instantaneous Frequency Deviation after the occurrence of an imbalance equal or less than the Reference Incident, beyond which emergency measures are activated.		
Maximum Steady-State Frequency Deviation means the maximum expected Frequency Deviation after the occurrence of an imbalance equal or less than the Reference Incident at which the System Frequency is designed to be stabilized;		
Monitoring Area means a part of the Synchronous Area or the entire Synchronous Area, physically demarcated by points of measurement of Tie-Lines to other LFC Areas, operated by one or more TSOs fulfilling the obligations of a Monitoring Area;		
Nominal Frequency means the rated value of the System Frequency in a power system;		
Normal Synchronous Area State means the Synchronous Area alert state; active if neither Elevated Synchronous Area State nor High Synchronous Area State are active;		This is the condition of normal operation when everything is working to plan and all credible security issues can be managed with the reserves available.
Notification Process means the process in which a TSO notifies an exchange and/or sharing agreement with another TSO to the other TSOs;		Part of an SO-SO activity
Operational Reserves means the spinning and non-spinning reserves that are accessible to at least one TSO;		
Prequalification means the Process to verify the compliance of a Reserve Providing Unit of kind FCR, FRR or RR with the requirements set by the TSO;		Prequalification applies to Reserve Providers and Reserve Providing Units. Providers must meet this criteria in order to be permitted to register and contract as a reserve provider. The specific requirements shall be defined according to local requirements at the time of registration by the relevant reserve connecting TSO.
Process Activation Structure means the structure to categorize the processes concerning the different types of Operational Reserves in terms of purpose and activation;		Different Reserves have different processes for activation and properties (ie speed of activation and length of delivery) the TSO must use them appropriately according to need for containtment, restoration or replacement….
Process Responsibility Structure means the structure to determine responsibilities and obligations with respect to Operational Reserves based on Area Types;		
Provider means an entity operating a Reserve Providing Unit or a Reserve Providing Group;		
Reference Incident means the maximum instantaneously occurring power deviation between generation and demand in a Synchronous Area in both positive and negative direction considered in the FCR dimensioning;		In GB terms this is a largest credible loss criteria, whether generation or demand
Replacement Power Interchange means the power which is interchanged between one or more LFC Areas within the Cross-Border RR Activation Process;		SO-SO activated reserves
Replacement Reserves (RR) means the reserves used to restore/support the required level of FRR to be prepared for further system imbalances. This category includes operating reserves with activation time from Time to Restore Frequency up to hours;		This is a reserve category. In general products for reserves which reach their target generation level outside of the TimetoRestoreFrequency would be considered to fall within the category of RR. This is generally used to alleviate generation used in the FRR and FCR categories, to ensure the system can cope with the next credible incident.
Reserve Capacity means the amount of FCR, FRR or RR that needs to be available to the TSO;		This will be published minimum requirement. Within GB the current approach to target reserve levels will continue to apply according to how far ahead of real-time the calculation is performed.
Reserve Connecting DSO means the DSO responsible for the Grid to which a Reserve Providing Unit or Reserve Providing Group is connected to providing Reserves to a TSO.		DSO is a new term which replaces the GB 'DNO'.
Reserve Connecting TSO means the TSO responsible for the Monitoring Area to which a Reserve Providing Unit is connected to;		The TSO where the unit is physically/electrically connected.
Reserve Providing Group: A conglomeration of generating and/or demand facilities that are located in the area of one single Reserve Connecting TSO together providing reserves of kind FCR, FRR or RR to a TSO and which together fulfil the requirements of the Reserve Connecting TSO;		The concept of a Reserve Providing Group comes from practices in Germany at present. However island operations on a system of the size of GB require that the SO maintains total control over which units provide reserves and where they are located on the electrical system. Thus grouping will be by exception rather then the normal approach to reserve provision.
Reserve Providing Unit means a single generating or demand facility providing reserves of kind FCR, FRR or RR to a TSO and fulfilling the requirements of the Reserve Connecting TSO;		
Reserve Receiving TSO means the TSO involved in an exchange or sharing agreement with a TSO and/or Reserve Providing Unit from another LFC Area;		
Reserve Replacement Process (RRP) means a process to restore activated FRR and additionally for Cyprus, GB and Ireland to restore the activated FCR.		
Reserve Sharing means a mechanism by which more than one TSO take the same reserves, being FCR, FRR or RR, into account to fulfil their respective reserve requirements resulting from the reserve dimensioning process.		Reserve sharing is a method by which two or more TSOs create a common pool of reserve with any of the partipating TSOs can call upon.
RR Availability Requirements means a set of requirements defined by an area regarding the availability of RR;		These specific technical requirements will be applied locally by the receiving area. These may take the form of registration/policy for those physically connected and participating locally or a declaration for services received from ouside GB via exchange or sharing mechanisms.
Set Point Frequency means the Frequency target value for FRR. In general the sum of the Nominal System Frequency and an offset value needed to reduce an Electrical Time Deviation;		The term set-point means different things by reserve category. AGC providers will receive an instruction to change MW output; Manual instructions this relates the target MW; for static services it would translate to the frequency sensitive trigger point (ie LF/HF services)
Standard Frequency Range means a defined interval symmetrically around the Nominal Frequency within which the System Frequency of a Synchronous Area is supposed to be operated;		This is what in GB is currently known as the 'Operational Limits' for system frequency.
Synchronous Area means an area covered by interconnected TSOs with a common System Frequency in a steady operational state such as the Synchronous Areas Continental Europe (CE), Cyprus (CY), Great Britain (GB), Ireland (IRE) and Northern Europe (NE) and the power systems of Lithuania, Latvia and Estonia (Baltic) as a part of a synchronous area;		
Synchronous Area Agreement means a multi-party agreement between all TSO of a Synchronous Area if the Synchronous Area consists of not only one TSO; if a Synchronous Area consists only of one TSO it means a formal declaration of the obligations defined in this NC;		This is a document which will need to be created within each Synchronous Area. For GB this document will cover all those TO, SO (OFTO etc) and Interconnector Owner to deliniate responsabilities under this code. The theme of managing/coordinating actions to establish and maintain frequency quality related aspects remain the sole domain of the GB NETSO.
Synchronous Area Monitor means a TSO responsible for collecting the Frequency Quality Evaluation Criteria Data and applying the Frequency Quality Evaluation Criteria for the LFC Block;		the specifics shall be defined within our GB Synchronous Area agreement. This role is interpreted to a responsibility that lies with a GB TO to provide system state data to the NETSO.
System Frequency is the electric frequency of the system that can be measured in all network areas of the synchronous system under the assumption of a coherent value for the system in the time frame of seconds (with minor differences between different measurement locations only).		A value unique to each Synchronous Area
Tie-Line means a transmission line that connects different areas excluding HVDC interconnectors;		This definition is under review. A tie-line is any electrical transmission path connecting two or more adjacent areas. Ie it defines the boundary point of any given area of control responsibility;
Time Control Process: Time control is a control action carried out to return the Electrical Time Deviation between synchronous time and UTC time to zero.		
Time To Restore Frequency means the maximum expected time after the occurrence of an imbalance smaller than or equal to the Reference Incident in which the System Frequency returns to the Frequency Range Within Time To Restore Frequency for Synchronous Areas with only one LFC Area or for Synchronous Areas with more than one LFC Area the maximum expected time after the occurrence of an imbalance of an LFC Area within which the imbalance is compensated;		The maximum time that a frequency deviation should remain outside of Frequency Range Within Time to Restore Frequency (Operational Limits) for a loss of MW less than or equal to the largest loss. For GB the NETSO currently dimensions so as to always be able to bring the system back to within operational limits within 10 minutes of the credible incident.

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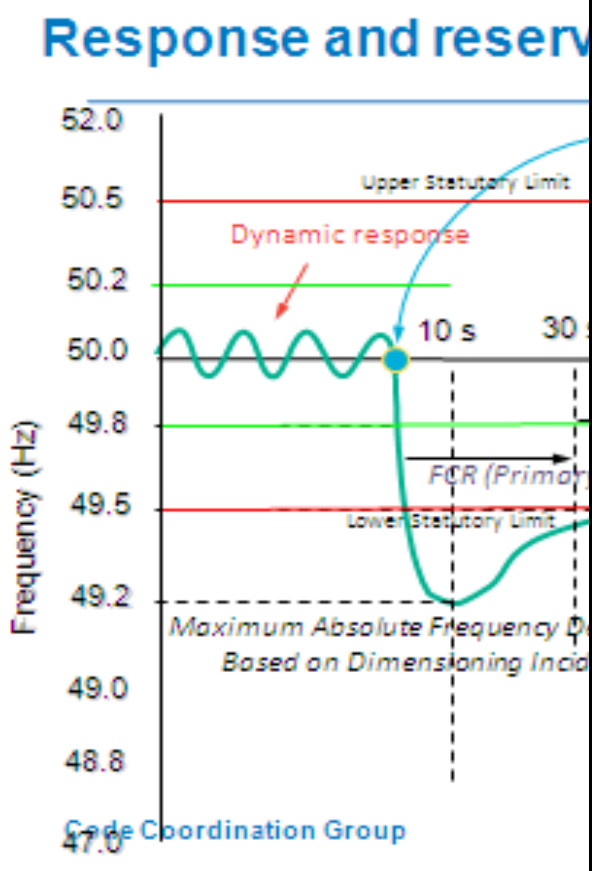
Time To Recover Frequency means the maximum expected time after the occurrence of an imbalance smaller than or equal to the Reference Incident in which the System Frequency returns to the Maximum Steady State Frequency Deviation;		For GB the NETSO currently operates to a target of 60 second to return the system within Maximum Steady State Frequency Deviation (500mHz 'Statutory') for incidents that are of a dimensioned size or less.
Virtual Tie-Line means an additional input of the controllers of the involved areas that has the same effect as a measuring value of a physical Tie-Line and allows exchange of electric energy between the respective areas		Used for settlement purposes. When reserves are procured across borders or netting takes place, volumes are allocated to virtual entities in order to manage imbalance settlement process.
Article 3		
REGULATORY ASPECTS		
1. The requirements established in this Network Code and their applications are based on the principle of non-discrimination and transparency as well as the principle of optimisation between the highest overall efficiency and lowest total cost for all involved parties.		
2. Notwithstanding the above, the application of the principle of non-discrimination and the principle of optimisation between the highest overall efficiency and lowest total costs while maintaining Operational Security as the highest priority for all involved parties shall be balanced with the aim of achieving the maximum transparency in issues of interest for the market and the assignment to the real originator of the costs.		
3. Where reference is made to this paragraph, the TSO shall, after consultation with its national regulatory authority, establish the terms and conditions or actions necessary to ensure Operational Security in accordance with the principles of transparency, proportionality and non-discrimination. The establishment of these terms and conditions or actions necessary to ensure Operational Security shall be performed in compliance with and respecting the TSO's responsibility to ensure system security according to national legislation.		
Article 4		
RECOVERY OF COSTS		
1. The costs related to the obligations referred to in this Network Code which have to be borne by regulated Transmission System Operators shall be assessed by National Regulatory Authorities.		
2. Costs assessed as reasonable and proportionate shall be recovered in a timely manner via network tariffs or appropriate mechanisms as determined by National Regulatory Authorities.		
3. If requested to do so by National Regulatory Authorities, regulated Transmission System Operators shall, within three months of such a request, use best endeavours to provide such additional information as reasonably requested by National Regulatory Authorities to facilitate the assessment of the costs incurred.		
Article 5		
CONFIDENTIALITY OBLIGATIONS		
1. Each TSO, Reserve Connecting DSO or Provider shall preserve the confidentiality of the information and data submitted to them in connection with this Network Code and shall use them exclusively for the purpose they have been submitted in compliance with this Network Code.		
2. Notwithstanding the above, disclosure of such information and data may occur in case a TSO or a Reserve Connecting DSO is compelled under relevant EU or national law to disclose it, under the conditions set forth in the relevant legislation. Such disclosure shall be reported to the owner of such information and data.		
3. In case of disclosure for other purposes than those described in Article 5(2) above, a TSO or a Reserve Connecting DSO shall seek the consent of the owner of such information and data based on reasoned request. This consent cannot be unreasonably withheld.		
Article 6		
Agreement with TSOs not bound by this Network Code		
1. No later than 12 months after entering into force of this Network Code all TSOs except the TSOs of the power systems of Lithuania, Latvia and Estonia within a Synchronous Area shall implement a Synchronous Area Agreement to ensure, that TSOs with no legal obligation to respect this Network Code, belonging to the Synchronous Area, also cooperate to fulfil the requirements.		
2. No later than 12 months after entering into force of this Network Code the TSOs of the power systems of Lithuania, Latvia and Estonia shall endeavour to implement a Synchronous Area Agreement including the requirements of this NC.		
Article 7		
TSO Cooperation		
1. Where the TSOs of a Synchronous Area are required to adopt a decision in accordance with this Network Code, all TSOs of a Synchronous Area shall cooperate loyally to adopt the decision.		
2. Where the TSOs of a Synchronous Area are required to adopt a decision in accordance with this Network Code, ENTSO-E shall facilitate the adoption of decisions.		

ENTSO-E Network Code Text		Commentary
Chapter 2		
FREQUENCY QUALITY		
Article 8		
TSO CO-OPERATION		LFC area and single Synchronous Area. The NETSO is empowered and accountable for all TSO activities defined in this code within GB. However other TSOs may have block monitor status. Further work within the code drafting team is ongoing to clarify the System Operator role. Other aspects will be resolved using the Synchronous Area agreement
1. All TSOs of a Synchronous Area shall define or amend the definition of:		
a) the Frequency Quality Target Parameters and the Frequency Quality Defining Parameters in accordance with Article 9;		
b) the Frequency Restoration Control Error Target Parameters and the Frequency Restoration Control Error Defining Parameters for each LFC Block in accordance with Article 10;		
c) the Data Collection and Delivery Process in accordance with Article 11;		
d) the Criteria Application Process in accordance with Article 12;		
e) the Frequency Quality Evaluation Criteria in accordance with Article 12; and		
f) the publication of results in accordance with Chapter 10.		
Article 9		
FREQUENCY QUALITY Defining and TARGET PARAMETERS		
1. TSOs of a Synchronous Area shall use the following Frequency Quality Defining Parameters:		
a) Nominal Frequency		50Hz
b) Standard Frequency Range;		Operational Range as used in GB 200mHz
c) Maximum Instantaneous Frequency Deviation;		Largest deviation according to the largest loss criteria in GB 800mHz
d) Maximum Steady-State Frequency Deviation;		Statutory Range as used in GB 500mHz
e) Time to Restore Frequency; and		Time to get back to operational range ie 10minutes
f) Time to Recover Frequency; and		Time to get back into statutory range ie 60 seconds
g) Frequency Range within Time to Restore Frequency		Statutory Range as used in GB 500mHz
2. TSOs of a Synchronous Area shall use the Frequency Quality Defining Parameters listed in (1) whose corresponding values are in Table 1.		

	Baltic	CY	CE	GB	IRE	NE
Nominal Frequency	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz
Standard Frequency Range	±50 mHz	±100 mHz	±50 mHz	±200 mHz	±200 mHz	±100 mHz
Maximum Instantaneous Frequency Deviation	800 mHz	1200 mHz	800 mHz	800 mHz	1000 mHz	800 mHz
Maximum Steady-state Frequency Deviation	200 mHz	500 mHz	200 mHz	500 mHz	500 mHz	500 mHz
Time to Recover Frequency	not used	not used	not used	1 minute	1 minute	not used
Frequency Range Within Time To Recover Frequency	not used	not used	not used	±500 mHz	±500 mHz	not used
Time To Restore Frequency	15 minutes	20 minutes	15 minutes	10 minutes	20 minutes	15 minutes
Frequency Range Within Time To Restore Frequency	not used	±100 mHz	not applicable	±200 mHz	±200 mHz	±100 mHz

Table 1 : Frequency Quality Defining Parameters of the Synchronous Areas



3. The TSOs of a Synchronous Area shall use the maximum number of minutes outside the Standard Frequency Range per year defined in Table 2 as Frequency Quality Target Parameter.	**These values are not finalised at this time. They are still being evaluated.**

ENTSO-E Network Code Text		Commentary

	Baltic	CE	CY	GB	IRE	NE
Maximum number of minutes outside the Standard Frequency Range	To be filled in.	To be filled in.	To be filled in.	15000	To be filled in.	To be filled in.

Table 2 : Frequency Quality Target Parameters of the Synchronous Area

These values are those currently used by GB as targets. Current method relies on managing the number of incidents outside limts to 1500 per year. Hence in new terminology 1500 x timetorestorefrequency = 15000 minutes.

** These values are still being reviewed.

4. While respecting the provisions of Article 3(3), the TSOs of a Synchronous Area shall agree on a common proposal for setting or changing the value of each Frequency Quality Defining Parameter and each Frequency Quality Target Parameters at least every five years taking into account factors including, but not limited to:

a) size of consumption and of generation of the Synchronous Area and inertia of the Synchronous Area;

b) grid structure and/or network topology; and

c) load and generation behaviour

d) For all Synchronous Areas except the Synchronous Areas IRE and GB: results of probabilistic simulations considering that it is only admissible having an event probability of one in twenty years in which there is a large-scale incident in the Synchronous Area due to lack of FCR.

This five yearly review mechanism and other decision making process will be considered for GB during implementation. It is expected to look similar to current code review structures, however where the aspect being considered has an international impact/interaction it will need to be dealt with by European processes.

block synchronous areas. This part of the code is still being worked upon and GB will have its own specific criteria since this Synchronous Area is driven from frequency whilst Continental Europe drives from LFC Block error (MW calculation). The translation between frequency and MW uses a k-factor (standardised inertia). However for GB there would be the requirement to continuously recalculate this relationship.

*****GB has proposed significant seperation of requirements and parameters by Synchronous Area to allow for differences.**

Article 10

FREQUENCY RESTORATION CONTROL ERROR TARGET PARAMETERS

1. The TSOs of a Synchronous Area shall define and use the following Frequency Restoration Control Error Defining Parameters for each LFC Block of a Synchronous Area for the next year with the goal of respecting the provisions of :

a) Level 1 Frequency Restoration Control Error Range and

b) Level 2 Frequency Restoration Control Error Range ;

For GB it is proposed to set this value to "Standard Frequency Range"
For GB it is propsed to set this value to "Maximum Steady State Frequency Range"

The TSOs of a Synchronous Area with more than one LFC Block shall ensure that the Level 1 Frequency Restoration Control Error Ranges and the Level 2 Frequency Restoration Control Error Ranges of the LFC Blocks of this Synchronous Area are proportional to the square root of the Initial FCR Obligations of the LFC Blocks.

2. The TSOs of a Synchronous Area shall agree on setting the value of the Frequency Quality Target Parameters for each LFC Block of the Synchronous Area at least every year.

3. The TSOs of a Synchronous Area shall use the following Frequency Restoration Control Error Target Parameters for each LFC Block of a Synchronous Area:

a) maximum number of time intervals outside the Level 1 Frequency Restoration Control Error Range within a time interval equal to the Time to Restore Frequency, per year shall be equal to 30% of the time intervals in the year;

b) maximum number of time intervals outside the Level 2 Frequency Restoration Control Error Range within a time interval equal to resolution the Time to Restore Frequency, per year shall be equal to 5% or the time intervals in the year.

4. Where a Control Block consists of more than one LFC Area, all TSOs of the LFC Block shall define in a TSO multi-party agreement the Frequency Restoration Control Error Defining Parameters and Frequency Restoration Control Error Target Parameters for each LFC Area complying with Article 10(1) and Article 10(2).

Separate clauses for GB are being proposed based on the frequency quality behaviour of the GB system the values here are for continental Europe's MW ACE and will not apply to GB. GB is proposing using Frequency values rather than ACE since there is only a single LFC Block and the nature of operations in GB means that an ACE would need to be continually recalculated based on the instantaneous k-factor (inertia). Europe intends to use a annual standardised k-factor. This would not be appropriate in GB.

***GB has proposed new values based on current standard deviation of frequency quality

Within GB, it is the NETSO will perform all functions associated with this section

Article 11

DATA COLLECTION AND DELIVERY PROCESS

1. The Data Collection and Delivery Process shall comprise the following:

ENTSO-E Network Code Text		Commentary
a) measurements of the System Frequency;		
b) calculation of the Frequency Quality Evaluation Data; and		
c) delivery of the Frequency Quality Evaluation Data for the Criteria Application Process.		
2. All TSOs of a Synchronous Area shall define in a Synchronous Area Agreement the list of Frequency Quality Evaluation Data, which shall include:		
a) for the Synchronous Area:		
i. Instantaneous Frequency Data;		
ii. 1-minute Average Frequency Data; and		Frequency Quality and Error values are to be derived based upon 1-minute averaged frequency data
iii. 1-minute Average Frequency Deviation Data.		
b) for each LFC Block of the Synchronous Area:		
i. Instantaneous Frequency Restoration Control Error Data; and		This is the Delta-Freq deviation data
ii. Average Frequency Restoration Control Error Data within a time interval equal to the Time to Restore Frequency for each LFC Block of the Synchronous Area.		This is the averaged value over each 10 minute period.
3. All TSOs of a Synchronous Area shall define in a Synchronous Area Agreement measurement, calculation and information exchange parameters for the Frequency Quality Evaluation Data including but not limited to:		
a) measurement period;		
The measurement period of the Instantaneous Frequency Data and the Instantaneous Frequency Restoration Control Error shall be shorter than or equal to 10 seconds.		
b) measurement accuracy;		
The measurement accuracy of the Instantaneous Frequency Data shall be 1 mHz or better and of the Instantaneous Frequency Restoration Control Error (if not measured in Hz) shall be 1% or better.		
c) calculation method;		
The calculation of the 1-minute average data mentioned in (2) shall be performed by obtaining the sum of the instantaneous values of each measurement within the corresponding minute and dividing by the number of samples used in the minute.		
The calculation of the Average Frequency Restoration Control Error Data within a time interval equal to the Time to Restore Frequency mentioned in (2) shall be performed by obtaining the sum of the instantaneous values of each measurement within the corresponding time interval equal to the Time to Restore Frequency and dividing by the number of samples used in the time interval equal to the Time to Restore Frequency.		
d) file format and means of exchange.		
Article 12		
CRITERIA APPLICATION PROCESS and FREQUENCY QUALITY EVALUATION CRITERIA		
1. The Criteria Application Process shall comprise: a) the collection of Frequency Quality Evaluation Data; and b) the application of Frequency Quality Evaluation Criteria.		
2. The Frequency Quality Evaluation Criteria shall comprise: a) for the Synchronous Area i. 1-minute Average Frequency Data during a 3-month period for the Synchronous Area; ii. standard deviation of the 1-minute Average Frequency Data during a 3-month period for the Synchronous Area; iii. absolute Frequency Deviation range corresponding to the 95-percentile of the 1-minute Average Frequency Data during a 3-month period for the Synchronous Area; iv. total time during a 3-month period in which the instantaneous Frequency Deviation was greater than the Maximum Instantaneous Frequency Deviation; and v. number of 1-minute Average Frequency Data values during a 3-month period outside the Standard Frequency Range; b) for the LFC Block: i. average during a 3-month period of the values corresponding to the average within a time interval equal to Time To Restore Frequency of the Frequency Restoration Control Error of the LFC Block; iii. standard deviation during a 3-month period of the values corresponding to the average within a time interval equal to Time To Restore Frequency of the Frequency Restoration Control Error of the LFC Block; iv. absolute Frequency Restoration Control Error range corresponding to the 95-percentile of the values corresponding to the average within a time interval equal to Time To Restore Frequency of the Frequency Restoration Control Error of the LFC Block during a 3-month period; v. number of time intervals of a period equal to Time To Restore Frequency in which the average of the Frequency Restoration Control Error of the LFC Block is outside the Level 1 Frequency Restoration Control Error Range during a 3-month period; vi. number of time intervals of a period equal to Time To Restore Frequency in which the average of the Frequency Restoration Control Error of the LFC Block is outside the Level 2 Frequency Restoration Control Error Range during a 3-month period; and		These form the metrics used to evaluate the appropriateness of the TABLE 1 values, dimensioning requirments of each reserve cateogry and the performance of the TSO over any given period. GB does not have the same dimensioning approach to Continental Europe and hence a seperate set of criteria for GB are being derived. It is currently not proposed that this criteria apply to GB.

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vii. number of events for which after the occurrence of a Frequency Restoration Control Error of a LFC Block outside the Level 2 Frequency Restoration Control Error Range the Frequency Restoration Control Error of the LFC Block is not returned to 10% of the Level 2 Frequency Restoration Control Error Range within the Time to Restore Frequency during a 3-month period;		The GB NETSO continually readjusts the holding of reserves in each criteria and thus does much more optimisation to ensure the optimal balance between security and cost.
3. The TSOs of a Synchronous Area shall define in a Synchronous Area Agreement a common methodology to assess the risk and the evolution of the risk of FCR Exhaustion of the Synchronous Area. This methodology shall be performed at least on an annual basis and shall be based at least on historical System Frequency data. The TSOs of a Synchronous Area shall provide the required input data for this analysis.		Within GB, operational protocol is such that the NETSO does not tollerate insecure operation and action will be take to ensure necessary holdings of FCR, FRR and RR are maintained to meet our needs. The approach includes actions such as instructing further units to provide reserves, or reconfiguring to reduce the largest loss on the system.
Article 13		
SYNCHRONOUS AREA MONITOR		
1. All TSOs of a Synchronous Area shall appoint in a Synchronous Area Agreement one TSO of this Synchronous Area or the relevant body of ENTSO-E as the Synchronous Area Monitor.		
2. The Synchronous Area Monitor shall implement the Data Collection and Delivery Process of the Synchronous Area as defined in accordance with Article 11.		
3. The Synchronous Area Monitor shall implement the Criteria Application Process as defined in accordance with the Article 12.		
4. The Synchronous Area Monitor shall collect the Frequency Quality Evaluation Data regarding the Synchronous Area and perform the Criteria Application Process during a 3-month period within six months from the time stamp of the last value of the Frequency Quality Evaluation Data.		This is the NETSO for GB
Article 14		
LFC BLOCK MONITOR		The NETSO undertakes this role as part of its normal duties.
1. All TSOs of a LFC Block shall appoint in a multi-party agreement a TSO of this LFC Block as LFC Block Monitor for the LFC Block.		
2. The LFC Block Monitor shall collect the Frequency Quality Evaluation Data for the LFC Block in accordance with the Criteria Application Process defined in accordance with Article 12.		
3. Each TSO of a LFC Area shall provide the LFC Block Monitor with the necessary real-time LFC Area measurements needed for collecting Frequency Quality Evaluation Data for the LFC Block.		
4. The LFC Block Monitor shall deliver the Frequency Quality Evaluation Data regarding the LFC Block and its LFC Areas during a 3-month period to the Synchronous Area Monitor within 6 months from the time stamp of the last value of the Frequency Quality Evaluation Data.		
Article 15		
Mitigation Procedures		**Particularly significant clause**
1. If the values calculated for the measurement period of the Frequency Quality Target Parameters or the Frequency Restoration Control Error Target Parameters are respectively outside the set targets for the Synchronous Area or for the Control Block, all TSOs of the relevant Synchronous Area or of the relevant Control Block shall address to ACER and / or to NRAs a proposal which addresses the deficiency, this may include a modification to the rules including balancing markets and / or ancillary services markets and / or the rules for the behaviour of market participants in order to respect the established Frequency Quality Target Parameter values.		The right to review and modify the Frequency Quality target parameters requirements on Reserve Providers or other Market Rules. This clause permits the ammendment of target paremters as system behaviour develops and/or the technical properties and capabilities of connected demand and generation units evolve.
2. If the value of the Frequency Quality Target Parameter is not met for the Synchronous Area or there is a justified expected risk that the Frequency Quality Target Parameter will not be met, each TSO of the affected Synchronous Area shall have the right to establish actions to improve System Frequency quality while respecting the provisions of Article 3(3). These actions shall include restrictions on the rate of change of active power output or input to Generating Units, Demand Facilities, HVDC Interconnectors connected to the TSO network.		These terms allow the TSO to ensure system frequency stability by ensuring the actions on one or the combined actions of several connected parties do not impose an unnecessary risk to frequency quality, Delta-F or errosion of reserve holdings. Ramping restrictions currently apply to GB participants in the Grid Code Operating Codes
3. If the value of any of the Frequency Restoration Control Error Target Parameters is not met for the LFC Block or there is a justified expected risk that any of the Frequency Restoration Control Error Target Parameters will not be met, each TSO of the affected LFC Block shall have the right to establish actions to improve Frequency Restoration Control Error quality while respecting the provisions of Article 3(3). These actions shall include restrictions on the rate of change of active power output or input to Generating Units, Demand Facilities and HVDC Interconnectors connected to the TSO.		*** This is a repeat of the clause above - it is necessary in continental Europe to distinguish between block and synchronous area responsabilities *** within GB all such responsabilities are allocated to the NETSO.

ENTSO-E Network Code Text		Commentary
Chapter 3		
LOAD-FREQUENCY CONTROL STRUCTURE		
		***** Further clarification of the SO code is being considered withn the drafting team. It may be possible to enhance this code to better distinguish between SO, TO, OFTO, IC etc roles. A possible replacement definition for TSO is being considered.** *****Note: GB is a single NETSO, single block, single LFC area and single Synchronous Area. The NETSO is empowered and accountable for all TSO activities defined in this code within GB. However other TSOs may have block monitor status.** **Further work within the code drafting team is ongoing to clarify the System Operator role.** **Other aspects will be resolved using the Synchronous Area agreement**
Article 16		
BASIC STRUCTURE		
1. All TSOs of a Synchronous Area shall define, in a Synchronous Area Agreement a Load-Frequency-Control Structure for the Synchronous Area while respecting the provisions of Article 3(3). Each TSO shall be responsible to implement and operate according to the Load-Frequency-Control Structure of its Synchronous Area.		Within GB a Synchronous Area agreement will also be written to highlight the various roles in industry as understood in GB. It will most likely describe the roles and responsabilities of the NETSO, various other Tos (onshore/offshore) and interconnectors and may describe aspects of the responsabilities of reserve providers. Other legal and process documents may also be created to structure and define these responsabilities and powers. That document will go into more detail and describe the other obligations and requirements from this document.
2. The Load-Frequency Control Structure of each Synchronous Area shall include:		
a) a Process Activation Structure according to Article 17; and		
b) a Process Responsibility Structure according to Article 18.		
Article 17		
Process Activation Structure		see the comment above
1. The Process Activation Structure shall include:		
a) a FCP according to Article 19; and		
b) a FRP according to Article 20.		
2. The Process Activation Structure may include:		
a) a RRP according to Article 21;		
b) an Imbalance Netting Process according to Article 22;		
c) a Cross-Border FRR Activation Process according to Article 23;		
d) a Cross-Border RR Activation Process according to Article 24; and		
e) a Time Control Process.		
Article 18		
PROCESS RESPONSIBILITY STRUCTURE		
		see the comment above concerning the use of the Synchronous Area agreement. This will delineat the roles and responsabilities of the NETSO, TOs OFTOs, Ics.
1. When defining the Process Responsibility Structure, all TSOs of a Synchronous Area shall take into account at least the following criteria:		
a) size and the total inertia and synthetic inertia of the Synchronous Area;		
b) grid structure and/or network topology; and		
c) Load, Generation and HVDC Behaviour.		
In addition the TSOs of a Synchronous Area shall ensure that:		
d) the Synchronous Area consists of at least one Monitoring Area, one LFC Area and one LFC Block		
e) the community of all Monitoring Areas is congruent to the Synchronous Area		
f) the community of all LFC Areas is congruent to the Synchronous Area		
g) the community of all LFC Block is congruent to the Synchronous Area		
h) a Monitoring Area is part of one and only one LFC Area		
i) a LFC Area is part of one and only one LFC Block		
j) a LFC Block is part of one and only one Synchronous Area		
k) a LFC Area is congruent to one or more Monitoring Areas		
l) a LFC Block is congruent to one or more LFC Area Synchronous Area is congruent to one or more LFC Blocks		
2. All TSOs of a Monitoring Area shall continuously calculate and monitor the real-time active power interchange of the Monitoring Area.		Normal GB current practice
3. All TSOs of a LFC Area shall:		
a) continuously monitor the Frequency Restoration Control Error of the LFC Area;		
b) implement and operate a FRP for the LFC Area;		
c) endeavour to fulfil the Frequency Restoration Control Error Target Parameters of the LFC Area as defined in Article 10; and		
d) have the right to implement one or several of the processes referred to in Article 16(2)		
4. All TSOs of a LFC Block shall:		
a) endeavour to fulfil the Frequency Restoration Control Error Target Parameters of the LFC Block as defined in Article 10; and		
b) comply with FRR Dimensioning Rules established in Article 30 and RR Dimensioning Rules established in Article 33.		
5. All TSOs of a Synchronous Area shall:		
a) implement and operate a FCP for the Synchronous Area;		
b) comply with FCR Dimensioning Rules established in Article 27 established; and		
c) endeavour to fulfil the Frequency Quality Target Parameters as established in Article 9.		
All TSOs of a Synchronous Area shall have the right to define in a Synchronous Area Agreement the maximum size of a LFC Block in terms of the sum of load and generation while respecting the provisions of Article 3(3).		
6. Each TSO shall comply with the obligations established in Article 18(3) to Article 18(5) for its Monitoring Area, LFC Area, LFC Block and Synchronous Area.		
7. All TSOs of a Monitoring Area shall agree in a TSO multi-party agreement on the specific allocation of responsibilities between TSOs within the Monitoring Area for the implementation of the obligations established in Article 18(3). All TSOs of a LFC Area, LFC Block and Synchronous Area shall agree on similar multi-party agreement for the implementation of the obligations established in Article 18 (4) to Article 18(5).		
Article 19		
FREQUENCY CONTAINMENT PROCESS (FCP)		
1. The FCP shall be designed to stabilize the System Frequency by activation of FCR.		
2. The overall characteristic for FCR activation in a Synchronous Area shall reflect a monotonically decrease of the FCR activation as a function of the Frequency Deviation.		As a given frequency deviation continues, so more FCR is activated and the amount of remaining FCR available for activation decreases.

ENTSO-E Network Code Text		Commentary
Article 20		
FREQUENCY RESTORATION PROCESS (FRP)		
1. The FRP shall be designed to		
a) regulate the Frequency Restoration Control Error to zero within the Time To Restore Frequency; and		Ensures the NETSO regulates the Delta-F (frequency deviationn) to zero during the 10 minute Time to Restore Frequency
b) for all Synchronous Areas except Cyprus, GB and Ireland: progressively replace the activated FCR by activation of FRR; for Cyprus, GB and Ireland refer to Article 20.1(c).		this article does not apply for GB. GB operational approach is more flexible in that the operators will choose the most appropriate strategy to deal with the issue and thus choose the reserve mix that best fits this criteria.
2. The Frequency Restoration Control Error shall be		
a) the Area Control Error (ACE) of a LFC Area where there are more than one LFC Area in a Synchronous Area; or		GB does not use this criteria
b) the Frequency Deviation where one LFC Area corresponds to the LFC Block and the Synchronous Area.		GB shall apply this criteria
3. The ACE of a LFC Area shall be calculated as the sum of the product of the K-Factor of the LFC Area with the Frequency Deviation and of the difference between:		GB does not have an ACE and further work would be required to apply ACE and keep current levels of efficiency in frequency operation. i.e. continuously recalculate system inertia (*k'-factor*).
a) the total Tie-Line and Virtual Tie-Line active power flow; and		
b) the Control Program.		
4. For automated FRR activation, the set-point value shall be defined by a single frequency restoration controller operated by a TSO within its LFC Area. The frequency restoration controller shall:		Any given Automatic FRR providinng unit in GB, will at any any given time have a single controler providing set-point values for it to operate to. This however does prevent the unit from providing multiple reserve services which are activated in different control timescales from being armed or in use simultaneously. Automatic FRR includes all 'armed' systems that respond either to frequency deviation (that is they are fully autonomous) or to a control signal generated automatically by a control system working to restore the frequency - examples might in future include automatic BOAs, deload or AGC instructions.
a) be an automatic control device designed to reduce the Frequency Restoration Control Error to zero;		
b) be operated in a closed-loop manner with Frequency Restoration Control Error as input and set-point value for FRR activation as output;		
c) have proportional-integral behaviour;		
d) have an Anti-Windup Logic; and		
e) be operated with a Cycle Time no longer than		
i. 5 seconds for the Synchronous Area CE;		
ii. 10 seconds for the Synchronous Area NE; and		
iii. a time interval to be agreed for Baltic, CY, GB, and IRE.		AGC is not currently part of the GB control mix hence not yet defined.
5. For manual FRR activation, the definition of the set-point value shall be left to the discretion of the TSO for its LFC Area.		for manual instruction, 'set-point' is interpreted to mean a given target MW instruction sent to a reserve provider by the a despatcher
6. Without prejudice to Article 18(3) and Article 20, when a LFC Block consists of more than one LFC Areas all TSOs of the LFC Block shall have the right to appoint in a TSO multi-party agreement referred to in Article 18(6) one TSO of the LFC Block to:		
a) calculate and monitor the Frequency Restoration Control Error of the whole LFC Block; and		
b) take the Frequency Restoration Control Error of the whole LFC Block into account for the calculation of the set-point value for FRR activation according to Article 20(4) and Article 20(5) in addition to the Frequency Restoration Control Error of his LFC Area.		
7. Where a LFC Area consists of more than one Monitoring Areas, all TSOs of the LFC Area shall appoint one TSO who shall be responsible for the implementation and operation of the Frequency Restoration Process according to Article 20 as part of the TSO multi-party agreement referred to in Article 18(6).		This is similar to the SO-TO agreements which exist in GB currently. The Synchronous Area Agreement will cater with this.
8. Without prejudice to Article 18(3), where a LFC Area consists of more than one Monitoring Areas, the Frequency Restoration Process of this LFC Area shall enable the control of the active power interchange of each Monitoring Area to a value determined as secure based on a real-time Operational Security assessment.		
Article 21		
RESERVE REPLACEMENT PROCESS (RRP)		
1. The RRP shall be designed to fulfil one or several of the following goals:		
a) progressively restore the activated FRR;		
b) support FRR activation;		
c) for Cyprus, GB and Ireland to progressively restore the activated FCR and FRR.		GB has a flexibile operational process where reserves are activated to balance risk and cost.
2. The set-point value shall be defined by a TSO for its LFC Area where the RRP is implemented.		The NETSO shall be responsible for all set-point instructions and controller configurations within GB
Article 22		
IMBALANCE NETTING PROCESS		
1. The Imbalance Netting Process shall be designed to reduce the amount of simultaneous counteracting FRR activation of different participating and adjacent LFC Areas by Imbalance Netting Power Interchange. In accordance with 0 each TSO shall have the right to implement the Imbalance Netting Process for LFC Areas within the same LFC Block, between different LFC Blocks or between different Synchronous Areas.		Imbalance Netting is a process whereby two areas reduce the amount of reserves activated by netting any simultaneous imbalance that occurs, when sufficient cross-border capacity exists to do so. The process requires exchange of relevant operational data and a means to coordinate centrally. The actual mechanism, and the entity responsible for coordination it is not defined within this code.
2. The Imbalance Netting Process shall not affect		
a) the stability of the FCP of the Synchronous Area;		The Imbalance Netting Process shall not interfere with effective frequency control within any given area. 'Stability' can be infered to mean effectiveness, efficiency and controllability in this context.
b) the stability of the FRP and the RRP of each LFC Area; and		
c) Operational Security.		
3. The Imbalance Netting Power Interchange between LFC Areas of the same Synchronous Area shall be implemented by one or several of the following actions:		
a) defining an active power flow over a Virtual Tie-Line which shall be part of the Frequency Restoration Control Error calculation; or		
b) adjusting the active power flows over HVDC interconnectors.		
4. The Imbalance Netting Power Interchange between LFC Areas of different Synchronous Areas shall be implemented by adjusting the active power flows over HVDC interconnectors.		
5. The Imbalance Netting Power Interchange of a LFC Area shall not exceed the actual amount of FRR activation which is necessary to regulate the Frequency Restoration Control Error of this LFC Area to zero without Imbalance Netting Power Interchange.		
6. The Imbalance Netting Power Interchange between LFC Areas shall not exceed the Available Transmission Capacity.		Appropriate consideration of the physical limitations of the transmission system and/or Interconnector Capabilities;
7. All TSOs participating in the same Imbalance Netting Process shall ensure that the sum of all Imbalance Netting Power exports of all LFC Areas is equal to the sum of all Imbalance Netting Power imports of all LFC Areas.		This ensures there is no external affect on areas not participating in the netting process. It also effectively limits the process to areas or groups of areas which share common physical boundaries.
8. The Imbalance Netting Process shall include a fall-back mechanism which shall:		
a) ensure that the Imbalance Netting Power Interchange of each LFC Area is zero or limited to a value below the Available Transmission Capacity;		
b) comply with the requirements established in Article 22(2).		

ENTSO-E Network Code Text		Commentary
9. All TSOs participating in the same Imbalance Netting Process shall appoint in a TSO multi-party agreement roles and responsibilities of the TSOs including		This is the TSO or appointed 3rd partywhich for a defined period of time, takes on the role of a central coordinator of the process;
a) the responsibility of all participating TSOs to provide input data for Imbalance Netting Power Interchange calculation including the Available Transmission Capacity; and		
b) the appointment of one of the TSOs who shall be responsible for the calculation of the Imbalance Netting Power Interchange including the limitation of the interchange with respect to the Available Transmission Capacity.		
Article 23		
CROSS-BORDER FRR ACTIVATION PROCESS		
1. The Cross-Border FRR Activation Process shall be designed to enable a TSO to perform the FRP by Frequency Restoration Power Interchange between LFC Areas. In accordance with 0 a TSO shall have the right to implement the Cross-Border FRR Activation Process for LFC Areas within the same LFC Block, between different LFC Blocks or between different Synchronous Areas.		This process will be defined within implementation.
2. The Cross-Border FRR Activation Process shall not affect		
a) the stability of the FCP of the Synchronous Area;		
b) the stability of the FRP and the RRP of each LFC Area; and		
c) Operational Security.		
3. The Frequency Restoration Power Interchange between LFC Areas of the same Synchronous Area shall be implemented by one or several of the following actions:		In the case of GB being a single SO controlling a single LFC Block comprised of a single LFC Area the only netting would be with other Synchronous Areas and via HVDC. The Virtual Tie-Line may form part of the technical solution for settlement purposes; although alternate designs for an Imbalance Responsable Party are possible.
a) defining an active power flow over a Virtual Tie-Line which shall be part of the Frequency Restoration Control Error calculation where FRR activation is automated;		
b) adjusting a Control Program or defining an active power flow over a Virtual Tie-Line between LFC Areas where FRR activation is manual; or		
c) adjusting the active power flows over HVDC interconnectors.		
4. The Frequency Restoration Power Interchange between LFC Areas of different Synchronous Areas shall be implemented by adjustment of active power flows over HVDC interconnectors.		
5. The Frequency Restoration Power Interchange between LFC Areas shall not exceed the Available Transmission Capacity		
6. All TSOs participating in the same Cross-Border FRR Activation Process shall ensure that the sum of all Frequency Restoration Power exports of all LFC Areas is equal to the sum of all Frequency Restoration Power imports of all LFC Areas.		Ensure that there is no FRR (frequency trace) noise pollution to other non-participating areas.
7. The Cross-Border FRR Activation Process shall include a fall-back mechanism which shall:		This is to ensure that should the systems or IC capacity required for the Netting process to work were to fail then the various areas contnue to be able to operate securely
a) ensure that the Frequency Restoration Power Interchange of each LFC Area is zero or limited to a value below the Available Transmission Capacity; and		
b) comply with the requirements established in Article 23(2).		
Article 24		
CROSS-BORDER RR ACTIVATION PROCESS		The same principles as defined for RR apply here.
1. The Cross-Border RR Activation Process shall be designed to enable a TSO to perform the RRP through Replacement Power Interchange between LFC Areas. In accordance with 0 a TSO shall have the right to implement the Cross-Border RR Activation Process for LFC Areas within the same LFC Block, between different LFC Blocks or between different Synchronous Areas.		
2. The Cross-Border RR Activation Process shall not affect		This process must cause any problems in the management of or effectiveness of reserve management processes within any of the effective synchronous areas. If it begins to do so or threatens to do so then the TSOs must take action - ie withdraw or prevent any such cross-border action.
a) the stability of the FCP of the Synchronous Area;		
b) the stability of the FRP and the RRP of each LFC Area; and		
c) Operational Security.		
3. The Replacement Power Interchange between LFC Areas of the same Synchronous Area shall be implemented by one or several of the following actions:		
a) defining an active power flow over a Virtual Tie-Line which shall be part of the Frequency Restoration Control Error calculation;		
b) adjusting of a Control Program; or		
c) adjusting of active power flows over HVDC interconnectors.		GB currently has no HVAC connections to other areas (by definition it is a separate synchronous area) and hence HVDC active power programme modification across one or more HVDC connections shall be the method by which this is achieved.
4. The Replacement Power Interchange between LFC Areas of different Synchronous Areas shall be implemented by adjustment of active power flows over HVDC interconnectors.		
5. The Replacement Power Interchange between LFC Areas shall not exceed the Available Transmission Capacity.		
6. All TSOs participating in the same Cross-Border RR Activation Process shall ensure that the sum of all Replacement Power exports of all LFC Areas is equal to the sum of all Replacement Power imports of all LFC Areas.		
7. The Cross-Border RR Activation Process shall include a fall-back mechanism which shall:		
a) ensure that the Replacement Power Interchange of each LFC Area is zero or limited to a value below the Available Transmission Capacity;		
b) comply with the requirements established in Article 24(1).		
Article 25		
ADDITIONAL REQUIREMENTS RELATED TO DIFFERENT AREA RESPONSIBILITIES		
1. Each TSO shall implement a Cross-Border FRR Activation Process when exercising the right established in Article 38(1), Article 40(1), Article 46(1), Article 47 and Article 50(1). Each TSO shall implement a Cross-Border RR Activation Process when exercising the right established in Article 41(1), Article 42(1), Article 48(1), Article 49 and Article 50(1).		There are obligatoins on TSOs to establish mechanisms that permit exchange of FRR
2. Where a LFC Block consists of more than one LFC Area and the FRR Capacity as well as RR Capacity is calculated based on the LFC Block Imbalances, all TSOs of the same LFC Block shall implement an Imbalance Netting Process and interchange the maximum amount of Imbalance Netting Power as defined in Article 22(5) with other LFC Areas of the same LFC Block while complying with Article 22(6).		
3. Where an Imbalance Netting Process is implemented for LFC Areas of different Synchronous Areas, all TSOs shall interchange the maximum amount of Imbalance Netting Power as defined in Article 22(5) with other TSOs of the same Synchronous Area participating in this Imbalance Netting Process while complying with Article 22(6).		
4. Where an Imbalance Netting Process is implemented for LFC Areas which are not part of the same LFC Block, all TSOs of the LFC Blocks shall fulfil the obligations established in Article 18(4) regardless of Imbalance Netting Power Interchange.		
5. All TSOs of a Synchronous Area shall determine in a Synchronous Area Agreement the roles and the responsibilities of the TSOs implementing an Imbalance Netting Process, a Cross-Border FRR Activation Process or a Cross-Border RR Activation Process between LFC Areas of different LFC Blocks or of different Synchronous Areas.		The Synchronous Area agreement and subsequent more detailed operational and contractual documents will establish who is responsible for doing what with regards cross-border activities involving HVDC power-flow changes;
Article 26		

ENTSO-E Network Code Text		Commentary
MEASUREMENTS AND INFRASTRUCTURE		
1. All TSOs of a Synchronous Area shall define in a Synchronous Area Agreement the parameters for measurement and real-time information exchange between TSOs. The parameters for measurement and information exchange shall include:		
a) precision of active power flow measurements;		
b) communication protocols; and		
c) measurement period.		
2. Each TSO of a Monitoring Area shall ensure:		
a) a sufficient quality and availability of a Tie-Line and a Virtual Tie-Line measurement;		
b) redundancy of measurement equipment; and		
c) redundancy of measurement signal transmission and its processing.		
3. Each TSO of a LFC Area shall:		
a) ensure a sufficient quality and availability of the Frequency Restoration Control Error calculation;		
b) perform real-time quality monitoring of the Frequency Restoration Control Error calculation;		
c) take action in case of Frequency Restoration Control Error miscalculation;		
d) perform an ex-post quality monitoring of the Frequency Restoration Control Error calculation by comparing Frequency Restoration Control Error to reference values at least on an annual basis; and		
4. All TSOs of a Synchronous Area shall define in a Synchronous Area Agreement further requirements for the infrastructure necessary to perform Load-Frequency Control. The further requirements shall include at least redundancy requirements of measurements and redundancy requirements of control systems.		

ENTSO-E Network Code Text		Commentary
		To understand the role of FCR please refer back to the diagram on Tab 2. Frequency Quality. Its role is primarily to arrest a frequency rise or drop following a sudden positive or negative imbalance. (Certain faster FCR services will also contribute to frequency stability and holding the dynamic range tight.)
Chapter 4 **FREQUENCY CONTAINMENT RESERVES (FCR)**		
Article 27		
FCR Dimensioning		
1. All TSOs of a Synchronous Area shall determine the FCR Capacity required for the Synchronous Area and the shares of FCR required for each TSO as the Initial FCR Obligation according to Article 27(5) and Article 27(7) while respecting the provisions of Article 3(3).		Withn GB FCR dimensioning will be performed by the NETSO and this shall be established within the Synchronous Area agreement.
2. All TSOs of a Synchronous Area shall apply a dimensioning approach in accordance with Article 27(5) for FCR based on a risk assessment criterion taking into account the pattern of load and generation.		
3. All TSOs of a Synchronous Area shall recalculate the required FCR Capacity and the Initial FCR Obligation for each TSO at least on an annual basis in accordance with Article 27(5) and Article 27(7).		Within GB this is dones on a nearly continuous basis. Subject to the changes and limitations imposed by the yet to be drafted "Balancing Code" this will continue to the be the practice for the NETSO. Local and National requirement for FCR (and other reserve types) may be optimised continously as the operating environment changes, subject to the NETSO having the operational and market tools to operate this flexibly.
4. When in accordance with 0, all the TSOs of a Synchronous Area agree, all the TSOs of the Synchronous Area shall have the right to recalculate the FCR Capacity and the Initial FCR Obligation for each TSO more frequently than on an annual basis while respecting the provisions of Article 3(3).		Within GB the NETSO will optimise within day on a regular basis; or as frequently as the harmonised EU market design permits it to do so.
5. All TSOs of a Synchronous Area shall define a dimensioning approach for FCR on the basis of the principle of covering remaining imbalances in the Synchronous Area after activation of FRR and RR that are likely to happen according to a probability of once in 20 years while respecting the provisions of Article 3(3). The FCR Capacity of a Synchronous Area shall at least cover the Reference Incident of the Synchronous Area.		Within GB the NETSO will continue to look at the volumes of each reserve category (and bias towards faster or slower response) required to to meet system conditions and requirements. These requirements vary according to the largest potential loss of demand or generation; specific inertia criteria; regional requirements due to network configuration/congestion etc
6. The TSOs of a Synchronous Area shall determine the size of the Reference Incident respecting the following conditions:		
a) For CE: the Reference Incident shall be the largest imbalance that may result from an instantaneous change of active power of two generating units, two demand facilities or two HVDC interconnectors connected to the same electrical node.		
b) For CY, GB, IRE, and NE: the Reference Incident shall be the largest imbalance that may result from an instantaneous change of active power of a single generating unit, single demand facility, single HVDC interconnector or from a tripping of an AC-Line.		This is the current policy used in GB and in Ireland.
7. The shares of the FCR Capacity required for each TSO as Initial FCR Obligation shall be based on the sum of the net generation and consumption of its area divided by the sum of net generation and consumption of the Synchronous Area over a period of one year.		GB has a single NETSO hence no sharing ratio.
8. Each TSO of a Small Synchronous Area may apply alternative Dimensioning approaches while respecting the provisions of Article 3(3).		Inertia requirements and specific other aspects of generation and demand mix (e.g. high penetrations of non-synchronous plant) affecting GB may require additional criteria
Article 28		
FCR TECHNICAL MINIMUM REQUIREMENTS		
1. Each Reserve Connecting TSO shall ensure that the FCR corresponds to the following properties listed according to its Synchronous Area in table 3:		These represent minimum requirements to be used for EU wide harmonisation of reserve categories.
Minimum accuracy of frequency measurement		

ENTSO-E Network Code Text		Commentary
Table 3: FCR Properties in the different Synchronous Area		
2. All TSOs of a Synchronous Area shall have the right to determine additional properties of the FCR required to ensure operational security in the Synchronous Area by means of a set of technical parameters while respecting the provisions of Article 3(3). These properties of FCR shall reflect the installed capacity, structure and pattern of consumption and generation of the Synchronous Area.		
3. All TSOs of a Synchronous Area shall review the additional properties of FCR at least on an annual basis.		
4. The Reserve Connecting TSO shall have the right to define additional requirements for FCR Providing Groups and shall have the right to exclude FCR Providing Groups from the provision of FCR based on technical arguments to ensure operational security. The FCR Provider shall ensure that monitoring of the FCR activation of the generating and/or demand facilities within a Reserve Providing Group is possible.		When procuring reserve cross-border, the receiving TSO has the right to insist on specific characteristic behaviour of the reserve providing unit. In the case of transfer by HVDC these capabilities have to be reflected in the HVDC controlling systems also.
Each TSO shall implement a FCR Prequalification Process to assess the fulfilment of the technical and availability requirements by possible FCR Proving Units and FCR Providers. A possible FCR Provider shall have the right to apply for a prequalification of possible FCR Providing Units and as FCR Provider at a relevant Reserve Connecting TSO.		Prequalification Process is a form of *Registration.* Reserve Providers and Reserve Providing Units must meet all the requirements in terms of electrical and system control capabilities and availability in order to qualify. The Reserve Connecting TSO will define the procedures and technical criteria for FCR provision.
The Reserve Connecting TSO shall process this application without undue delay and shall prequalify FCR Providing Units or FCR Providing Groups who successfully passed a FCR Prequalification Process.		
5. Each Reserve Connecting TSO, each FCR Providing Unit and each FCR Providing Group shall comply with the required properties for FCR according to Article 28(1) and Article 28(2).		
6. Each Reserve Connecting TSO has to implement a FCR Prequalification process for FCR Providing Units and FCR Providing Groups.		
7. A FCR Providing Unit or FCR Providing Group shall activate the agreed FCR by means of a proportional governor reacting to frequency deviations or alternatively based on a piecewise linear power-frequency characteristic in the case of relay activated FCR corresponding to Article 28(1) and Article 28(2).		These definitions come from standard Control Systems Definitions. Further links to web-sourced definitions are below. > http://en.wikipedia.org/wiki/Piecewise_linear_function The definition has been written in this manner to permit services from static (single or multiple stepped) service providers to be included within this definition. All reserve services currently deployed within GB should be catered-for by this.
8. Each Reserve Connecting TSO shall ensure that the activation of its FCR Providing Units is in line with the requirements of the Synchronous Area according to Article 28(1) and Article 28(2).		

Minimum accuracy of frequency measurement	Baltic	not defined	There may be a requirement for additional faster reserve criteria not currently covered as a European-wide standard in this code. The values in this table, however, represent the basic set of requriements necessary for a reserve providing unit to be considered as a FCR category unit
	CE	1 mHz	
	CY	1 mHz	
	GB	1 mHz	
	IRE	not defined	
	NE	1 mHz	
Maximum insensitivity of the governor of the FCR Providing Units	Baltic	10 mHz	
	CE	10 mHz	
	CY	20 mHz	
	GB	15 mHz	
	IRE	not defined	
	NE	10 mHz	
Full Activation Time of FCR	Baltic	30 s	
	CE	30s	
	CY	20s	
	GB	10s	
	IRE	15s	
	NE	~~30~~sif System Frequency is outside Standard Frequency Range	
FCR Full Activation Deviation.	Baltic	± 200 mHz	***These values are still being reviewed and are subject to change. *** GB is currently considering moving the full activation time to 30 seconds to permit existing "Secondary" products inside this category
	CE	± 200 mHz	
	CY	±500 mHz	
	GB	±500 mHz	
	IRE	Dynamic FCR ±500 mHzStatic FCR ±1000 mHz	
	NE	± 500 mHz	

ENTSO-E Network Code Text		Commentary
9. Each Reserve Connecting TSO shall monitor all FCR Providing Units in its Area. Each FCR Provider shall make available to the Reserve Connecting TSO for each of its FCR Providing Units at least the following information:		
a) status signal indicating if FCR is on or off;		
b) time-stamped scheduled active power output;		
c) time-stamped instantaneous active power;		
d) time-stamped instantaneous active power without FCR activation; and		These represent additional requirements for many classes of Reserve Providers. Many TSOs across Europe already have this information and it is deemed extremely important to measure both the individual and collective performance of reserve providers.
e) droop of the governor;		
On request from the Reserve Connecting TSO, a FCR Provider has to make this information available in real time with a time resolution of at least 10 seconds.		The GB NETSO will ask for metering as appropriate and the route for providing information may vary. Further consdieration and discussion is expected during implementation. In the future many providers within the DSO's network will also need to provide information either via the DSO or directly. The resiliance level of communications will also be considered more at that time.
10. Each FCR Providing Unit shall only have one Reserve Connecting TSO.		Any unit can only be controlled by one TSO at anyone time.
Article 29		
FCR PROVISION		
1. Each TSO shall ensure the availability of at least its FCR Obligation agreed upon in accordance with Article 27(7), Article 35, Article 44 and Article 45.		This is appropriate to the Dimensioning methods; individual Provider and Unit monitoring etc. Hence on the whole a given reliability factor will be assumed when dimensioning
2. The TSOs of a Synchronous Area shall determine at least on an annual basis the size of the K-Factor of the Synchronous Area taking into account factors including, but not limited to:		This is the calculation of K-Factor is a definition of system *'stiffness'* it has units of MW/Hz. In practice the frequency sensitivity to MW imbalance varies according to generation mix; demand structure etc. The consideration and link to the amount of FCR reserve that will need to be held is also not a simple evaluation as one must ensure both the stability of the system (within the normal dynamic range) and also ability to contain losses. Within GB everyone will be familiar with the "Largest Loss" criteria and the need to contain to 0.8Hz. So in GB from 1st April 2013, this value is 1800MW. For this number of MW the 'standardised' k-factor could thus be assumed to be 1800/0.8 = 2250MW/Hz. This value obviously varies from one synchronous area to another. In practice the instantaneous k'-factor varies continuously and this is much more noticable with smaller systems and those which have a continually changing generation mix (particularly high levels of non-synchronously connected plant).
a) The FCR Capacity divided by the Maximum Steady-State Frequency Deviation;		
b) the auto-control of generation; and		
c) the self-regulation of load.		
3. The shares of the K-Factor for each TSO shall be based on its FCR Obligation according to (1) of its area divided by the FCR Capacity.		In GB only the NETSO has this responsibility and hence all the FCR capacity requirements will be calculated and controlled by it.
4. Each TSO shall require from its FCR Provider the continuous availability of FCR with the exception of an unplanned outage of a Reserve Providing Unit. A FCR Provider shall comply with this availability requirement.		
A FCR Provider shall inform its Reserve Connecting TSO immediately about an unavailability of a FCR Providing Unit or all or a part of a FCR Providing Group.		
5. Each TSO shall ensure, or shall agree with its FCR Providers that they ensure that:		
a) The loss of a FCR Providing Unit does not endanger the System Security by:		
i. limiting the share of the FCR provided per Reserve Providing Unit to 3 % and per electrical node to 6 % of the FCR Capacity per Synchronous Area (CE and NE); or		
ii. taking the loss of the largest FCR Providing Unit into account in the dimensioning process (GB and IRE).		
b) the FCR which is made unavailable due to an unplanned outage or an unavailability of an FCR Providing Unit is replaced as soon as technically possible and		GB have requested this section as under GB market arrangements it is the NETSO which will rescure the appropriate level of FCR by other operational/market actions;
i. for GB and IRE: according to the conditions that shall be defined by the TSOs of the Synchronous Area		
ii. for all other Synchronous Areas: at the latest 12 hours after the incident.		
6. A FCR Providing Unit or FCR Providing Group:		
a) with unlimited FCR providing capability shall activate its FCR as long as the Frequency Deviation persists.		
b) with limited FCR providing capability shall activate its FCR as long as the Frequency Deviation persists unless its energy reservoir is exhausted in either direction		

ENTSO-E Network Code Text		Commentary
Such a FCR Providing Unit or FCR Providing Group shall be able to fully activate its FCR continuously for a time period of not less than 30 minutes and for an equivalent longer time period in case of smaller Frequency Deviations and shall specify the limitations of the energy reservoir in the Prequalification process.		*** GB is currently proposing changes in this area of the drafting text so as not to exclude certain existing FCR providers. ** The strict 30 minutes for all FCR providers is considered too onerous for GB and I have requested a change, to allow flexibility by provider technology and also according to the appropriate Prequalification process by provider.
An FCR Provider using such FCR Providing Units has to take appropriate measures to ensure recovery of energy reservoirs in any of the two directions		
i. for GB and IRE: according to the conditions that shall be defined by the TSOs of the Synchronous Area		GB and Ireland wish to avoid unforeseen consequences which might be detrimental to system security of implementing the obligation in (ii)
ii. for all other Synchronous Areas: within 2 hours,		
For the case of continuing large Frequency Deviations caused by a large Frequency Restoration Control Error in a LFC Block or in a LFC Area, the corresponding TSOs of that LFC Block or LFC Area shall initiate counter measures as described in Article 32 and if necessary collaborate with the other TSOs of the same Synchronous Area to implement predefined coordinated counter measures as described in Article 32.		The specific strategy for dealing with this type of system issue will be managed entirely internally within the NETSO.

ENTSO-E Network Code Text		Commentary
Chapter 5		
FREQUENCY RESTORATION RESERVES (FRR)		**FRR is a definition of all reserve services used to restore the system frequency.** Much of this section is being redrafted as the current rules in this section are not workable for Synchronous Area GB. GB has proposed new text to define its own dimensioning criteria based upon continual assessment of needs. GB currently does this but it is not current practice in Continental Europe.
Article 30		
FRR DIMENSIONING		
1. All TSOs of a LFC Block shall define FRR Dimensioning Rules in a TSO multiparty agreement while respecting the provisions of Article 3(3).		For GB this is the sole responsibility of the NETSO
2. The FRR Dimensioning Rules shall comprise at least the following requirements:		
a) All TSOs of a LFC Block shall determine the required FRR Capacity of the LFC Block based on consecutive historical records at least comprising historical LFC Block Imbalance values. The sampling of these historical records shall be at least the Time To Restore Frequency. The considered time period of these records shall be representative and include at least one full year period ending not earlier than 6 months prior to the calculation;		
b) All TSOs of a LFC Block shall determine the FRR Capacity of the LFC Block such that it is sufficient to respect the current Frequency Restoration Control Error Target Parameters in accordance with Article 10 for the considered historical period of time based at least on a probabilistic methodology. All TSOs of a LFC Block shall take expected significant changes to the distribution of LFC Block Imbalances or other relevant influencing factors relative to the considered time period into account for this determination;		The current values GB is using are in Table 1 - with the TimeToRestoreFrequency parameters. GB has translated current operational practice of restoring the frequency within 10 minutes for losses less than or equal to the largest loss criteria. However a considered review of the products which fall into this FRR category may drive this to a value of 20min or 30 minutes.
c) All TSOs of a LFC Block shall determine the ratio of Automatic FRR Capacity and Manual FRR Capacity and the Automatic FRR Full Activation Time and Manual FRR Full Activation Time such that requirement (b) can be fulfilled.		Automatic FRR = anything responding to a local trigger or receiving a signal to change output by a computer. Thus frequency sensitive systems and those centrally despatched in short timescales are included; Manual FRR = anything which is manually controlled. The specific 'products' which will ultimately fall into this category are up for review and the structures will be modified by the 'Balancing Code'
d) All TSOs of a LFC Block shall determine the positive FRR Capacity such that it is not smaller than the positive Dimensioning Incident of the LFC Block;		+MW reserve is related to the reserves necessary to deal with largest credible single loss of generation within the TimeToRestoreFrequency period.
e) All TSOs of a LFC Block shall determine the negative FRR Capacity such that it is not smaller than the negative Dimensioning Incident of the LFC Block;		-MW reserve is related to the reserves necessary to deal with the largest single credible loss of demand within a TimeToRestoreFrequency period.
f) All TSOs of a LFC Block shall determine the FRR Capacity of a LFC Block and possible geographical limitations for its distribution with respect to the Available Transmission Capacity within the LFC Block and to other LFC Blocks;		This statement relates to the requirement for reserves to be appropriate distributed to ensure that where constraints are active or contigencies might prevent transmission of reserve MWs from one area to another, the grid remains secure. For this reason the NETSO is obliged, where system conditions dictate to acquire reserves by location or area - not necessarily on strict market merit order basis.
g) All TSOs of a LFC Block shall ensure that the positive FRR Capacity is sufficient to cover the positive LFC Block Imbalances in at least 99% of the time based on the historical record as defined in (a) ;		
h) All TSOs of a LFC Block shall ensure that the negative FRR Capacity is sufficient to cover the negative LFC Block Imbalances in at least 99% of the time based on the historical record as defined in (a);		
i) All TSOs of a LFC Block, while respecting the provision **Error! Reference source not found.**, can enter into a sharing agreement for FRR Capacity with other LFC Blocks according to the provision of Chapter 7.		
j) All TSOs of a LFC Block are allowed to reduce the positive FRR Capacity of the LFC Block, resulting from the FRR Dimensioning Process, by concluding a sharing agreement for this positive FRR Capacity with other LFC Blocks in accordance with the provisions of Chapter 7. The reduction of the positive FRR Capacity of a LFC Block is:		As explained above, it is necessary to retain reserves geographically because of the physical nature and limitations of the transmission and distribution grids. This value has been proposed as an initial limit; however following analysis the structure of this section and the specific values that are applicable in GB have been modified.
i. limited to the difference, if positive, between the size of the Dimensioning Incident and the FRR Capacity required to cover the Positive LFC Block imbalances in 99% of time based on historical records as defined in (a); and		
ii. shall never exceed 30% of the size of the Positive Dimensioning Incident.		

ENTSO-E Network Code Text		Commentary
k) All TSOs of a LFC Block are allowed to reduce the negative FRR Capacity of the LFC Block, resulting from the FRR Dimensioning Process, by concluding a sharing agreement for this negative FRR Capacity with other LFC Blocks in accordance with the provisions of Chapter 7. The reduction of the negative FRR Capacity of a LFC Block is:		
i. limited to the difference, if positive, between the size of the Negative Dimensioning Incident and the FRR Capacity required to cover the Negative LFC Block imbalances in 99% of time based on historical records as defined in (a); and		
ii. shall never exceed 30% of the size of the Negative Dimensioning Incident.		
3. All TSOs of a LFC Block shall agree in a TSO multi-party agreement on the specific allocation of responsibilities between TSOs of different LFC Areas for the implementation of the obligations established in Article 30.		
4. All TSOs of a LFC Block shall have sufficient FRR Capacity according to the FRR Dimensioning Rules at any time. For the case of a severe risk of insufficient FRR Capacity of a LFC Block an escalation procedure shall be agreed by all TSOs of a LFC Block together with the relevant NRAs aiming to reduce the risk while respecting the provisions of Article 3(3).		
Article 31		
FRR TECHNICAL MINIMUM REQUIREMENTS		
1. All TSOs of a Synchronous Area shall define FRR Technical Minimum Requirements for their Synchronous Area in a Synchronous Area Agreement while respecting the provisions of Article 3(3).		
The FRR Technical Minimum Requirements for the Synchronous Area shall comprise at least the following requirements:		
a) A FRR Providing Unit or FRR Providing Group for Automatic FRR shall have an Automatic FRR Activation Delay of at most 30 seconds;		
b) The Automatic FRR Full Activation Time of a LFC Block and the Manual FRR Full Activation Time of the LFC Block shall at most be the Time to Restore Frequency; and		
c) A FRR Provider shall be able to supply real-time measurements to the Reserve Receiving TSO for each FRR Providing Unit and for each generating unit or demand facility larger than 1 MW being part of a FRR Providing Group. These real time measurements shall include the activated FRR and the relevant reference power production or consumption.		Similar to the requirements on the FCR this requirement on FRR provider is to provide the reference MW profile as well as the MW component activated on each facility providing this reserve service. This requirement is on all facilities greater than 1MW. **** GB has requested a specific modification to this clause. Whilst the 1 MW level comes from the [NC OS], GB feels that the TSO with regulatory oversight should have greater flexibility to vary this limit with time. Whilst it is evident that as industry moves towards an ever greater proportion of generation and smart-demand at lower voltage levels and smaller sized units, the TSO will need to have greater visibility and controls upon them. Nonetheless it may not be required or make economic sense on day-1 of the code.**
The TSOs of a Synchronous Area shall define common rules for the determination of Reserve Connecting TSO in a Synchronous Area Agreement such that there is one and only one Reserve Connecting TSO per FRR Providing Unit or FRR Providing Group.		
2. All TSOs of a LFC Block shall have the right to define complementary FRR Technical Minimum Requirements and FRR Availability Requirements for their LFC Block in a TSO multi-party agreement while respecting the provisions of Article 3(3). These requirements shall take into account the individual technical conditions of the LFC Block and shall not be contradictory to the common FRR Technical Minimum Requirements developed in accordance with (1).		
The FRR Technical Minimum Requirements and FRR Availability Requirements for the LFC Block shall comprise at least the following requirements:		
a) A FRR Providing Unit or FRR Providing Group for Automatic FRR shall be able to activate its complete FRR Capacity within the Automatic FRR Full Activation Time of the LFC Block; and		
b) A FRR Providing Unit or FRR Providing Group for Manual FRR shall be able to activate its complete Manual FRR Capacity within the Manual FRR Full Activation Time of the LFC Block.		
c) A FRR Provider shall fulfil FRR Availability Requirements of the LFC Block.		
d) A FRR Providing Unit or FRR Providing Group shall fulfil the ramp rate requirements of the LFC Block;		
A Reserve Connecting TSO shall have the right to define complementary technical minimum requirements for FRR Providing Units and FRR Providers such that the delivery of FRR is possible in a safe and secure way.		
The Reserve Connecting TSO shall have the right to define additional requirements for FRR Providing Groups and shall have the right to exclude FRR Providing Groups from the provision of FRR based on technical arguments to ensure operational security. The FRR Provider shall ensure that monitoring of the FRR activation of the generating and/or demand facilities within a Reserve Providing Group is possible.		
3. Each TSO shall implement a FRR Prequalification Process to assess the fulfilment of the technical and availability requirements by possible FRR Proving Units and FRR Providers according to (1) and (2). A possible FRR Provider shall have the right to apply for a prequalification of possible FRR Providing Units and as FRR Provider at a relevant Reserve Connecting TSO.		A registration and qualification process will be implemented similar to those present in GB presently.
The Reserve Connecting TSO shall process this application without undue delay and shall prequalify FRR Providing Units or FRR Providing Groups who successfully passed a FRR Prequalification Process.		
Each Reserve Connecting TSO shall ensure that for its FRR Providing Units and FRR Providers the fulfilment of the FRR Technical Requirements and FRR Availability Requirements is monitored.		

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FRR Providing Units shall fulfil the technical minimum requirements and the FRR Availability Requirements according to (1) and (2).		
A FRR Provider shall inform its Reserve Connecting TSO immediately about a reduction of the availability of its FRR Providing Unit or its FRR Providing Group.		
A FRR Provider shall activate the FRR on its FRR Providing Unit or FRR Providing Group according to the request by the TSO.		
Article 32		
FRR OPERATION		
1. All TSOs of a Synchronous Area shall establish a real-time exchange between TSOs of the data concerning the Frequency Restoration Control Error of the LFC Blocks.		**Article 32 contains many defintions which were developed specifically for Continental Europe. I am unable to explain their meaning and they are not defined.** **It has been proposed that they be removed from a later draft or better defined. Where they do not work effectively for GB (either not effective frequency management criteria or impose additional constrictions and costs to operations) we will seek a GB exemption from the section.**
2. The TSOs of a Synchronous Area shall determine the Synchronous Area risk level either to be:		
a) High Synchronous Area State; or b) Elevated Synchronous Area State; or c) Normal Synchronous Area State.		Much of this section is in the process of being redrafted the control error aspects moved to a separate chapter. For GB it is proposed that these be based on effective management of the Delta-F error (or in plane English how often the TSO expects the system frequency to be outside of what are currently operational and statutory limits);
3. The TSOs of a LFC Block shall determine the LFC Block Threshold level either to be: a) Level 2 LFC Block Threshold; or b) Level 1 LFC Block Threshold; or c) Normal LFC Block Threshold.		
4. All TSOs of a Synchronous Area shall define common rules for the operation of the FRPs in a Synchronous Area Agreement while respecting the provisions of Article 3(3). These common rules shall comprise at least: a) The Synchronous Area Monitor shall inform the TSOs of the Synchronous Area about the current Synchronous Area risk level b) in case of Elevated Synchronous Area State, the TSOs of a Synchronous Area shall perform predefined coordinated actions of LFC Blocks to actively reduce the Frequency Deviation. For these actions the TSOs of a Synchronous Area may deviate from the obligation set in Article 20(1)(a); and c) in case of High Synchronous Area State, the TSOs of a Synchronous Area shall perform predefined coordinated and individual actions of LFC Blocks to actively reduce the Frequency Deviation. For these actions the TSOs of a Synchronous Area may deviate from the obligation set in Article 20(1) (a). d) The TSOs of a LFC Block shall reduce the absolute value of Frequency Restoration Control Error of the LFC Block by activation of FRR and RR. e) The TSOs of a LFC Block shall make best endeavours to avoid times with persisting Frequency Restoration Control Errors.		
5. All TSOs of a LFC Block shall define common rules for the operation of the FRPs in a TSO multiparty agreement respecting the common rules of the Synchronous Area while respecting the provisions of Article 3(3). a) The LFC Block Monitor shall inform the TSOs of the Synchronous Area about the current LFC Block Threshold state b) If the LFC Block exceeds the Level 1 LFC Block Threshold the TSOs of a LFC Block shall have the right to perform predefined additional actions to actively reduce the Frequency Restoration Control Error. c) If the LFC Block exceeds the Level 2 LFC Block Threshold the TSOs of a LFC Block shall perform predefined additional actions to actively reduce the Frequency Restoration Control Error. For these actions the TSO may require changes in active power production or consumption of generating and demand facilities within its Area within reasonable limits d) When the Frequency Restoration Control Error exceeds 25% of the Reference Incident of the Synchronous Area for more than 30 consecutive minutes, the TSOs of a LFC Block shall perform predefined measures and predefined coordinated actions involving other LFC Blocks at least comprising emergency reserve exchanges to actively reduce the Frequency Restoration Control Error.		
6. All TSOs of a LFC Area shall operate its FRP according to the common rules for the operation of its Synchronous Area as defined Article 32(4) and of its LFC Block as defined in Article 32(5).		

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Chapter 6		
REPLACEMENT RESERVES (RR)		
Article 33		
RR DIMENSIONING		
1. Each TSO of a LFC Block with a RRP according to Article 16(2) shall define the RR Dimensioning Rules while respecting the provisions of Article 3(3).		
2. The RR Dimensioning Rules shall comprise at least the following requirements:		
a) sufficient RR Capacity to restore the required amount of FRR and for CY, GB and IRE: sufficient RR Capacity to restore the required amount of FCR and FRR;		
b) sufficient RR Capacity, if taken into account to dimension the FRR Capacity to respect the Frequency Restoration Error Quality Target for the considered period of time, based on theoretical considerations;		
c) respect of the Available Transmission Capacity within a LFC Block to determine RR Capacity.		
3. In case a TSO has RR, the dimensioning based on the System Imbalances shall apply for the combination of FRR and RR. However, the Dimensioning Incident shall be covered by FRR only.		
4. Each TSO which has RR shall comply with the requirements established in Article 30 for the combination of FRR and RR instead of FRR only with the exception of Article 30.2 d) and e) .		
5. All TSOs of a LFC Block with a Replacement Process shall have sufficient RR Capacity according to the RR Dimensioning Rules at any time. In case of insufficient RR Capacity due to market illiquidity an escalation procedure shall be agreed by the TSOs of each LFC Block with the relevant NRAs while respecting the provisions of Article 3(3).		
6. A TSO which has implemented a RRP according to Article 16(2) shall respect the RR Dimensioning Rules.		
All TSOs of a LFC Block shall agree in a TSO multi-party agreement on the specific allocation of responsibilities between TSOs of different LFC Areas for the implementation of the obligations if the process is needed by a LFC Block.		
Article 34		
RR TECHNICAL MINIMUM REQUIREMENTS		
1. Each TSO of a LFC Block shall have the right to operate Replacement Reserves Capacity to ensure that its FRR Capacity is sufficient to respect the values defined for the Frequency Restoration Control Error Target Parameters in accordance with Article 10 based on theoretical considerations defined in Article 31(3) while respecting the provisions of Article 3(3).		
2. Each TSO of a LFC Block which has implemented a RRP according to Article 16(2) shall define in a multi-lateral agreement RR Technical Minimum Requirements while respecting the provisions of Article 3(3).		
The RR Technical Minimum Requirements for RR Providing units and RR Providers shall comprise at least the following requirements:		
a) connection to only one Reserve Connecting TSO;		
b) activation of the complete RR Amount within the RR Full Activation Time; and		
c) supply of real-time measurements of activated RR and the relevant reference power production or consumption to the Reserve Connecting TSO for each RR Providing Unit. RR Providers and RR Providing Units shall fulfil their respective RR Technical Minimum Requirements of the Reserve Connecting TSO.		
3. The Reserve Connecting TSO shall have the right to define additional requirements for RR Providing Groups and shall have the right to exclude RR Providing Groups from the provision of RR based on technical arguments to ensure operational security. The RR Provider shall ensure that monitoring of the RR activation of the generating and/or demand facilities within a Reserve Providing Group is possible.		Whereby TSOs share reserves cross-border and create a mechanism of TSO to BSP (direct relationship rather than TSO-TSO) then the connecting TSO has the right to impose additional technical requirements.
Each Reserve Connecting TSO shall ensure that its RR Providing Units fulfil the RR technical requirements by means of a RR Prequalification Process.		
Each Reserve Connecting TSO shall ensure that for its RR Providing Units the fulfilment of the RR Technical Requirements is monitored.		
A FRR Provider shall activate the FRR on its FRR Providing Unit or FRR Providing Group according to the request by the TSO.		
4. A RR Provider shall comply with the RR Availability Requirements defined by its Reserve Connecting TSO in the RR Prequalification Process. A RR Provider shall inform its Reserve Connecting TSO immediately about an unavailability of its RR Providing Unit.		These obligations are very similar to those in the existing Balancing Mechanism and specific A/S contractual obligations;

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Chapter 7 **EXCHANGE AND SHARING OF RESERVES**	
Section 1 **Exchange and Sharing of Reserves within a Synchronous Area**	Section 1 of this document applies to the rules for exchanging holdings and obligations between System Operators within the same synchronous area. GB has a single NETSO withing the GB Synchronous Area and thus Section 1 does not apply to current GB operations. Section 2, which is relevant to exchanges between GB and other synchronous areas is found further down the page.
	As commented elsewhere, this secition would also benefit significantly from greater clarity of definition of the TSO role. GB has requested this for discussion in future drafting meetings.
Article 35 **EXCHANGE OF FCR WITHIN A SYNCHRONOUS AREA**	
1. Each TSO shall have the right to exchange part of its initial FCR Obligation defined in accordance with Article 27(1) with other TSOs of its Synchronous Area in accordance with the provisions of this Article.	
2. All TSOs participating to an exchange of FCR Obligation shall ensure to respect the limits and requirements for the exchange of FCR Obligation within the Synchronous Area as defined in table 4:	

~~Synchronous Area~~	~~Exchange of FCR allowed between:~~	~~Limits for the exchange of FCR~~
Synchronous Area CE	TSOs of LFC Blocks	- the TSOs of a LFC Block shall secure, that part of its Initial FCR Obligation, according to **Error! Reference source not found.**(**Error! Reference source not found.**), is provided inside the LFC Block. As a minimum 30 % of the Initial FCR Obligation shall be kept inside the LFC Block
	TSOs of the LFC Areas of Adjacent LFC Blocks	- the total FCR Obligation that the TSOs of a LFC Block fulfil for TSOs of Adjacent LFC Blocks shall be limited to 30% of the sum of the Initial FCR Obligations, according to **Error! Reference source not found.**(**Error! Reference source not found.**), of the TSOs of the LFC Block. - In case the 30% of the sum of the Initial FCR Obligations of the TSOs of the LFC Areas constituting a LFC Block is less than 100 MW, this limit is set by default to 100 MW.
	TSOs of the LFC Areas of the same LFC Block	- The TSOs of the LFC Areas constituting a LFC Block shall set internal limits in a TSO multi-party agreement while respecting the provisions of Article 3(3), for the exchange of FCR between the LFC Areas of the LFC Block as to: o avoid internal congestions or issues in case of network splitting; and o avoid that the stability of the FCP or the Operational Security is affected.
other Synchronous Areas	TSOs	- The TSOs of the Synchronous Area shall agree on the limits for the exchange of FCR within a Synchronous Area Agreement.

~~Table 4: Limits and requirements for the Exchange of FCR Obligation~~

3. When proceeding to an exchange of FCR Obligations, the Reserve Connecting TSO and Reserve Receiving TSO shall notify the TSOs of the Synchronous Areaof at least:	
a) the maximum considered volume of the exchanged FCR Obligation;	
b) the period of time for the exchange of FCR Obligation; and	
c) the results of a simulation or estimation of the impact of the planned exchange of FCR Obligation on the cross-border flows within the Synchronous Area in case of FCR activation.	
A TSO of the Synchronous Area shall qualify as an Affected TSO if the impact of the exchange of FCR Obligation on its cross-border flows exceeds the common threshold.	
An exchange of FCR Obligations shall be agreed by the Reserve Connecting TSO, the Reserve Receiving TSO and all Affected TSOs.	
4. All TSOs of a Synchronous Area shall define, in a Synchronous Area Agreement, a common threshold for the impact of the exchange of FCR Obligation on the cross-border flows in case of FCR activation and inform the NRA(s) while respecting the provisions of Article 3(3).	
5. Each Affected TSO shall ensure that its transmission reliability margin is sufficient to enable the planned exchange of FCR Obligations and ensures the operational security	
6. Each TSO of a LFC Area shall adjust the parameters of its Frequency Restoration Control Error calculation to take the exchange of FCR Obligation into account.	
7. The Reserve Connecting TSO shall be responsible for the exchanged FCR Obligation according to the requirements of Article 28 and Article 29.	
8. The FCR Providing Unit shall only have a responsibility for FCR activation towards its Reserve Connecting TSO.	
Article 36 **SHARING OF FCR WITHIN A SYNCHRONOUS AREA**	
1. A TSO shall not share part of its Initial FCR Obligation with other TSOs in the Synchronous Area, in order to reduce the total amount of FCR of the Synchronous Area as defined in accordance with Article 27(1).	This statement is saying that given areas may not reduce their overall holding of reserves. However other forms of optimisation in terms of how reserves are activated may be developed.
Article 37 **GENERAL REQUIREMENTS FOR THE EXCHANGE OF FRR AND RR**	
1. The Reserve Connecting and Reserve Receiving TSOs, participating to an exchange of FRR/RR shall organise the exchange in such a way that one of them is responsible for the activation and monitoring of the exchanged FRR/RR. The Reserve Connecting TSO shall give its prior consent to the Reserve Receiving TSO before it can be held responsible for the activation and monitoring of the exchanged FRR/RR.	It is important that both the TSO in the region providing (and its coordination/control of the providing unit) and the receiving TSO [as well as the interconnector operator(s) in the middle] come to legal and technical procedural agreement on who is responsible for what...

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The Reserve Connecting TSO must give its prior consent in case of a direct relationship between the Reserve Receiving TSO and the FRR /RR Provider.		
2. Sufficient cross-border transmission capacity must be available for the cross-border exchange of FRR/RR. The Reserve Connecting TSO and Reserve Receiving TSO shall agree on the identity of the TSO responsible to secure and ensure before real-time the availability of sufficient transmission capacity for the exchange of FRR/RR in a TSO multi-party agreement.		
3. All TSOs of a Synchronous Area shall define, in a Synchronous Area Agreement 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 shall cover at least:		
a) Notification process;		
b) Scheduling and accounting of the activated exchanged FRR/RR; and		
c) Data delivery and transparency.		
4. The Reserve Receiving and Reserve Connecting TSO shall consult any Affected TSO prior to the exchange of FRR and/or RR and have its prior agreement.		This is particularly imporant in the case of cross-area exchanges. Thus in this example GB would have the right on techincal/security grounds to restrict Ireland from agreeing to service exchanges with continental TSOs (whereby flows pass through GB). Equally as an example other continental TSOs may have rights to object to or set thresholds on what services GB could procure from an eastern European TSO.
The Reserve Receiving TSO shall inform any Affected TSO of at least:		
a) the total amount of the planned exchange of FRR/RR;		
b) the period of time of the exchange; and		
c) expected power flow due to the exchange.		
5. In case of the exchange of FRR and/or RR, a FRR and/or RR Providing Unit shall only have one responsibility for FRR/RR activation towards one TSO at any time in accordance with the Article 37.		
6. In case of the exchange of FRR/RR, each TSO of a LFC Block shall have the right to limit the amount of its FRR/RR that can be located outside its LFC Area in a multi-party agreement with other TSOs of the LFC Block according to the provision of Article 3(3).		
Article 38		
General requirements for the sharing of FRR and RR		
1. Each Reserve Receiving TSO shall remain responsible to cope with incidents and imbalances in case the shared FRR/RR are unavailable due to:		
a) transmission capacity congestions;		
b) activation of the shared FRR by the Reserve Connecting TSO.		
2. The Reserve Connecting TSO, participating to the sharing of FRR/RR, is responsible for the activation and monitoring of the shared FRR/RR.		
3. The Reserve Receiving TSO shall not activate the shared FRR/RR in case insufficient transmission capacity is available. The Reserve Receiving TSO is responsible to ensure the availability of sufficient transmission capacity required for the activation of shared FRR/RR.		
4. All TSOs of a Synchronous Area shall define, in a Synchronous Area Agreement the roles and responsibilities of the Reserve Connecting TSO, the Reserve Receiving TSO and Affected TSO for the sharing of FRR/RR. The roles and responsibilities shall cover at least:		
d) Notification process;		
e) Scheduling and accounting of the activated shared FRR/RR; and		
f) Data delivery and transparency.		
5. In case of the sharing of FRR/RR, an FRR/RR Providing Unit shall only have a responsibility for FRR/RR activation towards the Reserve Connecting TSO.		
6. The Reserve Receiving and Reserve Connecting TSO shall consult any Affected TSO prior to the sharing of FRR/RR and have its prior agreement.		
The Reserve Receiving TSO shall inform any Affected TSO of at least:		
d) the total amount of the planned sharing of FRR/RR;		
e) the period of time of the sharing; and		
f) expected power flow due to the sharing.		
Article 39		
EXCHANGE OF FRR WITHIN A SYNCHRONOUS AREA		
1. Each TSO shall have the right to exchange part of its FRR with other TSOs of its Synchronous Area in accordance with the provisions of this Article and Article 37.		
2. All TSOs in a Synchronous Area consisting of more than one LFC Block participating to an exchange of FRR shall ensure to respect the requirements and limits for the exchange of FRR within a Synchronous Area as defined in table 5:		

Synchronous Area	Exchange of FRR allowed between	Limits for the exchange of FRR
All Synchronous Areas excluding Baltic consisting of more than one LFC Block	TSOs of the LFC Areas of different LFC Blocks	- The TSOs of a LFC Block shall ensure that at least 50% of their total FRR, resulting from the FRR Dimensioning Process according to **Error! Reference source not found.**(**Error! Reference source not found.**), remains located within their LFC Block.
	TSOs of the LFC Areas of the same LFC Block	- The TSOs of the LFC Areas constituting a LFC Block shall set internal limits in a TSO multi-party agreement and inform the NRA(s) while respecting the provisions of **Error! Reference source not found.**(**Error! Reference source not found.**), if required for the exchange of FRR between the LFC Areas of the LFC Block as to: o Avoid internal congestions or issues in case of network splitting; and o Avoid that the stability of the FRP or the Operational Security is affected.

Table 5: Requirements and limits for the exchange of FRR Obligations within the Synchronous Area

ENTSO-E Network Code Text		Commentary
The limits for cross-border exchange of FRR within a Synchronous Area shall not apply for the exchange of FRR supplementary to the FRR resulting from the FRR Dimensioning Process according to Article 30(1).		
Article 40		
Sharing of FRR within a Synchronous Area		
1. Each TSO of a LFC Block shall have the right to share part of its FRR with other LFC Blocks of its Synchronous Area within the limits set by the FRR Dimensioning Process in Article 30(1) while respecting the general rules of Article 38.		
Article 41		
EXCHANGE OF RR WITHIN A SYNCHRONOUS AREA		
2. Each TSO shall have the right to exchange part of its RR with other TSOs of its Synchronous Area in accordance with the provisions of this Article and Article 37.		
3. All TSOs in a Synchronous Area consisting of more than one LFC Block participating to an exchange of RR shall ensure to respect the requirements and limits for the exchange of RR within a Synchronous Area as defined in table 6:		

Synchronous Area	Exchange of RR allowed between	Limits for the exchange of RR
All Synchronous Areas excluding Baltic consisting of more than one LFC Block	TSOs of the LFC Areas of different LFC Blocks	- The TSOs of the LFC Areas constituting a LFC Block shall ensure that at least 50% of their RR, resulting from the RR Dimensioning Process according to **Error! Reference source not found.**(**Error! Reference source not found.**), remains located within their LFC Block.
	TSOs of the LFC Areas of the same LFC Block	- The TSOs of the LFC Areas constituting a LFC Block shall set internal limits in a TSO multi-party agreement and inform the NRA(s) while respecting the provisions of **Error! Reference source not found.**(**Error! Reference source not found.**), if required for the exchange of RR between LFC Areas of the LFC Block as to: o Avoid internal congestions or issues in case of network splitting; and o Avoid that the stability of the RRP or the Operational Security is affected.

Table 6: Requirements and limits for the exchange of RR Obligations within the Synchronous Area

The above mentioned limits for cross-border exchange of RR shall not apply for the exchange of RR supplementary to the RR resulting from the RR Dimensioning Process.		
Article 42		
Sharing of RR within a Synchronous Area		
1. Each TSO of a LFC Block shall have the right to share part of its RR with other LFC Blocks while respecting the general rules of Article 38.		
2. The TSOs of a LFC Block shall only consider a reduction of the required RR for the LFC Block, defined by the RR Dimensioning Process of Article 33, as a result of a RR sharing agreement after verifying, together with the Reserve Connecting TSO(s), that the probability of the simultaneous need for the shared RR capacity by more than one TSO is very unlikely to happen according to Article 3(3).		
Section 2		
Exchange and Sharing of Reserves between Synchronous Areas		
Article 43		
EXCHANGE AND SHARING OF RESERVES BETWEEN SYNCHRONOUS AREAS		
1. Each operator of an HVDC interconnector interconnecting Synchronous Areas shall provide the capability where the technology exists to allow the Connecting TSOs of the HVDC interconnector to perform FCR exchange and FRR and RR sharing or exchange on HVDC interconnectors.		The ability to share/exchange reserves with areas outside GB is very dependant on both the techncial capabilities of HVDC interconnections and also the operational controllability of HVDC interconnectors. This code obliges the owners/operators of HVDC interconnectors to provide methods (where their installation has that capability) to control and coordinate active power transfer with TSOs/Blocks quickly enough for the relevant reserve service to function correctly. * The HVDC connection code considers the obligations and requirements on HVDC installations including rapid controllability of active power
2. For the exchange and sharing of reserves between Synchronous Areas, the provisions contained in Article 35 and Article 37 to Article 42 shall apply together with the provisions of the Article 44 to Article 49.		These relate to the limitations in volumes which are permitted to be shared or exchanged. These geographic restrictions are to prevent security issues arising from insufficient adequecy within any given area. When the Balancing Code considers the development of commercial products these will need to respect these limits.
Article 44		
EXCHANGE OF FCR BETWEEN SYNCHRONOUS AREAS		
1. All TSOs participating to an exchange of FCR shall organise the cross-border exchange in such a way that the TSOs of a first Synchronous Area may receive part of the total FCR required for their Synchronous Area as defined in accordance with the Article 27(1) within a second Synchronous Area.		
The part of the total FCR required for the first Synchronous Area which is exchanged shall be provided within the second Synchronous Area in addition to the total FCR required for this second Synchronous Area in accordance with Article 27(1).		
Each operator of a HVDC interconnector shall control the Active Power Flow over the HVDC interconnector depending on the Frequency Deviation of the first Synchronous Area in accordance with the FCR requirements established in Article 27(1).		

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2. All TSOs of the Synchronous Area shall define rules and minimum requirements for exchange of FCR between Synchronous Areas in a multi-party agreement. The rules and minimum requirements shall cover at least		
a) the operational impact between the Synchronous Areas; and		
b) the impact on the frequency quality of the involved Synchronous Areas.		
3. The Reserve Connecting TSO and the Reserve Receiving TSO shall agree in a TSO multi-party agreement upon the exchange of FCR Obligation.		
4. The Reserve Connecting TSO and the Reserve Receiving TSO shall inform all TSOs of the Synchronous Area of at least :		
a) the volume of the exchanged FCR Obligation; and		The intention is for regional agreements to be developed appropriate security considerations of involved and affected areas dealing with FCR exchange.
b) the period of time for the exchange of FCR Obligation.		
5. For the exchange of FCR between Synchronous Areas, the provisions contained in Article 27 shall apply. Each TSO shall ensure or reflect in its FCR requirement elaborated in accordance with Article 27 that the contribution from each Bipole of a HVDC interconnector and the total contribution from a HVDC interconnector do not exceed the limits established in Article 29(5).		
Article 45		
SHARING OF FCR BETWEEN SYNCHRONOUS AREAS		
1. A TSO shall not share part of its FCR with other TSOs of another Synchronous Area, unless the TSO is sharing FCR between the Synchronous Area Great Britain and the Synchronous Area Ireland.		Continental TSOs have (in this public consultation draft version of the code) not been willing to permit sharing between TSOs in continental Europe and other areas. This code restricts this to provisions which exist in the form of LF & HF services between Ireland and GB.
2. When sharing FCR in accordance with Article 45(1), all TSOs participating shall organise the cross-border sharing in such a way that the TSOs of a first Synchronous Area has the right to share part of the FCR Capacity as defined in accordance with the Article 27(1) with a second Synchronous Area.		
3. Each operator of a HVDC interconnector shall control the Active Power Flow over the HVDC interconnector depending on the Frequency Deviation of the first Synchronous Area and the Frequency Deviation of the second Synchronous Area in accordance with the FCR requirements in Article 27 and the specifications defined by the TSOs of the first and second Synchronous Areas in a multi-party agreement while respecting the provisions of Article 3(3).		
Article 46		
EXCHANGE OF FRR BETWEEN SYNCHRONOUS AREAS		
1. The TSOs of the LFC Blocks involved in the different Synchronous Areas shall have the right to exchange FRR. For the exchange of FRR between Synchronous Areas, the provisions contained in Article 38 shall apply.		
2. All TSOs participating to an exchange of FRR shall organise the cross-border exchange in such a way that the TSO of a first Synchronous Area may receive part of the FRR Capacity as defined in accordance with Article 31 within the second Synchronous Area.		
The part of the FRR Capacity which is exchanged shall be provided within an LFC Block of the second Synchronous Area in addition to the FRR Capacity of this LFC Block of the second Synchronous Area as defined in accordance with **Error! Reference source not found.**.		
Each operator of a HVDC interconnector shall control the Active Power Flow over the HVDC interconnector depending on the set point of the first Synchronous Area in accordance with the FRR requirements established in Article 31.		
3. The TSOs of the LFC Block involved in the different Synchronous Areas shall agree upon the exchange of FRR in a multi-party agreement.		
4. The TSOs of the LFC Block involved in the different Synchronous Areas shall inform all TSOs of the Synchronous Areasof at least:		
a) the volume of the exchanged FRR Obligation; and		
b) the period of time for the exchange of FRR Obligation.		
Article 47		
SHARING OF FRR BETWEEN SYNCHRONOUS AREAS		
1. Each TSO of a LFC Block shall have the right to share part of its FRR with a TSO from another Synchronous Area in accordance with the rules established in Article 40(1) to Article 40(0).		
Article 48		
EXCHANGE OF RR BETWEEN SYNCHRONOUS AREAS.		
1. The TSOs of LFC Blocks involved in the different Synchronous Areas shall have the right to exchange RR. For the exchange of RR between Synchronous Areas, the provisions contained in Article 41 shall apply.		
2. If capacity on a HVDC interconnector allows, HVDC interconnector operators shall allow the interconnected TSOs to exchange RR by changing flows on the HVDC interconnector. The amount of RR available shall be dependent on the interconnector flow and total capability of the interconnector.		
3. When several TSOs of a first Synchronous Area entered into an agreement with the TSOs of a second Synchronous Area for the exchange of RR via a HVDC interconnector, the total RR which could be exchanged shall not be greater than the total RR provided by the HVDC interconnector. When the total RR is greater than the available capacity of the HVDC interconnector, it should be proportionally allocated to the contracted TSOs.		The market arrangements should prevent over allocation of Cross-Border 'RR' however this clause states that where there are insuffient paths between Synchronous Areas to meet the obligations between TSOs then there will be an overall reduction to that physical limitation on a % or pro-rata basis between TSOs on each side of the boundary
Article 49		
SHARING OF RR BETWEEN SYNCHRONOUS AREAS		
1. Each TSO of a LFC Block shall have the right to share part of its RR with a TSO of a LFC Block from another Synchronous Area according to the requirements of Article 42.		
Section 3		
Cross-Border Activation Process of FRR and RR for Optimisation Purposes		
Article 50		
CROSS-BORDER ACTIVATION PROCESS OF FRR AND RR FOR OPTIMIZATION PURPOSES		

ENTSO-E Network Code Text		Commentary
1. Each TSO shall have the right to make part of its FRR or RR available to other TSOs of its Synchronous Area or from another Synchronous Area, regardless of any exchange and/or sharing agreement for FRR / RR, in order to optimize the activation of FRR or RR balancing energy in accordance with the provisions of the [NC Balancing].		
2. All TSOs of the Synchronous Area shall set limits in a Synchronous Area Agreement to the amount of FRR or RR which can be made available to other TSOs in accordance with Article 50 in order to ensure the continuous access to the required FRR or RR resulting from their FRR or RR Dimensioning Process while respecting the provisions of Article 3(3).		
3. The cross-border activation of FRR and RR is only allowed in case sufficient transmission capacity is available.		
4. Each TSO shall ensure that, and limit if required, the amount of its FRR or RR made available to other TSOs in accordance with Article 50(1), does not jeopardise:		The overall design of the sharing/exchange, does not cause or threaten to cause any security consideration. Under such circumstances the volumes which may be exported or imported in one or more reserve categories may be restricted.
a) the stability of the FCP, FRP and Replacement Process;		
b) the ability of its LFC Block to reach its Frequency Restoration Control Error Quality Target;		
c) the general rule that FRR and RR capacity should remain physically located within the LFC Block where the imbalances originate before optimization, reflected by the FRR Dimensioning Rules and the limits for the sharing and exchange of FRR and RR; and		
d) the Operational Security.		

ENTSO-E Network Code Text		Commentary
Chapter 8		
TIME CONTROL PROCESS		Time control is currently not a statutory obligation in GB and will not become one under this code. To do so would introduce additional balancing costs.
Article 51		
TIME CONTROL PROCESS		
1. The Electrical Time Control Process is used at the level of the Synchronous Area for ensuring that the average value of the System Frequency is equal to the Nominal Frequency.		
2. The Time Control Process shall be designed to:		
a) define the Electrical Time Deviations values after which corrective actions start ;		
b) monitor continuously the Electrical Time Deviations;		
c) calculate the System Frequency offset value needed to reduce the Electrical Time Deviation;		
d) inform the TSO operating a LFC Area for the moment when the Set Point Frequency will be corrected with the frequency offset value.		
3. All TSOs of the Synchronous Area shall modify the Set Point Frequency with the System Frequency offset value when the Electrical Time Deviation exceeds the values indicated in the Table 7:		
4. All TSOs of a Synchronous Area shall appoint one TSO of this Synchronous Area for implementing the Time Control Process.		

	Baltic	CE	CY	GB	IRE	NE
Electrical Time Deviation	+/- 20s	+/- 20s	+/- 10s	Not applicable	Not applicable	+/- 30s

Table 7: Electrical Time Deviation Parameter

ENTSO-E Network Code Text		Commentary
Chapter 9		
CO-OPERATION WITH DSO		
Article 52		
RESERVE PROVIDING UNITS CONNECTED TO THE DSO GRID		
1. Two months before the Prequalification of a Reserve Providing Unit or Reserve Providing Group connected to a distribution network, the responsible Provider shall inform its Reserve Connecting DSO of:		
a) the voltage level and location of each power generating module and demand unit of the Reserve Providing Group;		
b) the provided reserve type, being FCR, FRR or RR;		
c) the maximum Reserve Capacity provided by each power generating module and demand unit of the Reserve Providing Group; and		
d) the maximum change of rate of active power for each generating module and demand unit.		
2. Within one month from the delivery of the information referred to in Article 52(1), each Reserve Connecting DSO shall have the right, on the basis of a security analysis, to object to the use by the TSO of such reserve or set limits to the volume delivered of such reserve to the TSO while respecting the provision of Article 3(3).		
3. Each Reserve Connecting DSO shall have the right to request from a Provider the provision of the information referred to in Article 52(1) during the time the Reserve Providing Unit or Reserve Providing Group is in operation.		

ENTSO-E Network Code Text		Commentary
Chapter 10		
Transparency of Information		
Article 53		
General Requirements		
1. All TSOs shall ensure that information is published at a time and in a format which does not create an actual or potential competitive advantage or disadvantage to any individual party or category of party.		
2. All TSOs shall have the right to define parameters and implement processes and methodologies without complying with publication timeframes defined in Article 54, Article 55, Article 56, Article 57 and Article 58 if required for the maintenance of Operational Security.		
3. All TSO shall endeavour the availability and the correctness of the information.		
4. The publication of the information required in Article 54, Article 55, Article 56, Article 57 , Article 58 and Article 59 shall at least be published in English language.		
Article 54		
Information on Frequency Quality		
1. All TSOs of each Synchronous Area shall publish on a common public website		
a) the Frequency Quality Defining Parameters;		
b) the Frequency Quality Target Parameters;		
c) the Frequency Restoration Control Error Defining Parameters; and		
d) the Frequency Restoration Control Error Target Parameters		
for each Synchronous Area not later than one month before the effective date of the definition of a parameter according to Article 8.		
2. All TSOs of each Synchronous Area shall publish on a common public website the results of the Criteria Application Process comprising at least		
a) the values of the Frequency Quality Evaluation Criteria;		
b) the measurement period;		
c) the precision of the recorded measurements; and		
d) the calculation method		
for each Synchronous Area not later than six months after the last time stamp of the measurement period and at least four times a year.		
Article 55		
Information on Load-Frequency-Control Structure		
1. All TSOs of each Synchronous Area shall publish on a common public website the content of the Synchronous Area A referred to in Article 16 and related to		
a) the Process Activation Structure; and		
b) the Process Responsibility Structure		
for each Synchronous Area not later than one month before the entry into force of the Synchronous Area Agreement.		
2. The publication according to Article 55(1) shall at least include the information on		
a) the defined Monitoring Areas, LFC Areas and LFC Blocks and its TSOs; and		
b) the defined processes listed in Article 16(1) and Article 16(2).		
3. All TSOs implementing an Imbalance Netting Process shall announce the implementation on their public websites not later than one month before the beginning of the operation.		
Article 56		
Information on FCR		
1. All TSOs of each Synchronous Area except the Synchronous Area IRE shall publish on a common public website		
a) the dimensioning approach for FCR;		
b) the total amount of FCR for each Synchronous Area; and		
c) the shares of FCR required for each TSO as the Initial FCR Obligation		
for each Synchronous Area not later than one month before the effective date of the decision referred to in Article 27.		
2. All TSOs of each Synchronous Area shall publish on a common public website the FCR Properties defined for each Synchronous Area according to Article 28 not later than one month before the effective date of the decision.		
Article 57		
Information on FRR		
1. All TSOs of each Synchronous Area shall publish on a common public website the FRR Technical Requirements for each Synchronous Area not later than one month before the effective date of the decision referred to in Article 31(1).		
2. All TSOs of each LFC Block shall publish on a common public website the complementary FRR Technical Requirements and FRR Availability Requirements for the LFC Block not later than one month before the entry into force of the TSO multi-party agreement referred to in Article 31(2).		

ENTSO-E Network Code Text		Commentary
3. All TSOs of each LFC Block shall publish on a common public website the FRR Dimensioning Rules defined for the LFC Block not later than one month before the entry into force of the TSO multi-party agreement referred to in Article 30(1).		
4. All TSOs of each Synchronous Area shall ensure the publication of an outlook of the FRR capacities of each LFC Block for the next year not later than the 30th of November of the current year on a common public website. All TSOs of each Synchronous Area shall ensure the publication of the actual FRR capacities of each LFC Block of the past quarter not later than the 30 days after the end of the quarter on a common public website.		
Article 58		
Information on RR		
1. All TSOs of each LFC Block which operates a Reserve Replacement Process shall publish on a common public website the RR Technical Requirements and RR Availability Requirements for the LFC Block not later than one month before the effective date of the entry into force of the TSO multi-party agreement referred to in Article 34(2).		
2. All TSOs of each LFC Block shall publish on a common public website the RR Dimensioning Rules defined for the LFC Block not later than one month before the entry into force of the TSO multi-party agreement referred to in Article 33(1).		
3. All TSOs of each Synchronous Area shall ensure the publication of an outlook of the RR capacities of each LFC Block for the next year not later than the 30th of November of the current year on a common public website. All TSOs of each Synchronous Area shall ensure the publication of the actual RR capacities of each LFC Block of the past quarter not later than the 30 days after the end of the quarter on a common public website.		
Article 59		
Information on Sharing and Exchange		
1. All TSOs of each Synchronous Area shall publish on a common public website the annual compilation of the sharing agreements for each LFC Block as part of the publications required by Article 57(2) and Article 58(3). The publication shall include the information about		
a) and the identity of the LFC Blocks between which a sharing agreement exists;		
b) the realized reduction of FRR and RR due to the sharing agreement.		
2. All TSOs of each Synchronous Area shall publish on a common public website the amount of FCR shared between Synchronous Areas as part of the publication required by Article 56(1). The publication shall include the information about		
a) the amount of shared/exchanged FCR Capacity between TSOs which entered sharing agreements; and		
b) which TSOs reduced FCR Capacity and which TSOs provided FCR Capacity.		
3. All TSOs of each LFC Area or LFC Block shall publish the information on FCR, FRR and RR exchange in accordance to the national regulations.		

ENTSO-E Network Code Text		Commentary
Chapter 11		
FINAL PROVISIONS		
Article 60		
AMENDMENT OF CONTRACTS AND GENERAL TERMS AND CONDITIONS		
Within three years after the entry into force of this Network Code, each relevant TSO, Reserve Connecting DSO and each Provider shall amend all relevant clauses in contracts and / or relevant clauses in general terms and conditions relating to the processes of load-frequency control and the provision of reserves, regardless of whether the relevant contracts or general terms and conditions contain an amendment process, in order to achieve compliance with the requirements of this Network Code.		
Article 61		
ENTRY INTO FORCE		
This Network Code shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.		
It shall apply as from the day of expiration of a two years period following its publication.		
This Network Code shall be binding in its entirety and directly applicable in all Member States.		
The implementation of the requirements defined in this NC and the agreement of the necessary Synchronous Area Agreements and TSO multi-party agreements shall be finalised 12 months after the NC is set into force.		