

Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (Text with EEA relevance)

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THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003⁽¹⁾, and in particular Article 18(3)(d) and Article 18(5) thereof,

Whereas:

- (1) A fully functioning and interconnected internal energy market is crucial for maintaining security of energy supply, increasing competitiveness and ensuring that all consumers can purchase energy at affordable prices.
- (2) Regulation (EC) No 714/2009 sets out non-discriminatory rules governing access to the network for cross-border exchanges in electricity with a view to ensuring the proper functioning of the internal market in electricity.
- (3) Harmonised rules on system operation for transmission system operators ('TSOs'), distribution system operators ('DSOs') and significant grid users ('SGUs') should be set out in order to provide a clear legal framework for system operation, facilitate Union-wide trade in electricity, ensure system security, ensure the availability and exchange of necessary data and information between TSOs and between TSOs and all other stakeholders, facilitate the integration of renewable energy sources, allow more efficient use of the network and increase competition for the benefit of consumers.
- (4) To ensure the operational security of the interconnected transmission system, it is essential to define a common set of minimum requirements for Union-wide system operation, for the cross-border cooperation between the TSOs and for utilising the relevant characteristics of the connected DSOs and SGUs.
- (5) All TSOs should comply with the common minimum requirements on procedures necessary to prepare real-time operation, to develop individual and deliver common grid models, to facilitate the efficient and coordinated use of remedial actions which are necessary for real-time operation in order to maintain the operational security, quality and stability of the interconnected transmission system, and to support the efficient functioning of the European internal electricity market and facilitate the integration of renewable energy sources ('RES').

- (6) While there are currently a number of voluntary regional cooperation initiatives in system operations promoted by TSOs, formalised coordination between TSOs is necessary for operating the Union transmission system in order to address the transformation of the Union electricity market. The rules for system operation provided for in this Regulation require an institutional framework for enhanced coordination between TSOs, including the mandatory participation of TSOs in regional security coordinators ('RSCs'). The common requirements for the establishment of RSCs and for their tasks set out in this Regulation constitute a first step towards further regional coordination and integration of system operation and should facilitate the achievement of the aims of Regulation (EC) No 714/2009 and ensure higher security of supply standards in the Union.
- (7) This Regulation should set out a framework for the mandated cooperation of TSOs via the appointment of RSCs. RSCs should issue recommendations to the TSOs of the capacity calculation region for which it is appointed. TSOs should, individually, decide whether to follow or not the recommendations of the RSC. The TSO should remain responsible for maintaining operational security of its control area.
- (8) Rules on operational training and certification are required in order to guarantee that system operator employees and other operational staff are skilled and well trained and that the system operator employees in real-time operation are certified to operate the transmission system in a secure way during all operational situations. The rules on training and certification strengthen and formalise existing best practices amongst TSOs and ensure that minimum standards are applied by all TSOs in the Union.
- (9) Operational testing and monitoring requirements aim at ensuring the correct functioning of the elements of the transmission system, the distribution system and of the grid users' equipment. Planning for and the coordination of operational tests are necessary to minimise disruptions in the stability, operation and economic efficiency of the interconnected system.
- (10) In view that planned outages impact grid stability also outside of a TSO's control area, each TSO should, within the scope of operational planning, monitor the feasibility of planned outages for each time-frame and where necessary, coordinate outages with and between TSOs, DSOs and SGUs when those outages have an impact on cross-border flows affecting the operational security of the transmission systems.
- (11) The operational and scheduling processes required to anticipate real-time operational security difficulties and develop relevant remedial measures involve timely and adequate data exchange. Therefore, such exchange should not be hampered by any barriers between the different actors involved.
- (12) One of the most critical processes in ensuring operational security with a high level of reliability and quality is the load-frequency control ('LFC'). Effective LFC can be made possible only if there is an obligation for the TSOs and the reserve connecting DSOs to cooperate for the operation of the interconnected transmission systems as one entity and for providers' power generating modules and providers' demand facilities to meet the relevant minimum technical requirements.

- (13) The provisions on LFC and reserves, aim at setting out clear, objective and harmonised requirements for TSOs, reserve connecting DSOs, providers' power generating modules and providers' 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. The provisions on LFC and reserves provide the technical framework necessary for the development of cross-border balancing markets.
- (14) In order to ensure the quality of the common system frequency, it is essential that a common set of minimum requirements and principles for Union-wide LFC and reserves 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. To that end, this Regulation addresses the LFC structure and operational rules, the quality criteria and targets, the reserve dimensioning, the reserve exchange, sharing and distribution and the monitoring related to LFC.
- (15) Synchronous areas do not stop at the Union's borders and can include the territory of third countries. The Union, Member States and TSOs should aim for secure system operation inside all synchronous areas across the Union. They should support third countries in applying similar rules to those contained in this Regulation. ENTSO for Electricity should facilitate cooperation between Union TSOs and third country TSOs concerning secure system operation.
- (16) In accordance with Article 8 of Regulation (EC) No 713/2009 of the European Parliament and of the Council⁽²⁾, the Agency for the Cooperation of Energy Regulators ('the Agency') should take a decision if the competent regulatory authorities are not able to reach an agreement on common terms and conditions or methodologies.
- (17) This Regulation has been developed in close cooperation with the Agency, ENTSO for Electricity and stakeholders, in order to adopt effective, balanced and proportionate rules in a transparent and participative manner. In accordance with Article 18(3) of Regulation (EC) No 714/2009, the Commission will consult the Agency, ENTSO for Electricity and other relevant stakeholders before proposing any amendment to this Regulation.
- (18) The measures provided for in this Regulation are in accordance with the opinion of the Committee referred to in Article 23(1) of Regulation (EC) No 714/2009,

HAS ADOPTED THIS REGULATION:

PART I

GENERAL PROVISIONS

Article 1

Subject matter

For the purpose of safeguarding operational security, frequency quality and the efficient use of the interconnected system and resources, this Regulation lays down detailed guidelines on:

- (a) requirements and principles concerning operational security;
- (b) rules and responsibilities for the coordination and data exchange between TSOs, between TSOs and DSOs, and between TSOs or DSOs and SGUs, in operational planning and in close to real-time operation;
- (c) rules for training and certification of system operator employees;
- (d) requirements on outage coordination;
- (e) requirements for scheduling between the TSOs' control areas; and
- (f) rules aiming at the establishment of a Union framework for load-frequency control and reserves.

Article 2

Scope

1 The rules and requirements set out in this Regulation shall apply to the following SGUs:

- a existing and new power generating modules that are, or would be, classified as type B, C and D in accordance with the criteria set out in Article 5 of Commission Regulation (EU) 2016/631⁽³⁾;
- b existing and new transmission-connected demand facilities;
- c existing and new transmission-connected closed distribution systems;
- d existing and new demand facilities, closed distribution systems and third parties if they provide demand response directly to the TSO in accordance with the criteria in Article 27 of Commission Regulation (EU) 2016/1388⁽⁴⁾;
- e providers of redispatching of power generating modules or demand facilities by means of aggregation and providers of active power reserve in accordance with Title 8 of Part IV of this Regulation; and
- f existing and new high voltage direct current ('HVDC') systems in accordance with the criteria in Article 3(1) of Commission Regulation (EU) 2016/1447⁽⁵⁾.

2 This Regulation shall apply to all transmission systems, distribution systems and interconnections in the Union and regional security coordinators, except transmission systems and distribution systems or parts of the transmission systems and distribution systems located in islands of Member States of which the systems are not operated synchronously with Continental Europe ('CE'), Great Britain ('GB'), Nordic, Ireland and Northern Ireland ('IE/NI') or Baltic synchronous area.

3 Where more than one TSO exists in a Member State, this Regulation shall apply to all TSOs in a Member State. Where a TSO does not have a function relevant to one or more obligations under this Regulation, Member States may, under the national regulatory regime, provide that the responsibility of a TSO to comply with one or some or all obligations under this Regulation is assigned to one or more specific TSOs.

4 The TSOs of Lithuania, Latvia and Estonia are, as long as and to the extent that they are operating in a synchronous mode in a synchronous area where not all countries are bound by Union legislation, exempted from the application of the provisions listed in Annex I to this Regulation, unless otherwise foreseen in a cooperation agreement with third country TSOs setting the basis for their cooperation concerning secure system operation pursuant to Article 13.

5 Where the requirements under this Regulation are to be established by a relevant system operator that is not a TSO, Member States may provide that instead the TSO be responsible for establishing the relevant requirements.

Article 3

Definitions

1 For the purposes of this Regulation, the definitions in Article 2 of Regulation (EC) No 714/2009, Article 2 of Commission Regulation (EU) 2015/1222⁽⁶⁾, Article 2 of Commission Regulation (EU) 2016/631, Article 2 of Commission Regulation (EU) 2016/1388, Article 2 of Commission Regulation (EU) 2016/1447, Article 2 of Commission Regulation (EU) 2016/1719⁽⁷⁾, Article 2 of Commission Regulation (EU) No 543/2013⁽⁸⁾ on submission and publication of data in electricity markets and Article 2 of Directive 2009/72/EC of the European Parliament and of the Council⁽⁹⁾ shall apply.

2 In addition, the following definitions shall apply:

- (1) ‘operational security’ means the transmission system's capability to retain a normal state or to return to a normal state as soon as possible, and which is characterised by operational security limits;
- (2) ‘constraint’ means a situation in which there is a need to prepare and activate a remedial action in order to respect operational security limits;
- (3) ‘N-situation’ means the situation where no transmission system element is unavailable due to occurrence of a contingency;
- (4) ‘contingency list’ means the list of contingencies to be simulated in order to test the compliance with the operational security limits;
- (5) ‘normal state’ means a situation in which the system is within operational security limits in the N-situation and after the occurrence of any contingency from the contingency list, taking into account the effect of the available remedial actions;
- (6) ‘frequency containment reserves’ or ‘FCR’ means the active power reserves available to contain system frequency after the occurrence of an imbalance;
- (7) ‘frequency restoration reserves’ or ‘FRR’ means the active power reserves available to restore system frequency to the nominal frequency and, for a synchronous area consisting of more than one LFC area, to restore power balance to the scheduled value;

- (8) 'replacement reserves' or 'RR' means the active power reserves available to restore or support the required level of FRR to be prepared for additional system imbalances, including generation reserves;
- (9) 'reserve provider' means a legal entity with a legal or contractual obligation to supply FCR, FRR or RR from at least one reserve providing unit or reserve providing group;
- (10) 'reserve providing unit' means a single or an aggregation of power generating modules and/or demand units connected to a common connection point fulfilling the requirements to provide FCR, FRR or RR;
- (11) 'reserve providing group' means an aggregation of power generating modules, demand units and/or reserve providing units connected to more than one connection point fulfilling the requirements to provide FCR, FRR or RR;
- (12) 'load-frequency control area' or 'LFC area' means a part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control;
- (13) 'time to restore frequency' means the maximum expected time after the occurrence of an instantaneous power imbalance smaller than or equal to the reference incident in which the system frequency returns to the frequency restoration range for synchronous areas with only one LFC area and in the case of synchronous areas with more than one LFC area, the maximum expected time after the occurrence of an instantaneous power imbalance of an LFC area within which the imbalance is compensated;
- (14) '(N-1) criterion' means the rule according to which the elements remaining in operation within a TSO's control area after occurrence of a contingency are capable of accommodating the new operational situation without violating operational security limits;
- (15) '(N-1) situation' means the situation in the transmission system in which one contingency from the contingency list occurred;
- (16) 'active power reserve' means the balancing reserves available for maintaining the frequency;
- (17) 'alert state' means the system state in which the system is within operational security limits, but a contingency from the contingency list has been detected and in case of its occurrence the available remedial actions are not sufficient to keep the normal state;
- (18) 'load-frequency control block' or 'LFC block' means a part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other LFC blocks, consisting of one or more LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control;
- (19) 'area control error' or 'ACE' means the sum of the power control error (' ΔP '), that is the real-time difference between the measured actual real time power interchange value ('P') and the control program ('P0') of a specific LFC area or LFC block and the frequency control error (' $K \cdot \Delta f$ '), that is the product of the K-factor and the frequency deviation of that specific LFC area or LFC block, where the area control error equals $\Delta P + K \cdot \Delta f$;
- (20) 'control program' means a sequence of set-point values for the netted power interchange of a LFC area or LFC block over alternating current ('AC') interconnectors;

- (21) ‘voltage control’ means the manual or automatic control actions at the generation node, at the end nodes of the AC lines or HVDC systems, on transformers, or other means, designed to maintain the set voltage level or the set value of reactive power;
- (22) ‘blackout state’ means the system state in which the operation of part or all of the transmission system is terminated;
- (23) ‘internal contingency’ means a contingency within the TSO's control area, including interconnectors;
- (24) ‘external contingency’ means a contingency outside the TSO's control area and excluding interconnectors, with an influence factor higher than the contingency influence threshold;
- (25) ‘influence factor’ means the numerical value used to quantify the greatest effect of the outage of a transmission system element located outside of the TSO's control area excluding interconnectors, in terms of a change in power flows or voltage caused by that outage, on any transmission system element. The higher is the value the greater the effect;
- (26) ‘contingency influence threshold’ means a numerical limit value against which the influence factors are checked and the occurrence of a contingency located outside of the TSO's control area with an influence factor higher than the contingency influence threshold is considered to have a significant impact on the TSO's control area including interconnectors;
- (27) ‘contingency analysis’ means a computer based simulation of contingencies from the contingency list;
- (28) ‘critical fault clearing time’ means the maximum fault duration for which the transmission system retains stability of operation;
- (29) ‘fault’ means all types of short-circuits (single-, double- and triple-phase, with and without earth contact), a broken conductor, interrupted circuit, or an intermittent connection, resulting in the permanent non-availability of the affected transmission system element;
- (30) ‘transmission system element’ means any component of the transmission system;
- (31) ‘disturbance’ means an unplanned event that may cause the transmission system to divert from the normal state;
- (32) ‘dynamic stability’ is a common term including the rotor angle stability, frequency stability and voltage stability;
- (33) ‘dynamic stability assessment’ means the operational security assessment in terms of dynamic stability;
- (34) ‘frequency stability’ means the ability of the transmission system to maintain frequency stable in the N-situation and after being subjected to a disturbance;
- (35) ‘voltage stability’ means the ability of a transmission system to maintain acceptable voltages at all nodes in the transmission system in the N-situation and after being subjected to a disturbance;
- (36) ‘system state’ means the operational state of the transmission system in relation to the operational security limits which can be normal state, alert state, emergency state, blackout state and restoration state;

- (37) 'emergency state' means the system state in which one or more operational security limits are violated;
- (38) 'restoration state' means the system state in which the objective of all activities in the transmission system is to re-establish the system operation and maintain operational security after the blackout state or the emergency state;
- (39) 'exceptional contingency' means the simultaneous occurrence of multiple contingencies with a common cause;
- (40) 'frequency deviation' means the difference between the actual and the nominal frequency of the synchronous area which can be negative or positive;
- (41) 'system frequency' means the electric frequency of the system that can be measured in all parts of the synchronous area under the assumption of a coherent value for the system in the timeframe of seconds, with only minor differences between different measurement locations;
- (42) 'frequency restoration process' or 'FRP' means a process that aims at restoring frequency to the nominal frequency and, for synchronous areas consisting of more than one LFC area, a process that aims at restoring the power balance to the scheduled value;
- (43) 'frequency restoration control error' or 'FRCE' means the control error for the FRP which is equal to the ACE of a LFC area or equal to the frequency deviation where the LFC area geographically corresponds to the synchronous area;
- (44) 'schedule' means a reference set of values representing the generation, consumption or exchange of electricity for a given time period;
- (45) 'K-factor of an LFC area or LFC block' means a value expressed in megawatts per hertz ('MW/Hz'), which is as close as practical to, or greater than the sum of the auto-control of generation, self-regulation of load and of the contribution of frequency containment reserve relative to the maximum steady-state frequency deviation;
- (46) 'local state' means the qualification of an alert, emergency or blackout state when there is no risk of extension of the consequences outside of the control area including interconnectors connected to this control area;
- (47) 'maximum steady-state frequency deviation' means the maximum expected frequency deviation after the occurrence of an imbalance equal to or less than the reference incident at which the system frequency is designed to be stabilised;
- (48) 'observability area' means a TSO's own transmission system and the relevant parts of distribution systems and neighbouring TSOs' transmission systems, on which the TSO implements real-time monitoring and modelling to maintain operational security in its control area including interconnectors;
- (49) 'neighbouring TSOs' means the TSOs directly connected via at least one AC or DC interconnector;
- (50) 'operational security analysis' means the entire scope of the computer based, manual and automatic activities performed in order to assess the operational security of the transmission system and to evaluate the remedial actions needed to maintain operational security;

- (51) ‘operational security indicators’ means indicators used by TSOs to monitor the operational security in terms of system states as well as faults and disturbances influencing operational security;
- (52) ‘operational security ranking’ means the ranking used by TSOs to monitor the operational security on the basis of the operational security indicators;
- (53) ‘operational tests’ means the tests carried out by a TSO or DSO for maintenance, development of system operation practices and training and to acquire information on transmission system behaviour under abnormal system conditions and the tests carried out by significant grid users for similar purposes on their facilities;
- (54) ‘ordinary contingency’ means the occurrence of a contingency of a single branch or injection;
- (55) ‘out-of-range contingency’ means the simultaneous occurrence of multiple contingencies without a common cause, or a loss of power generating modules with a total loss of generation capacity exceeding the reference incident;
- (56) ‘ramping rate’ means the rate of change of active power by a power generating module, demand facility or HVDC system;
- (57) ‘reactive power reserve’ means the reactive power which is available for maintaining voltage;
- (58) ‘reference incident’ means the maximum positive or negative power deviation occurring instantaneously between generation and demand in a synchronous area, considered in the FCR dimensioning;
- (59) ‘rotor angle stability’ means the ability of synchronous machines to remain in synchronism under N-situation and after being subject to a disturbance;
- (60) ‘security plan’ means the plan containing a risk assessment of critical TSO's assets to major physical- and cyber-threat scenarios with an assessment of the potential impacts;
- (61) ‘stability limits’ means the permitted boundaries for the operation of the transmission system in terms of respecting the limits of voltage stability, rotor angle stability and frequency stability;
- (62) ‘wide area state’ means the qualification of an alert state, emergency state or blackout state when there is a risk of propagation to the interconnected transmission systems;
- (63) ‘system defence plan’ means the technical and organisational measures to be undertaken to prevent the propagation or deterioration of a disturbance in the transmission system, in order to avoid a wide area state disturbance and blackout state;
- (64) ‘topology’ means the data concerning the connectivity of the different transmission system or distribution system elements in a substation and includes the electrical configuration and the position of circuit breakers and isolators;
- (65) ‘transitory admissible overloads’ means the temporary overloads of transmission system elements which are allowed for a limited period and which do not cause physical damage to the transmission system elements as long as the defined duration and thresholds are respected;
- (66) ‘virtual tie-line’ means an additional input of the controllers of the involved LFC areas that has the same effect as a measuring value of a physical interconnector and allows exchange of electric energy between the respective areas;

- (67) ‘flexible alternating current transmission systems’ or ‘FACTS’ means equipment for the alternating current transmission of electric power, aiming at enhanced controllability and increased active power transfer capability;
- (68) ‘adequacy’ means the ability of in-feeds into an area to meet the load in that area;
- (69) ‘aggregated netted external schedule’ means a schedule representing the netted aggregation of all external TSO schedules and external commercial trade schedules between two scheduling areas or between a scheduling area and a group of other scheduling areas;
- (70) ‘availability plan’ means the combination of all planned availability statuses of a relevant asset for a given time period;
- (71) ‘availability status’ means the capability of a power generating module, grid element or demand facility to provide a service for a given time period, regardless of whether or not it is in operation;
- (72) ‘close to real-time’ means the time lapse of not more than 15 minutes between the last intraday gate closure and real-time;
- (73) ‘consumption schedule’ means a schedule representing the consumption of a demand facility or of a group of demand facilities;
- (74) ‘ENTSO for Electricity operational planning data environment’ means the set of application programs and equipment developed in order to allow the storage, exchange and management of the data used for operational planning processes between TSOs;
- (75) ‘external commercial trade schedule’ means a schedule representing the commercial exchange of electricity between market participants in different scheduling areas;
- (76) ‘external TSO schedule’ means a schedule representing the exchange of electricity between TSOs in different scheduling areas;
- (77) ‘forced outage’ means the unplanned removal from service of a relevant asset for any urgent reason that is not under the operational control of the operator of the concerned relevant asset;
- (78) ‘generation schedule’ means a schedule representing the electricity generation of a power generating module or of a group of power generating modules;
- (79) ‘internal commercial trade schedule’ means a schedule representing the commercial exchange of electricity within a scheduling area between different market participants;
- (80) ‘internal relevant asset’ means a relevant asset which is part of a TSO's control area or a relevant asset located in a distribution system, including a closed distribution system, which is connected directly or indirectly to that TSO's control area;
- (81) ‘netted area AC position’ means the netted aggregation of all AC external schedules of an area;
- (82) ‘outage coordination region’ means a combination of control areas for which TSOs define procedures to monitor and where necessary coordinate the availability status of relevant assets in all time-frames;
- (83) ‘relevant demand facility’ means a demand facility which participates in the outage coordination and the availability status of which influences cross-border operational security;

- (84) ‘relevant asset’ means any relevant demand facility, relevant power generating module, or relevant grid element partaking in the outage coordination;
- (85) ‘relevant grid element’ means any component of a transmission system, including interconnectors, or of a distribution system, including a closed distribution system, such as a single line, a single circuit, a single transformer, a single phase-shifting transformer, or a voltage compensation installation, which participates in the outage coordination and the availability status of which influences cross-border operational security;
- (86) ‘outage planning incompatibility’ means the state in which a combination of the availability status of one or more relevant grid elements, relevant power generating modules, and/or relevant demand facilities and the best estimate of the forecasted electricity grid situation leads to violation of operational security limits taking into account remedial actions without costs which are at the TSO's disposal;
- (87) ‘outage planning agent’ means an entity with the task of planning the availability status of a relevant power generating module, a relevant demand facility or a relevant grid element;
- (88) ‘relevant power generating module’ means a power generating module which participates in the outage coordination and the availability status of which influences cross-border operational security;
- (89) ‘regional security coordinator’ (‘RSC’) means the entity or entities, owned or controlled by TSOs, in one or more capacity calculation regions performing tasks related to TSO regional coordination;
- (90) ‘scheduling agent’ means the entity or entities with the task of providing schedules from market participants to TSOs, or where applicable third parties;
- (91) ‘scheduling area’ means an area within which the TSOs' obligations regarding scheduling apply due to operational or organisational needs;
- (92) ‘week-ahead’ means the week prior to the calendar week of operation;
- (93) ‘year-ahead’ means the year prior to the calendar year of operation;
- (94) ‘affected TSO’ means a TSO for which information on the exchange of reserves and/or sharing of reserves and/or imbalance netting process and/or cross-border activation process is needed for the analysis and maintenance of operational security;
- (95) ‘reserve capacity’ means the amount of FCR, FRR or RR that needs to be available to the TSO;
- (96) ‘exchange of reserves’ means the possibility of a TSO to access reserve capacity connected to another LFC area, LFC block, or synchronous area to fulfil its reserve requirements resulting from its own reserve dimensioning process of either FCR, FRR or RR and where that reserve capacity is exclusively for that TSO, and is not taken into account by any other TSO to fulfil its reserve requirements resulting from their respective reserve dimensioning processes;
- (97) ‘sharing of reserves’ means a mechanism in which more than one TSO takes the same reserve capacity, being FCR, FRR or RR, into account to fulfil their respective reserve requirements resulting from their reserve dimensioning processes;
- (98) ‘alert state trigger time’ means the time before alert state becomes active;

- (99) ‘automatic FRR’ means FRR that can be activated by an automatic control device;
- (100) ‘automatic FRR activation delay’ means the period of time between the setting of a new setpoint value by the frequency restoration controller and the start of physical automatic FRR delivery;
- (101) ‘automatic FRR full activation time’ means the time period between the setting of a new setpoint value by the frequency restoration controller and the corresponding activation or deactivation of automatic FRR;
- (102) ‘average FRCE data’ means the set of data consisting of the average value of the recorded instantaneous FRCE of a LFC area or a LFC block within a given measured period time;
- (103) ‘control capability providing TSO’ means the TSO that shall trigger the activation of its reserve capacity for a control capability receiving TSO under the conditions of an agreement for sharing reserves;
- (104) ‘control capability receiving TSO’ means the TSO calculating reserve capacity by taking into account reserve capacity which is accessible through a control capability providing TSO under the conditions of an agreement for sharing reserves;
- (105) ‘criteria application process’ means the process of calculating 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;
- (106) ‘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;
- (107) ‘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;
- (108) ‘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;
- (109) ‘dimensioning incident’ means the highest expected instantaneously occurring active power imbalance within a LFC block in both positive and negative direction;
- (110) ‘electrical time deviation’ means the time discrepancy between synchronous time and coordinated universal time (‘UTC’);
- (111) ‘FCR full activation frequency deviation’ means the rated value of frequency deviation at which the FCR in a synchronous area is fully activated;
- (112) ‘FCR full activation time’ means the time period between the occurrence of the reference incident and the corresponding full activation of the FCR;
- (113) ‘FCR obligation’ means the part of all of the FCR that falls under the responsibility of a TSO;
- (114) ‘frequency containment process’ or ‘FCP’ means a process that aims at stabilising the system frequency by compensating imbalances by means of appropriate reserves;
- (115) ‘frequency coupling process’ means a process agreed between all TSOs of two synchronous areas that allows linking the activation of FCR by an adaptation of HVDC flows between the synchronous areas;

- (116) ‘frequency quality defining parameter’ means the main system frequency variables that define the principles of frequency quality;
- (117) ‘frequency quality target parameter’ means the main system frequency target on which the behaviour of FCR, FRR and RR activation processes is evaluated in normal state;
- (118) ‘frequency quality evaluation criteria’ means a set of calculations using system frequency measurements that allows the evaluation of the quality of the system frequency against the frequency quality target parameters;
- (119) ‘frequency quality evaluation data’ means the set of data that allows the calculation of the frequency quality evaluation criteria;
- (120) ‘frequency recovery range’ means the system frequency range to which the system frequency is expected to return in the GB and IE/NI synchronous areas, after the occurrence of an imbalance equal to or smaller than the reference incident, within the time to recover frequency;
- (121) ‘time to recover frequency’ means, for the synchronous areas GB and IE/NI, 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;
- (122) ‘frequency restoration range’ means the system frequency range to which the system frequency is expected to return in the GB, IE/NI and Nordic synchronous areas, after the occurrence of an imbalance equal to or smaller than the reference incident within the time to restore frequency;
- (123) ‘FRCE target parameters’ means the main target LFC block variables on the basis of which the dimensioning criteria for FRR and RR of the LFC block are determined and evaluated and which are used to reflect the LFC block behaviour in normal operation;
- (124) ‘frequency restoration power interchange’ means the power which is interchanged between LFC areas within the cross-border FRR activation process;
- (125) ‘frequency setpoint’ means the frequency target value used in the FRP, defined as the sum of the nominal system frequency and an offset value needed to reduce an electrical time deviation;
- (126) ‘FRR availability requirements’ means a set of requirements defined by the TSOs of a LFC block regarding the availability of FRR;
- (127) ‘FRR dimensioning rules’ means the specifications of the FRR dimensioning process of a LFC block;
- (128) ‘imbalance netting process’ means a process agreed between TSOs that allows avoiding the simultaneous activation of FRR in opposite directions, taking into account the respective FRCEs as well as the activated FRR and by correcting the input of the involved FRPs accordingly;
- (129) ‘imbalance netting power interchange’ means the power which is interchanged between LFC areas within the imbalance netting process;
- (130) ‘initial FCR obligation’ means the amount of FCR allocated to a TSO on the basis of a sharing key;

- (131) ‘instantaneous frequency data’ means a set of data measurements of the overall system frequency for the synchronous area with a measurement period equal to or shorter than one second used for system frequency quality evaluation purposes;
- (132) ‘instantaneous frequency deviation’ means a set of data measurements of the overall system frequency deviations for the synchronous area with a measurement period equal to or shorter than one second used for system frequency quality evaluation purposes;
- (133) ‘instantaneous FRCE data’ means a set of data of the FRCE of a LFC block with a measurement period equal to or shorter than 10 seconds used for system frequency quality evaluation purposes;
- (134) ‘level 1 FRCE range’ means the first range used for system frequency quality evaluation purposes on LFC block level within which the FRCE should be kept for a specified percentage of the time;
- (135) ‘level 2 FRCE range’ means the second range used for system frequency quality evaluation purposes on LFC block level within which the FRCE should be kept for a specified percentage of the time;
- (136) ‘LFC block operational agreement’ means a multi-party agreement between all TSOs of a LFC block if the LFC block is operated by more than one TSO and means a LFC block operational methodology to be adopted unilaterally by the relevant TSO if the LFC block is operated by only one TSO;
- (137) ‘replacement power interchange’ means the power which is interchanged between LFC areas within the cross-border RR activation process;
- (138) ‘LFC block imbalances’ means the sum of the FRCE, FRR activation and RR activation within the LFC block and the imbalance netting power interchange, the frequency restoration power interchange and the replacement power interchange of this LFC block with other LFC blocks;
- (139) ‘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;
- (140) ‘load-frequency control structure’ means the basic structure considering all relevant aspects of load-frequency control in particular concerning respective responsibilities and obligations as well as types and purposes of active power reserves;
- (141) ‘process responsibility structure’ means the structure to determine responsibilities and obligations with respect to active power reserves based on the control structure of the synchronous area;
- (142) ‘process activation structure’ means the structure to categorise the processes concerning the different types of active power reserves in terms of purpose and activation;
- (143) ‘manual FRR full activation time’ means the time period between the setpoint change and the corresponding activation or deactivation of manual FRR;
- (144) ‘maximum instantaneous frequency deviation’ means the maximum expected absolute value of an instantaneous frequency deviation after the occurrence of an imbalance equal to or smaller than the reference incident, beyond which emergency measures are activated;

- (145) ‘monitoring area’ means a part of the synchronous area or the entire synchronous area, physically demarcated by points of measurement at interconnectors to other monitoring areas, operated by one or more TSOs fulfilling the obligations of a monitoring area;
- (146) ‘prequalification’ means the process to verify the compliance of a reserve providing unit or a reserve providing group with the requirements set by the TSO;
- (147) ‘ramping period’ means a period of time defined by a fixed starting point and a length of time during which the input and/or output of active power will be increased or decreased;
- (148) ‘reserve instructing TSO’ means the TSO responsible for the instruction of the reserve providing unit or the reserve providing group to activate FRR and/or RR;
- (149) ‘reserve connecting DSO’ means the DSO responsible for the distribution network to which a reserve providing unit or reserve providing group, providing reserves to a TSO, is connected;
- (150) ‘reserve connecting TSO’ means the TSO responsible for the monitoring area to which a reserve providing unit or reserve providing group is connected;
- (151) ‘reserve receiving TSO’ means the TSO involved in an exchange with a reserve connecting TSO and/or a reserve providing unit or a reserve providing group connected to another monitoring or LFC area;
- (152) ‘reserve replacement process’ or ‘RRP’ means a process to restore the activated FRR and, additionally for GB and IE/NL, to restore the activated FCR;
- (153) ‘RR availability requirements’ means a set of requirements defined by the TSOs of a LFC block regarding the availability of RR;
- (154) ‘RR dimensioning rules’ means the specifications of the RR dimensioning process of a LFC block;
- (155) ‘standard frequency range’ means a defined symmetrical interval around the nominal frequency within which the system frequency of a synchronous area is supposed to be operated;
- (156) ‘standard frequency deviation’ means the absolute value of the frequency deviation that limits the standard frequency range;
- (157) ‘steady state frequency deviation’ means the absolute value of frequency deviation after occurrence of an imbalance, once the system frequency has been stabilised;
- (158) ‘synchronous area monitor’ means a TSO responsible for collecting the frequency quality evaluation criteria data and applying the frequency quality evaluation criteria for the synchronous area;
- (159) ‘time control process’ means a process for time control, where time control is a control action carried out to return the electrical time deviation between synchronous time and UTC time to zero.

Article 4

Objectives and regulatory aspects

- 1 This Regulation aims at:
 - a determining common operational security requirements and principles;
 - b determining common interconnected system operational planning principles;
 - c determining common load-frequency control processes and control structures;
 - d ensuring the conditions for maintaining operational security throughout the Union;
 - e ensuring the conditions for maintaining a frequency quality level of all synchronous areas throughout the Union;
 - f promoting the coordination of system operation and operational planning;
 - g ensuring and enhancing the transparency and reliability of information on transmission system operation;
 - h contributing to the efficient operation and development of the electricity transmission system and electricity sector in the Union.
- 2 When applying this Regulation, Member States, competent authorities, and system operators shall:
 - a apply the principles of proportionality and non-discrimination;
 - b ensure transparency;
 - c apply the principle of optimisation between the highest overall efficiency and lowest total costs for all parties involved;
 - d ensure TSOs make use of market-based mechanisms as far as possible, to ensure network security and stability;
 - e respect the responsibility assigned to the relevant TSO in order to ensure system security, including as required by national legislation;
 - f consult with relevant DSOs and take account of potential impacts on their system; and
 - g take into consideration agreed European standards and technical specifications.

Article 5

Terms and conditions or methodologies of TSOs

- 1 TSOs shall develop the terms and conditions or methodologies required by this Regulation and submit them for approval to the competent regulatory authorities in accordance with Article 6(2) and (3) or for approval to the entity designated by the Member State in accordance with Article 6(4) within the respective deadlines set out in this Regulation.
- 2 Where a proposal for terms and conditions or methodologies pursuant to this Regulation needs to be developed and agreed by more than one TSO, the participating TSOs shall closely cooperate. TSOs, with the assistance of ENTSO for Electricity, shall regularly inform the regulatory authorities and the Agency about the progress of developing those terms and conditions or methodologies.
- 3 Where no consensus is reached among TSOs deciding on proposals for terms and conditions or methodologies in accordance with Article 6(2), they shall decide by qualified majority. The qualified majority for proposals in accordance with Article 6(2) shall require a majority of:

- a TSOs representing at least 55 % of the Member States; and
- b TSOs representing Member States comprising at least 65 % of the population of the Union.

4 A blocking minority for decisions in accordance with Article 6(2) must include TSOs representing at least four Member States, failing of which the qualified majority shall be deemed attained.

5 Where the regions concerned are composed of more than five Member States and no consensus is reached among TSOs deciding on proposals for terms and conditions or methodologies in accordance with Article 6(3) they shall decide by qualified majority. A qualified majority for proposals in accordance with Article 6(3) shall require a majority of:

- a TSOs representing at least 72 % of the Member States concerned; and
- b TSOs representing Member States comprising at least 65 % of the population of the concerned region.

6 A blocking minority for decisions in accordance with Article 6(3) must include at least a minimum number of TSOs representing more than 35 % of the population of the participating Member States, plus TSOs representing at least one additional Member State concerned, failing of which the qualified majority shall be deemed attained.

7 TSOs deciding on proposals for terms and conditions or methodologies in accordance with Article 6(3) in relation to regions composed of five Member States or less shall decide on the basis of a consensus.

8 For TSO decisions under paragraphs 3 and 4, one vote shall be attributed per Member State. If there is more than one TSO in the territory of a Member State, the Member State shall allocate the voting powers among the TSOs.

9 Where TSOs fail to submit a proposal for terms and conditions or methodologies to the regulatory authorities in accordance with Article 6(2) and (3) or to the entities designated by the Member States in accordance with Article 6(4) within the deadlines defined in this Regulation, they shall provide the competent regulatory authorities and the Agency with the relevant drafts of the terms and conditions or methodologies, and explain why an agreement has not been reached. The Agency shall inform the Commission and shall, in cooperation with the competent regulatory authorities, at the Commission's request, investigate the reasons for the failure and inform the Commission thereof. The Commission shall take the appropriate steps to make possible the adoption of the required terms and conditions or methodologies within 4 months from the receipt of the Agency's information.

Article 6

Approval of terms and conditions or methodologies of TSOs

1 Each regulatory authority shall approve the terms and conditions or methodologies developed by TSOs under paragraphs 2 and 3. The entity designated by the Member State shall approve the terms and conditions or methodologies developed by TSOs under paragraph 4. The designated entity shall be the regulatory authority unless otherwise provided by the Member State.

2 The proposals for the following terms and conditions or methodologies shall be subject to approval by all regulatory authorities of the Union, on which a Member State may provide an opinion to the concerned regulatory authority:

- a key organizational requirements, roles and responsibilities in relation to data exchange related to operational security in accordance with Article 40(6);
- b methodology for building the common grid models in accordance with Article 67(1) and Article 70;
- c methodology for coordinating operational security analysis in accordance with Article 75.

3 The proposals for the following terms and conditions or methodologies shall be subject to approval by all regulatory authorities of the concerned region, on which a Member State may provide an opinion to the concerned regulatory authority:

- a methodology for each synchronous area for the definition of minimum inertia in accordance with Article 39(3)(b);
- b common provisions for each capacity calculation region for regional operational security coordination in accordance with Article 76;
- c methodology, at least per synchronous area, for assessing the relevance of assets for outage coordination in accordance with Article 84;
- d methodologies, conditions and values included in the synchronous area operational agreements in Article 118 concerning:
 - (i) the frequency quality defining parameters and the frequency quality target parameter in accordance with Article 127;
 - (ii) the dimensioning rules for FCR in accordance with Article 153;
 - (iii) the additional properties of the FCR in accordance with Article 154(2);
 - (iv) for the GB and IE/NI synchronous areas, the measures to ensure the recovery of energy reservoirs in accordance with Article 156(6)(b);
 - (v) for the CE and Nordic synchronous areas, the minimum activation period to be ensured by FCR providers in accordance with Article 156(10);
 - (vi) for the CE and Nordic synchronous areas, the assumptions and methodology for a cost-benefit analysis in accordance with Article 156(11);
 - (vii) for synchronous areas other than CE and if applicable, the limits for the exchange of FCR between TSOs in accordance with Article 163(2);
 - (viii) for the GB and IE/NI synchronous areas, the methodology to determine the minimum provision of reserve capacity on FCR between synchronous areas, defined in accordance with Article 174(2)(b);
 - (ix) limits on the amount of exchange of FRR between synchronous areas defined in accordance with Article 176(1) and limits on the amount of sharing of FRR between synchronous areas defined in accordance with Article 177(1);
 - (x) limits on the amount of exchange of RR between synchronous areas defined in accordance with Article 178(1) and limits on the amount of sharing of RR between synchronous areas defined in accordance with Article 179(1);
- e methodologies and conditions included in the LFC block operational agreements in Article 119, concerning:
 - (i) ramping restrictions for active power output in accordance with Article 137(3) and (4);
 - (ii) coordination actions aiming to reduce FRCE as defined in Article 152(14);

- (iii) measures to reduce FRCE by requiring changes in the active power production or consumption of power generating modules and demand units in accordance with Article 152(16);
 - (iv) the FRR dimensioning rules in accordance with Article 157(1);
 - f mitigation measures per synchronous area or LFC block in accordance with Article 138;
 - g common proposal per synchronous area for the determination of LFC blocks in accordance with Article 141(2).
- 4 Unless determined otherwise by the Member State, the following terms and conditions or methodologies shall be subject to individual approval by the entity designated in accordance with paragraph 1 by the Member State:
- a for the GB and IE/NI synchronous areas, the proposal of each TSO specifying the level of demand loss at which the transmission system shall be in the blackout state;
 - b scope of data exchange with DSOs and significant grid users in accordance with Article 40(5);
 - c additional requirements for FCR providing groups in accordance with Article 154(3);
 - d exclusion of FCR providing groups from the provision of FCR in accordance with Article 154(4);
 - e for the CE and Nordic synchronous areas, the proposal concerning the interim minimum activation period to be ensured by FCR providers as proposed by the TSO in accordance with Article 156(9);
 - f FRR technical requirements defined by the TSO in accordance with Article 158(3);
 - g rejection of FRR providing groups from the provision of FRR in accordance with Article 159(7);
 - h technical requirements for the connection of RR providing units and RR providing groups defined by the TSO in accordance with Article 161(3); and
 - i rejection of RR providing groups from the provision of RR in accordance with Article 162(6).
- 5 Where an individual relevant system operator or TSO is required or permitted under this Regulation to specify or agree on requirements that are not subject to paragraph 4, Member States may require prior approval by the competent regulatory authority of these requirements.
- 6 The proposal for terms and conditions or methodologies shall include a proposed timescale for their implementation and a description of their expected impact on the objectives of this Regulation. Proposals on terms and conditions or methodologies subject to the approval by several or all regulatory authorities shall be submitted to the Agency at the same time that they are submitted to regulatory authorities. Upon request by the competent regulatory authorities, the Agency shall issue an opinion within 3 months on the proposals for terms and conditions or methodologies.
- 7 Where the approval of the terms and conditions or methodologies requires a decision by more than one regulatory authority, the competent regulatory authorities shall consult and closely cooperate and coordinate with each other in order to reach an agreement. Where the Agency issues an opinion, the competent regulatory authorities shall take that opinion into account. Regulatory authorities shall take decisions concerning the submitted terms and conditions or methodologies in accordance with paragraphs (2) and (3), within 6 months following the receipt of the terms and conditions or methodologies by the regulatory authority or, where applicable, by the last regulatory authority concerned.

8 Where the regulatory authorities have not been able to reach an agreement within the period referred to in paragraph 7 or upon their joint request, the Agency shall adopt a decision concerning the submitted proposals for terms and conditions or methodologies within 6 months, in accordance with Article 8(1) of Regulation (EC) No 713/2009.

9 Where the approval of the terms and conditions or methodologies requires a decision by a single designated entity in accordance with paragraph 4, the designated entity shall reach a decision within 6 months following the receipt of the terms and conditions or methodologies.

10 Any party can complain against a relevant system operator or TSO in relation to that relevant system operator's or TSO's obligations or decisions under this Regulation and may refer the complaint to the regulatory authority which, acting as dispute settlement authority, shall issue a decision within 2 months after receipt of the complaint. That period may be extended by a further 2 months where additional information is sought by the regulatory authority. That extended period may be further extended with the agreement of the complainant. The regulatory authority's decision shall be binding unless and until overruled on appeal.

Article 7

Amendments to the terms and conditions or methodologies of TSOs

1 Where one or several regulatory authorities require an amendment in order to approve the terms and conditions or methodologies submitted in accordance with paragraphs 2 and 3 of Article 6, the relevant TSOs shall submit a proposal for amended terms and conditions or methodologies for approval within 2 months following the requirement from the regulatory authorities. The competent regulatory authorities shall decide on the amended terms and conditions or methodologies within 2 months following their submission.

2 Where a designated entity requires an amendment in order to approve the terms and conditions or methodologies submitted in accordance with Article 6(4), the relevant TSO shall submit a proposal for amended terms and conditions or methodologies for approval within 2 months following the requirement from the designated entity. The designated entity shall decide on the amended terms and conditions or methodologies within 2 months following their submission.

3 Where the competent regulatory authorities have not been able to reach an agreement on terms and conditions or methodologies pursuant to paragraphs 2 and 3 of Article 6 within the two-month deadline, or upon their joint request, the Agency shall adopt a decision concerning the amended terms and conditions or methodologies within 6 months, in accordance with Article 8(1) of Regulation (EC) No 713/2009. If the relevant TSOs fail to submit a proposal for amended terms and conditions or methodologies, the procedure provided for in Article 5(7) shall apply.

4 TSOs responsible for developing a proposal for terms and conditions or methodologies or regulatory authorities or designated entities responsible for their adoption in accordance with paragraphs 2, 3 and 4 of Article 6 may request amendments of those terms and conditions or methodologies. Proposals for amendment to the terms and conditions or methodologies shall be submitted to consultation if applicable in accordance with the procedure set out in Article 11 and approved in accordance with the procedure set out in Articles 5 and 6.

Article 8

Publication on internet

1 TSOs responsible for specifying the terms and conditions or methodologies in accordance with this Regulation shall publish them on the internet following approval by the competent regulatory authorities or, where no such approval is required, following their specification, except where such information is considered confidential in accordance with Article 12.

2 The publication shall also concern:

- a enhancements of network operation tools in accordance with Article 55(1)(e);
- b FRCE target parameters in accordance with Article 128;
- c ramping restrictions on synchronous area level in accordance with Article 137(1);
- d ramping restrictions on LFC block level in accordance with Article 137(3);
- e measures taken in the alert state due to there being insufficient active power reserves in accordance with Article 152(11); and
- f request of the reserve connecting TSO to an FCR provider to make the information available in real time in accordance with Article 154(11).

Article 9

Recovery of costs

1 The costs borne by system operators subject to network tariff regulation and stemming from the obligations laid down in this Regulation shall be assessed by the relevant regulatory authorities. Costs assessed as reasonable, efficient and proportionate shall be recovered through network tariffs or other appropriate mechanisms.

2 If requested by the relevant regulatory authorities, system operators referred to in paragraph 1 shall, within 3 months of the request, provide the information necessary to facilitate assessment of the costs incurred.

Article 10

Stakeholder involvement

The Agency, in close cooperation with ENTSO for Electricity, shall organise stakeholder involvement regarding secure system operation and other aspects of the implementation of this Regulation. Such involvement shall include regular meetings with stakeholders to identify problems and propose improvements related to the secure system operation.

Article 11

Public consultation

1 TSOs responsible for submitting proposals for terms and conditions or methodologies or their amendments in accordance with this Regulation shall consult stakeholders, including the relevant authorities of each Member State, on the draft proposals for terms and conditions

or methodologies listed in Article 6(2) and (3). The consultation shall last for a period of not less than 1 month.

2 The proposals for terms and conditions or methodologies submitted by the TSOs at Union level shall be published and submitted to public consultation at Union level. Proposals submitted by the TSOs at regional level shall be submitted to public consultation at least at regional level. Parties submitting proposals at bilateral or at multilateral level shall carry out a public consultation at least in the Member States concerned.

3 The TSOs responsible for developing the proposal for terms and conditions or methodologies shall duly take into account the views of stakeholders resulting from the consultations prior to its submission for regulatory approval. In all cases, a sound justification for including or not including the views resulting from the consultation shall be provided together with the submission of the proposal and published in a timely manner before, or simultaneously with the publication of the proposal for terms and conditions or methodologies.

Article 12

Confidentiality obligations

1 Any confidential information received, exchanged or transmitted pursuant to this Regulation shall be subject to the conditions of professional secrecy laid down in paragraphs 2, 3 and 4.

2 The obligation of professional secrecy shall apply to any persons subject to the provisions of this Regulation.

3 Confidential information received by the persons or regulatory authorities referred to in paragraph 2 in the course of their duties may not be divulged to any other person or authority, without prejudice to cases covered by national law, the other provisions of this Regulation or other relevant Union legislation.

4 Without prejudice to cases covered by national or Union legislation, regulatory authorities, bodies or persons who receive confidential information pursuant to this Regulation may use it only for the purpose of carrying out their duties under this Regulation.

Article 13

Agreements with TSOs not bound by this Regulation

Where a synchronous area encompasses both union and third country TSOs, within 18 months after entry into force of this Regulation, all Union TSOs in that synchronous area shall endeavour to conclude with the third country TSOs not bound by this Regulation an agreement setting the basis for their cooperation concerning secure system operation and setting out arrangements for the compliance of the third country TSOs with the obligations set in this Regulation.

Article 14

Monitoring

1 ENTSO for Electricity shall monitor the implementation of this Regulation in accordance with Article 8(8) of Regulation (EC) No 714/2009. Monitoring shall cover at least the following matters:

- a operational security indicators in accordance with Article 15;
- b load-frequency control in accordance with Article 16;
- c regional coordination assessment in accordance with Article 17;
- d identification of any divergences in the national implementation of this Regulation for the terms and conditions or methodologies listed in Article 6(3);
- e identification of any additional improvements of tools and services in accordance with subparagraphs (a) and (b) of Article 55, beyond the improvements identified by the TSOs in accordance with Article 55(e);
- f identification of any necessary improvements in the annual report on incidents classification scale in accordance with Article 15, which are necessary in order to support sustainable and long-term operational security; and
- g identification of any difficulties concerning cooperation on secure system operation with third country TSOs.

2 The Agency, in cooperation with ENTSO for Electricity, shall produce within 12 months from the entry into force of this Regulation a list of the relevant information to be communicated by ENTSO for Electricity to the Agency in accordance with Articles 8(9) and 9(1) of Regulation (EC) No 714/2009. The list of relevant information may be subject to updates. ENTSO for Electricity shall maintain a comprehensive, standardised format, digital data archive of the information required by the Agency.

3 Relevant TSOs shall submit to ENTSO for Electricity the information required to perform the tasks referred to in paragraphs 1 and 2.

4 Based on a request of the regulatory authority, DSOs shall provide TSOs with the information under paragraph 2 unless that information is already available to the regulatory authorities, TSOs, the Agency or ENTSO for Electricity in relation to their respective implementation monitoring tasks, with the objective of avoiding duplication of information.

Article 15

Annual report on operational security indicators

1 By 30 September, ENTSO for Electricity shall publish an annual report based on the incidents classification scale adopted in accordance with Article 8(3)(a) of Regulation (EC) No 714/2009. The Agency may provide its opinion on the format and contents of that annual report, including the geographical scope of the incidents reported, the electrical interdependencies between the TSOs' control areas and any relevant historical information.

2 The TSOs of each Member State shall provide ENTSO for Electricity, by 1 March, with the necessary data and information for the preparation of the annual reports based on the incident classification scale referred to in paragraph 1. The data provided by the TSOs shall cover the preceding year.

3 The annual reports referred to in paragraph 1 shall contain at least the following operational security indicators relevant to operational security:

- a number of tripped transmission system elements per year per TSO;
- b number of tripped power generation facilities per year per TSO;
- c energy not supplied per year due to unscheduled disconnection of demand facilities per TSO;
- d time duration and number of instances of being in the alert and emergency states per TSO;
- e time duration and number of events within which there was a lack of reserves identified per TSO;
- f time duration and number of voltage deviations exceeding the ranges from Tables 1 and 2 of Annex II per TSO;
- g number of minutes outside the standard frequency range and number of minutes outside the 50 % of maximum steady state frequency deviation per synchronous area;
- h number of system-split separations or local blackout states; and
- i number of blackouts involving two or more TSOs.

4 The annual report referred to in paragraph 1 shall contain the following operational security indicators relevant to operational planning:

- a number of events in which an incident contained in the contingency list led to a degradation of the system operation state;
- b number of the events referred to in point (a) in which a degradation of system operation conditions occurred as a result of unexpected discrepancies from load or generation forecasts;
- c number of events in which there was a degradation in system operation conditions due to an exceptional contingency;
- d number of the events referred to in point (c) in which a degradation of system operation conditions occurred as a result of unexpected discrepancies from load or generation forecasts; and
- e number of events leading to a degradation in system operation conditions due to lack of active power reserves.

5 The annual reports shall contain explanations of the reasons for incidents at the operational security ranking scales 2 and 3 as per the incidents classification scale adopted by ENTSO for Electricity. Those explanations shall be based on an investigation of the incidents by TSOs which process shall be set out in the incidents classification scale. TSOs shall inform the respective regulatory authorities about an investigation in due time before it is launched. Regulatory authorities and the Agency may be involved in the investigation upon their request.

Article 16

Annual report on load-frequency control

1 By 30 September, ENTSO for Electricity shall publish an annual report on load-frequency control based on the information provided by the TSOs in accordance with paragraph 2. The annual report on load-frequency control shall include the information listed in paragraph 2 for each Member State.

2 Starting from 14 September 2018, the TSOs of each Member State shall notify to ENTSO for Electricity, by 1 March every year, the following information for the previous year:

- a the identification of the LFC blocks, LFC areas and monitoring areas in the Member State;
 - b the identification of LFC blocks that are not in the Member State and that contain LFC areas and monitoring areas that are in the Member State;
 - c the identification of the synchronous areas each Member State belongs to;
 - d the data related to the frequency quality evaluation criteria for each synchronous area and each LFC block in subparagraphs (a), (b) and (c) covering each month of at least 2 previous calendar years;
 - e the FCR obligation and the initial FCR obligation of each TSO operating within the Member State covering each month of at least 2 previous calendar years; and
 - f a description and date of implementation of any mitigation measures and ramping requirements to alleviate deterministic frequency deviations taken in the previous calendar year in accordance with Articles 137 and 138, in which TSOs of the Member State were involved.
- 3 The data provided by the TSOs shall cover the preceding year. The information concerning synchronous areas, LFC blocks, LFC areas and monitoring areas in subparagraphs (a), (b) and (c) shall be reported once. Where these areas change, this information shall be reported by 1 March of the following year.
- 4 Where appropriate, all TSOs of a synchronous area or LFC block shall cooperate in collecting the data listed in paragraph 2.

Article 17

Annual report on regional coordination assessment

- 1 By 30 September, ENTSO for Electricity shall publish an annual report on regional coordination assessment based on the annual reports on regional coordination assessment provided by the regional security coordinators in accordance with paragraph 2, assess any interoperability issues and propose changes aiming at improving effectiveness and efficiency in the system operation coordination.
- 2 By 1 March, each regional security coordinator shall prepare an annual report and submit it to ENTSO for Electricity providing the following information for the tasks it performs:
- a the number of events, average duration and reasons for the failure to fulfil its functions;
 - b the statistics regarding constraints, including their duration, location and number of occurrences together with the associated remedial actions activated and their cost in case they have been incurred;
 - c the number of instances where TSOs refuse to implement the remedial actions recommended by the regional security coordinator and the reasons thereof;
 - d the number of outage incompatibilities detected in accordance with Article 80; and
 - e a description of the cases where the lack of regional adequacy has been assessed and a description of mitigation actions set in place.
- 3 The data provided to ENTSO for Electricity by the regional security coordinators shall cover the preceding year.

PART II

OPERATIONAL SECURITY

TITLE 1

OPERATIONAL SECURITY REQUIREMENTS

CHAPTER 1

System states, remedial actions and operational security limits

Article 18

Classification of system states

1 A transmission system shall be in the normal state when all of the following conditions are fulfilled:

- a voltage and power flows are within the operational security limits defined in accordance with Article 25;
- b frequency meets the following criteria:
 - (i) the steady state system frequency deviation is within the standard frequency range; or
 - (ii) the absolute value of the steady state system frequency deviation is not larger than the maximum steady state frequency deviation and the system frequency limits established for the alert state are not fulfilled;
- c active and reactive power reserves are sufficient to withstand contingencies from the contingency list defined in accordance with Article 33 without violating operational security limits;
- d operation of the concerned TSO's control area is and will remain within operational security limits after the activation of remedial actions following the occurrence of a contingency from the contingency list defined in accordance with Article 33.

2 A transmission system shall be in the alert state when:

- a voltage and power flows are within the operational security limits defined in accordance with Article 25; and
- b the TSO's reserve capacity is reduced by more than 20 % for longer than 30 minutes and there are no means to compensate for that reduction in real-time system operation; or
- c frequency meets the following criteria:
 - (i) the absolute value of the steady state system frequency deviation is not larger than the maximum steady state frequency deviation; and
 - (ii) the absolute value of the steady state system frequency deviation has continuously exceeded 50 % of the maximum steady state frequency deviation for a time period longer than the alert state trigger time or the standard frequency range for a time period longer than time to restore frequency; or

- d at least one contingency from the contingency list defined in accordance with Article 33 leads to a violation of the TSO's operational security limits, even after the activation of remedial actions.

3 A transmission system shall be in the emergency state when at least one of the following conditions is fulfilled:

- a there is at least one a violation of a TSO's operational security limits defined in accordance with Article 25;
- b frequency does not meet the criteria for the normal state and for the alert state defined in accordance with paragraphs 1 and 2;
- c at least one measure of the TSO's system defence plan is activated;
- d there is a failure in the functioning of tools, means and facilities defined in accordance with Article 24(1), resulting in the unavailability of those tools, means and facilities for longer than 30 minutes.

4 A transmission system shall be in the blackout state when at least one of the following conditions is fulfilled:

- a loss of more than 50 % of demand in the concerned TSO's control area;
- b total absence of voltage for at least three minutes in the concerned TSO's control area, leading to the triggering of restoration plans.

A TSO of GB and IE/NI synchronous areas may develop a proposal specifying the level of demand loss at which the transmission system shall be in the blackout state. The TSOs of GB and IE/NI synchronous areas shall notify this instance to ENTSO for Electricity.

5 A transmission system shall be in the restoration state when a TSO, being in the emergency or blackout state, has started to activate measures of its restoration plan.

Article 19

Monitoring and determination of system states by TSOs

1 Each TSO shall, in real-time operation, determine the system state of its transmission system.

2 Each TSO shall monitor the following transmission system parameters in real-time in its control area, based on real-time telemetry measurements or on calculated values from its observability area, taking into account the structural and real-time data in accordance with Article 42:

- a active and reactive power flows;
- b busbar voltages;
- c frequency and frequency restoration control error of its LFC area;
- d active and reactive power reserves; and
- e generation and load.

3 In order to specify the system state, each TSO shall perform contingency analysis at least once every 15 minutes, monitoring the transmission system's parameters defined in accordance with paragraph 2, against the operational security limits defined in accordance with Article 25 and the criteria for system states defined in accordance with Article 18. Each TSO shall also monitor the level of available reserves against the reserve capacity. When carrying out the contingency analysis, each TSO shall take into account the effect of remedial actions and the measures of the system defence plan.

4 If its transmission system is not in normal state and if that system state is qualified as a wide area state the TSO shall:

- a inform all TSOs about the system state of its transmission system via an IT tool for the exchange of real-time data at pan-European level; and
- b provide with additional information on its transmission system elements which are part of the observability area of other TSOs, to those TSOs.

Article 20

Remedial actions in system operation

1 Each TSO shall endeavour to ensure that its transmission system remains in the normal state and shall be responsible for managing operational security violations. To achieve that objective, each TSO shall design, prepare and activate remedial actions taking into account their availability, the time and resources needed for their activation and any conditions external to the transmission system which are relevant for each remedial action.

2 The remedial actions used by TSOs in system operation in accordance with paragraph 1 and with Articles 21 to 23 of this Regulation shall be consistent with the remedial actions taken into account in capacity calculation in accordance with Article 25 of Regulation (EU) 2015/1222.

Article 21

Principles and criteria applicable to remedial actions

1 Each TSO shall apply the following principles when activating and coordinating remedial actions in accordance with Article 23:

- a for operational security violations which do not need to be managed in a coordinated way, a TSO shall design, prepare and activate remedial actions to restore the system to the normal state and to prevent the propagation of the alert or emergency state outside of the TSO's control area from the categories defined in Article 22;
- b for operational security violations which need to be managed in a coordinated way, a TSO shall design, prepare and activate remedial actions in coordination with other concerned TSOs, following the methodology for the preparation of remedial actions in a coordinated way under Article 76(1)(b) and taking into account the recommendation of a regional security coordinator in accordance with Article 78(4).

2 When selecting the appropriate remedial actions, each TSO shall apply the following criteria:

- a activate the most effective and economically efficient remedial actions;
- b activate remedial actions as close as possible to real-time taking into account the expected time of activation and the urgency of the system operation situation they intend to resolve;
- c consider the risks of failures in applying the available remedial actions and their impact on operational security such as:
 - (i) the risks of failure or short-circuit caused by topology changes;
 - (ii) the risks of outages caused by active or reactive power changes on power generating modules or demand facilities; and

- (iii) the risks of malfunction caused by equipment behaviour;
- d give preference to remedial actions which make available the largest cross-zonal capacity for capacity allocation, while satisfying all operational security limits.

Article 22

Categories of remedial actions

- 1 Each TSO shall use the following categories of remedial actions:
 - a modify the duration of a planned outage or return to service transmission system elements to achieve the operational availability of those transmission system elements;
 - b actively impact power flows by means of:
 - (i) tap changes of the power transformers;
 - (ii) tap changes of the phase-shifting transformers;
 - (iii) modifying topologies;
 - c control voltage and manage reactive power by means of:
 - (i) tap changes of the power transformers;
 - (ii) switching of the capacitors and reactors;
 - (iii) switching of the power-electronics-based devices used for voltage and reactive power management;
 - (iv) instructing transmission-connected DSOs and significant grid users to block automatic voltage and reactive power control of transformers or to activate on their facilities the remedial actions set out in points (i) to (iii) if voltage deterioration jeopardises operational security or threatens to lead to a voltage collapse in a transmission system;
 - (v) requesting the change of reactive power output or voltage setpoint of the transmission-connected synchronous power generating modules;
 - (vi) requesting the change of reactive power output of the converters of transmission-connected non-synchronous power generating modules;
 - d re-calculate day-ahead and intraday cross-zonal capacities in accordance with Regulation (EU) 2015/1222;
 - e redispatch transmission or distribution-connected system users within the TSO's control area, between two or more TSOs;
 - f countertrade between two or more bidding zones;
 - g adjust active power flows through HVDC systems;
 - h activate frequency deviation management procedures;
 - i curtail, pursuant to Article 16(2) of Regulation (EC) No 714/2009, the already allocated cross-zonal capacity in an emergency situation where using that capacity endangers operational security, all TSOs at a given interconnector agree to such adjustment, and re-dispatching or countertrading is not possible; and
 - j where applicable, include the normal or alert state, manually controlled load-shedding.
- 2 Where necessary and justified in order to maintain operational security, each TSO may prepare and activate additional remedial actions. The TSO shall report and justify those

instances to the relevant regulatory authority and, where applicable, the Member State, at least once every year, after the activation of the additional remedial actions. The relevant reports and justifications shall also be published. The European Commission or the Agency may request the relevant regulatory authority to provide additional information concerning the activation of additional remedial actions in those instances where they affect a neighbouring transmission system.

Article 23

Preparation, activation and coordination of remedial actions

1 Each TSO shall prepare and activate remedial actions in accordance with the criteria set out in Article 21(2) to prevent the system state from deteriorating on the basis of the following elements:

- a the monitoring and determination of system states in accordance with Article 19;
- b the contingency analysis in real-time operation in accordance with Article 34; and
- c the contingency analysis in operational planning in accordance with Article 72.

2 When preparing and activating a remedial action, including redispatching or countertrading pursuant to Articles 25 and 35 of Regulation (EU) 2015/1222, or a procedure of a TSO's system defence plan which affects other TSOs, the relevant TSO shall assess, in coordination with the TSOs concerned, the impact of such remedial action or measure within and outside of its control area, in accordance with Article 75(1), Article 76(1)(b) and Article 78(1), (2) and (4) and shall provide the TSOs concerned with the information about this impact.

3 When preparing and activating remedial actions which have an impact on the transmission-connected SGUs and DSOs, each TSO shall, if its transmission system is in normal or alert state, assess the impact of such remedial actions in coordination with the affected SGUs and DSOs and select remedial actions that contribute to maintaining normal state and secure operation of all involved parties. Each affected SGU and DSO shall provide to the TSO all necessary information for this coordination.

4 When preparing and activating remedial actions each TSO shall, if its transmission system is not in normal or alert state, coordinate to the extent possible such remedial actions with the affected transmission-connected SGUs and DSOs to maintain the operational security and the integrity of the transmission system.

When a TSO activates a remedial action each impacted transmission-connected significant grid user and DSO shall execute the instructions given by the TSO

5 Where constraints have only consequences on the local state within the TSO's control area and the operational security violation does not need to be managed in a coordinated way, the TSO responsible for its management may decide not to activate remedial actions with costs to relieve them.

Article 24

Availability of TSO's means, tools and facilities

1 Each TSO shall ensure the availability, reliability and redundancy of the following items:

- a facilities for monitoring the system state of the transmission system, including state estimation applications and facilities for load-frequency control;

Status: This is the original version (as it was originally adopted).

- b means to control the switching of circuit breakers, coupler circuit breakers, transformer tap changers and other equipment which serve to control transmission system elements;
- c means to communicate with the control rooms of other TSOs and RSCs;
- d tools for operational security analysis; and
- e tools and communication means necessary for TSOs to facilitate cross-border market operations.

2 Where the TSO's tools, means and facilities referred to in paragraph 1 affect the transmission-connected DSOs or SGUs involved in supplying balancing services, ancillary services or in system defence or restoration or in delivery of real-time operational data according to Articles 44, 47, 50, 51 and 52, the relevant TSO and those DSOs and SGUs shall cooperate and coordinate to specify and ensure the availability, reliability and redundancy of these tools, means and facilities.

3 Within 18 months from the entry into force of this Regulation each TSO shall adopt a business continuity plan detailing its responses to a loss of critical tools, means and facilities, containing provisions for their maintenance, replacement and development. Each TSO shall review at least annually its business continuity plan and update it as necessary and in any case following any significant change of the critical tools, means and facilities or of the relevant system operation conditions. The TSO shall share parts of the business continuity plan which affect DSOs and SGUs with the DSOs and SGUs concerned.

Article 25

Operational security limits

1 Each TSO shall specify the operational security limits for each element of its transmission system, taking into account at least the following physical characteristics:

- a voltage limits in accordance with Article 27;
- b short-circuit current limits according to Article 30; and
- c current limits in terms of thermal rating including the transitory admissible overloads.

2 When defining the operational security limits, each TSO shall take into account the capabilities of SGUs to prevent that voltage ranges and frequency limits in normal and alert states lead to their disconnection.

3 In case of changes of one of its transmission system elements, each TSO shall validate and where necessary update the operational security limits.

4 For each interconnector each TSO shall agree with the neighbouring TSO on common operational security limits in accordance with paragraph 1.

Article 26

Security plan for critical infrastructure protection

1 Each TSO shall specify, taking into account Article 5 of Council Directive 2008/114/EC⁽¹⁰⁾, a confidential security plan containing a risk assessment of assets owned or operated by the TSO, covering major physical or cyber threat scenarios determined by the Member State.

2 The security plan shall consider potential impacts to the European interconnected transmission systems, and include organizational and physical measures aiming at mitigating the identified risks.

3 Each TSO shall regularly review the security plan to address changes of threat scenarios and reflect the evolution of the transmission system.

CHAPTER 2

Voltage control and reactive power management

Article 27

Obligations of all TSOs regarding voltage limits

1 In accordance with Article 18, each TSO shall endeavour to ensure that during the normal state the voltage remains in steady-state at the connection points of the transmission system within the ranges specified in the Tables 1 and 2 of Annex II.

2 If the relevant TSO in Spain requires in accordance with Article 16(2) of Regulation (EU) 2016/631 that power generating modules connected to nominal voltages between 300 and 400 kV stay connected in the voltage range from 1,05 to 1,0875 per unit for an unlimited time, that additional voltage range shall be considered by the relevant TSO in Spain when complying with paragraph 1.

3 Each TSO shall define the voltage base for the per unit values' notation.

4 Each TSO shall endeavour to ensure that, during the normal state and after the occurrence of a contingency, the voltage remains, within wider voltage ranges for limited times of operation if there is agreement about those wider voltage ranges with transmission-connected DSOs, power generating facility owners in accordance with Article 16(2) of Regulation (EU) 2016/631 or HVDC system owners in accordance with Article 18 of Regulation (EU) 2016/1447.

5 Each TSO shall agree, with the transmission-connected DSOs and the transmission-connected significant grid users, about voltage ranges at the connection points below 110 kV if those voltage ranges are relevant for maintaining operational security limits. Each TSO shall endeavour to ensure that the voltage remains within the agreed range during the normal state and after the occurrence of a contingency.

Article 28

Obligations of SGUs concerning voltage control and reactive power management in system operation

1 By 3 months after entry into force of this Regulation, all SGUs which are transmission-connected power generating modules not subject to Article 16 of Regulation (EU) 2016/631, or which are HVDC systems not subject to Article 18 of Regulation (EU) 2016/1447, shall inform their TSO about their capabilities compared to the voltage requirements in Article 16 of Regulation (EU) 2016/631 or in Article 18 of Regulation (EU) 2016/1447, declaring their voltage capabilities and the time they can withstand without disconnection.

2 SGUs which are demand facilities subject to the requirements of Article 3 of Regulation (EU) 2016/1388 shall not disconnect due to a disturbance within the voltage ranges referred to in Article 27. By 3 months after entry into force of this Regulation, SGUs which are transmission-connected demand facilities and which are not subject to Article 3 of

Regulation (EU) 2016/1388 shall inform their TSO about their capabilities in relation to the voltage requirements defined in Annex II of Regulation (EU) 2016/1388 declaring their voltage capabilities and the time they can withstand without disconnection.

3 Each SGU which is a transmission-connected demand facility shall maintain the reactive power setpoints, power factor ranges and voltage setpoints for voltage control in the range agreed with its TSO in accordance with Article 27.

Article 29

Obligations of all TSOs concerning voltage control and reactive power management in system operation

1 If voltage at a connection point to the transmission system is outside the ranges defined in Tables 1 and 2 of Annex II to this Regulation, each TSO shall apply voltage control and reactive power management remedial actions in accordance with Article 22(1)(c) of this Regulation in order to restore voltage at the connection point within the range specified in Annex II and within time range specified in Article 16 of Regulation (EU) 2016/631 and Article 13 of Regulation (EU) 2016/1388.

2 Each TSO shall take into account in its operational security analysis the voltage values at which transmission-connected SGUs not subject to the requirements of Regulation (EU) 2016/631 or Regulation (EU) 2016/1388 may disconnect.

3 Each TSO shall ensure reactive power reserve, with adequate volume and time response, in order to keep the voltages within its control area and on interconnectors within the ranges set out in Annex II.

4 TSOs interconnected by AC interconnectors shall jointly specify the adequate voltage control regime in order to ensure that the common operational security limits established in accordance with Article 25(4) are respected.

5 Each TSO shall agree with each transmission-connected DSO on the reactive power setpoints, power factor ranges and voltage setpoints for voltage control at the connection point between the TSO and the DSO in accordance with Article 15 of Regulation (EU) 2016/1388. To ensure that those parameters are maintained, each transmission-connected DSO shall use its reactive power resources and have the right to give voltage control instructions to distribution-connected SGUs.

6 Each TSO shall be entitled to use all available transmission-connected reactive power capabilities within its control area for effective reactive power management and maintaining the voltage ranges set out in Tables 1 and 2 of Annex II of this Regulation.

7 Each TSO shall, directly or indirectly in coordination with the transmission-connected DSO where applicable, operate reactive power resources within its control area, including the blocking of automatic voltage/reactive power control of transformers, voltage reduction and low voltage demand disconnection, in order to maintain operational security limits and to prevent a voltage collapse of the transmission system.

8 Each TSO shall determine the voltage control actions in coordination with the transmission-connected SGUs and DSOs and with neighbouring TSOs.

9 When relevant for the voltage control and reactive power management of the transmission system, a TSO may require, in coordination with a DSO, a distribution-connected SGU to follow voltage control instructions.

CHAPTER 3

Short-circuit current management

Article 30

Short-circuit current

Each TSO shall determine:

- (a) the maximum short-circuit current at which the rated capability of circuit breakers and other equipment is exceeded; and
- (b) the minimum short-circuit current for the correct operation of protection equipment.

Article 31

Short-circuit current calculation and related measures

1 Each TSO shall perform short-circuit current calculations in order to evaluate the impact of neighbouring TSOs and transmission-connected SGUs and transmission-connected distribution systems including closed distribution systems on the short-circuit current levels in transmission system. Where a transmission-connected distribution system including closed distribution system has an impact on short-circuit current levels, it shall be included in the transmission system short-circuit current calculations.

2 While performing short-circuit current calculations, each TSO shall:

- a use the most accurate and high quality available data;
- b take into account international standards; and
- c consider as the basis of the maximum short-circuit current calculation such operational conditions, which provide the highest possible level of short-circuit current, including the short-circuit current from other transmission systems and distribution systems including closed distribution systems.

3 Each TSO shall apply operational or other measures to prevent deviation from the maximum and minimum short-circuit current limits referred to in Article 30, at all time-frames and for all protection equipment. If such a deviation occurs, each TSO shall activate remedial actions or apply other measures to ensure that the limits referred to in Article 30 are re-established. A deviation from those limits is allowed only during switching sequences.

CHAPTER 4

Power flow management

Article 32

Power flow limits

1 Each TSO shall maintain power flows within the operational security limits defined when the system is in normal state and after the occurrence of a contingency from the contingency list referred to in Article 33(1).

2 In the (N-1)-situation, in the normal state each TSO shall maintain power flows within the transitory admissible overloads referred to in Article 25(1)(c), having prepared remedial actions to be applied and executed within the time-frame allowed for transitory admissible overloads.

CHAPTER 5

Contingency analysis and handling

Article 33

Contingency lists

1 Each TSO shall establish a contingency list, including the internal and external contingencies of its observability area, by assessing whether any of those contingencies endangers the operational security of the TSO's control area. The contingency list shall include both ordinary contingencies and exceptional contingencies identified by application of the methodology developed pursuant to Article 75.

2 To establish a contingency list, each TSO shall classify each contingency on the basis of whether it is ordinary, exceptional or out-of-range, taking into account the probability of occurrence and the following principles:

- a each TSO shall classify contingencies for its own control area;
- b when operational or weather conditions significantly increase the probability of an exceptional contingency, each TSO shall include that exceptional contingency in its contingency list; and
- c in order to account for exceptional contingencies with high impact on its own or neighbouring transmission systems, each TSO shall include such exceptional contingencies in its contingency list.

3 Each transmission-connected DSO and SGU which is a power generating facility shall deliver all information relevant for contingency analysis as requested by the TSO, including forecast and real-time data, with possible data aggregation in accordance with Article 50(2).

4 Each TSO shall coordinate its contingency analysis in terms of coherent contingency lists at least with the TSOs from its observability area, in accordance with the Article 75.

5 Each TSO shall inform the TSOs in its observability area about the external contingencies included in its contingency list.

6 Each TSO shall inform, sufficiently in advance, the TSOs concerned in its observability area of any intended topological changes on its transmission system elements which are included as external contingencies in the contingency lists of the TSOs concerned.

7 Each TSO shall ensure that the real-time data is sufficiently accurate to allow the convergence of load-flow calculations which are performed in the contingency analysis.

Article 34

Contingency analysis

1 Each TSO shall perform contingency analysis in its observability area in order to identify the contingencies which endanger or may endanger the operational security of its control area and to identify the remedial actions that may be necessary to address the contingencies, including mitigation of the impact of exceptional contingencies.

2 Each TSO shall ensure that potential violations of the operational security limits in its control area which are identified by the contingency analysis do not endanger the operational security of its transmission system or of interconnected transmission systems.

3 Each TSO shall perform contingency analysis based on the forecast of operational data and on real-time operational data from its observability area. The starting point for the contingency analysis in the N-Situation shall be the relevant topology of the transmission system which shall include planned outages in the operational planning phases.

Article 35

Contingency handling

1 Each TSO shall assess the risks associated with the contingencies after simulating each contingency from its contingency list and after assessing whether it can maintain its transmission system within the operational security limits in the (N-1) situation.

2 When a TSO assesses that the risks associated with a contingency are so significant that it might not be able to prepare and activate remedial actions in a timely manner to prevent non-compliance with the (N-1) criterion or that there is a risk of propagation of a disturbance to the interconnected transmission system, the TSO shall prepare and activate remedial actions to achieve compliance with the (N-1) criterion as soon as possible.

3 In case of an (N-1) situation caused by a disturbance, each TSO shall activate a remedial action in order to ensure that the transmission system is restored to a normal state as soon as possible and that this (N-1) situation becomes the new N-Situation.

4 A TSO shall not be required to comply with the (N-1) criterion in the following situations:

- a during switching sequences;
- b during the time period required to prepare and activate remedial actions.

5 Unless a Member State determines otherwise, a TSO shall not be required to comply with the (N-1) criterion as long as there are only local consequences within the TSO's control area.

CHAPTER 6

Protection

Article 36

General requirements on protection

- 1 Each TSO shall operate its transmission system with the protection and backup protection equipment in order to automatically prevent the propagation of disturbances that could endanger the operational security of its own transmission system and of the interconnected system.
- 2 At least once every 5 years, each TSO shall review its protection strategy and concepts and update them where necessary to ensure the correct functioning of the protection equipment and the maintenance of operational security.
- 3 After a protection operation which had an impact outside a TSO's control area including interconnectors, that TSO shall assess whether the protection equipment in its control area worked as planned and shall undertake corrective actions if necessary.
- 4 Each TSO shall specify setpoints for the protection equipment of its transmission system that ensure reliable, fast and selective fault clearing, including backup protection for fault clearing in case of malfunction of the primary protection system.
- 5 Before protection and backup protection equipment entry into service or following any modifications, each TSO shall agree with the neighbouring TSOs on the definition of protection setpoints for the interconnectors and shall coordinate with those TSOs before changing the settings.

Article 37

Special protection schemes

Where a TSO uses a special protection scheme, it shall:

- (a) ensure that each special protection scheme acts selectively, reliably and effectively;
- (b) evaluate, when designing a special protection scheme, the consequences for the transmission system in the event of its incorrect functioning, taking into account the impact on TSOs concerned;
- (c) verify that the special protection scheme has a comparable reliability to the protection systems used for the primary protection of transmission system elements;
- (d) operate the transmission system with the special protection scheme within the operational security limits determined in accordance with Article 25; and
- (e) coordinate special protection scheme functions, activation principles and setpoints with neighbouring TSOs and affected transmission-connected DSOs, including closed distribution systems and affected transmission-connected SGUs.

Article 38

Dynamic stability monitoring and assessment

1 Each TSO shall monitor the dynamic stability of the transmission system by studies conducted offline in accordance with paragraph 6. Each TSO shall exchange the relevant data for monitoring the dynamic stability of the transmission system with the other TSOs of its synchronous area.

2 Each TSO shall perform a dynamic stability assessment at least once a year to identify the stability limits and possible stability problems in its transmission system. All TSOs of each synchronous area shall coordinate the dynamic stability assessments, which shall cover all or parts of the synchronous area.

3 When performing coordinated dynamic stability assessments, concerned TSOs shall determine:

- a the scope of the coordinated dynamic stability assessment, at least in terms of a common grid model;
- b the set of data to be exchanged between concerned TSOs in order to perform the coordinated dynamic stability assessment;
- c a list of commonly agreed scenarios concerning the coordinated dynamic stability assessment; and
- d a list of commonly agreed contingencies or disturbances whose impact shall be assessed through the coordinated dynamic stability assessment.

4 In case of stability problems due to poorly damped inter-area oscillations affecting several TSOs within a synchronous area, each TSO shall participate in a coordinated dynamic stability assessment at the synchronous area level as soon as practicable and provide the data necessary for that assessment. Such assessment shall be initiated and conducted by the concerned TSOs or by ENTSO for Electricity.

5 When a TSO identifies a potential influence on voltage, rotor angle or frequency stability in relation with other interconnected transmission systems, the TSOs concerned shall coordinate the methods used in the dynamic stability assessment, providing the necessary data, planning of joint remedial actions aiming at improving the stability, including the cooperation procedures between the TSOs.

6 In deciding the methods used in the dynamic stability assessment, each TSO shall apply the following rules:

- a if, with respect to the contingency list, steady-state limits are reached before stability limits, the TSO shall base the dynamic stability assessment only on the offline stability studies carried out in the longer term operational planning phase;
- b if, under planned outage conditions, with respect to the contingency list, steady-state limits and stability limits are close to each other or stability limits are reached before steady-state limits, the TSO shall perform a dynamic stability assessment in the day-ahead operational planning phase while those conditions remain. The TSO shall plan remedial actions to be used in real-time operation if necessary; and
- c if the transmission system is in the N-situation with respect to the contingency list and stability limits are reached before steady-state limits, the TSO shall perform a dynamic stability assessment in all phases of operational planning and re-assess the stability limits as soon as possible after a significant change in the N-situation is detected.

Article 39

Dynamic stability management

1 Where the dynamic stability assessment indicates that there is a violation of stability limits, the TSOs in whose control area the violation has appeared shall design, prepare and activate remedial actions to keep the transmission system stable. Those remedial actions may involve SGUs.

2 Each TSO shall ensure that the fault clearing times for faults that may lead to wide area state transmission system instability are shorter than the critical fault clearing time calculated by the TSO in its dynamic stability assessment carried out in accordance with Article 38.

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

- a all TSOs of that synchronous area shall conduct, not later than 2 years after entry into force of this Regulation, a common study per synchronous area to identify whether the minimum required inertia needs to be established, taking into account the costs and benefits as well as potential alternatives. All TSOs shall notify their studies to their regulatory authorities. All TSOs shall conduct a periodic review and shall update those studies every 2 years;
- b where the studies referred to in point (a) demonstrate the need to define minimum required inertia, all TSOs from the concerned synchronous area shall jointly develop a methodology for the definition of minimum inertia required to maintain operational security and to prevent violation of stability limits. That methodology shall respect the principles of efficiency and proportionality, be developed within 6 months after the completion of the studies referred to in point (a) and shall be updated within 6 months after the studies are updated and become available; and
- c each TSO shall deploy in real-time operation the minimum inertia in its own control area, according to the methodology defined and the results obtained in accordance with paragraph (b).

TITLE 2

DATA EXCHANGE

CHAPTER 1

General requirements on data exchange

Article 40

Organisation, roles, responsibilities and quality of data exchange

1 The exchange and provision of data and information pursuant to this Title shall reflect, to the extent possible, the real and forecasted situation of the transmission system.

2 Each TSO shall be responsible for providing and using high quality data and information.

3 Each TSO shall gather the following information about its observability area and shall exchange this data with all other TSOs to the extent that it is necessary for carrying out the operational security analysis in accordance with Article 72:

- a generation;
- b consumption;
- c schedules;
- d balance positions;
- e planned outages and substation topologies; and
- f forecasts.

4 Each TSO shall represent the information in paragraph (3) as injections and withdrawals at each node of the TSO's individual grid model referred to in Article 64.

5 In coordination with the DSOs and SGUs, each TSO shall determine the applicability and scope of the data exchange based on the following categories:

- a structural data in accordance with Article 48;
- b scheduling and forecast data in accordance with Article 49;
- c real-time data in accordance with Articles 44, 47 and 50; and
- d provisions in accordance with Articles 51, 52 and 53.

6 By 6 months after entry into force of this Regulation, all TSOs shall jointly agree on key organisational requirements, roles and responsibilities in relation to data exchange. Those organisational requirements, roles and responsibilities shall take into account and complement where necessary the operational conditions of the generation and load data methodology developed in accordance with Article 16 of Regulation (EU) 2015/1222. They shall apply to all data exchange provisions in this Title and shall include organisational requirements, roles and responsibilities for the following elements:

- a obligations for TSOs to communicate without delay to all neighbouring TSOs any changes in the protection settings, thermal limits and technical capacities at the interconnectors between their control areas;
- b obligations for DSOs directly connected to the transmission system to inform the TSOs they are connected to, within the agreed timescales, of any changes in the data and information pursuant to this Title;
- c obligations for the adjacent DSOs and/or between the downstream DSO and upstream DSO to inform each other within agreed timescales of any changes in the data and information pursuant to this Title;
- d obligations for SGUs to inform their TSO or DSO, within agreed timescales, about any relevant changes in the data and information established pursuant to this Title;
- e detailed contents of the data and information established pursuant to this Title, including main principles, type of data, communication means, format and standards to be applied, timing and responsibilities;
- f the time stamping and frequency of delivery of the data and information to be provided by DSOs and SGUs, to be used by TSOs in the different timescales. The frequency of information exchanges for real-time data, scheduled data and update of structural data shall be defined; and
- g the format for the reporting of the data and information established pursuant to this Title.

The organisational requirements, roles and responsibilities shall be published by ENTSO for Electricity.

7 By 18 months after entry into force of this Regulation, each TSO shall agree with the relevant DSOs on effective, efficient and proportional processes for providing and managing

data exchanges between them, including, where required for efficient network operation, the provision of data related to distribution systems and SGUs. Without prejudice to the provisions of paragraph 6(g), each TSO shall agree with the relevant DSOs on the format for the data exchange.

8 Transmission-connected SGUs shall have access to the data related to their commissioned network installations at the connection point.

9 Each TSO shall agree with the transmission-connected DSOs on the scope of additional information to be exchanged between them concerning commissioned network installations.

10 DSOs with a connection point to a transmission system shall be entitled to receive the relevant structural, scheduled and real-time information from the relevant TSOs and to gather the relevant structural, scheduled and real-time information from the neighbouring DSOs. Neighbouring DSOs shall determine, in a coordinated manner, the scope of information that may be exchanged.

CHAPTER 2

Data exchange between TSOs

Article 41

Structural and forecast data exchange

1 Neighbouring TSOs shall exchange at least the following structural information related to the observability area:

- a the regular topology of substations and other relevant data, by voltage level;
- b technical data on transmission lines;
- c technical data on transformers connecting the DSOs, SGUs which are demand facilities and generators' block-transformers of SGUs which are power generating facilities;
- d the maximum and minimum active and reactive power of SGUs which are power generating modules;
- e technical data on phase-shifting transformers;
- f technical data on HVDC systems;
- g technical data on reactors, capacitors and static volt-ampere reactive (VAR) compensators; and
- h operational security limits defined by each TSO according to Article 25.

2 To coordinate the protection of their transmission systems, neighbouring TSOs shall exchange the protection setpoints of the lines for which the contingencies are included as external contingencies in their contingency lists.

3 To coordinate their operational security analysis and to establish the common grid model in accordance with Articles 67, 68, 69 and 70, each TSO shall exchange, with at least all other TSOs from the same synchronous area, at least the following data:

- a the topology of the 220 kV and higher voltage transmission systems within its control area;
- b a model or an equivalent of the transmission system with voltage below 220 kV with significant impact on its own transmission system;

- c the thermal limits of the transmission system elements; and
 - d a realistic and accurate forecasted aggregate amount of injection and withdrawal, per primary energy source, at each node of the transmission system, for different time-frames.
- 4 To coordinate the dynamic stability assessments pursuant to Article 38(2) and (4), and to carry them out, each TSO shall exchange with the other TSOs of the same synchronous area or of its relevant part the following data:
- a data concerning SGUs which are power generating modules relating to, but not limited to:
 - (i) electrical parameters of the alternator suitable for the dynamic stability assessment, including total inertia;
 - (ii) protection models;
 - (iii) alternator and prime mover;
 - (iv) step-up transformer description;
 - (v) minimum and maximum reactive power;
 - (vi) voltage models and speed controller models; and
 - (vii) prime movers models and excitation system models suitable for large disturbances;
 - b the data on type of regulation and voltage regulation range concerning tap changers, including the description of existing on-load tap changers, and the data on type of regulation and voltage regulation range concerning step-up and network transformers; and
 - c the data concerning HVDC systems and FACTS devices on the dynamic models of the system or the device and its associated regulation suitable for large disturbances.

Article 42

Real-time data exchange

- 1 In accordance with Articles 18 and 19, each TSO shall exchange with the other TSOs of the same synchronous area the following data on the system state of its transmission system using the IT tool for real-time data exchange at pan-European level as provided by ENTSO for Electricity:
- a frequency;
 - b frequency restoration control error;
 - c measured active power interchanges between LFC areas;
 - d aggregated generation infeed;
 - e system state in accordance with Article 18;
 - f setpoint of the load-frequency controller; and
 - g power interexchange via virtual tie-lines.
- 2 Each TSO shall exchange with the other TSOs in its observability area the following data about its transmission system using real-time data exchanges between the TSOs' supervisory control and data acquisition (SCADA) systems and energy management systems:
- a actual substation topology;

- b active and reactive power in line bay, including transmission, distribution and lines connecting SGUs;
- c active and reactive power in transformer bay, including transmission, distribution and SGUs connecting transformers;
- d active and reactive power in power generating facility bay;
- e regulating positions of transformers, including phase-shifting transformers;
- f measured or estimated busbar voltage;
- g reactive power in reactor and capacitor bay or from a static VAR compensator; and
- h restrictions on active and reactive power supply capabilities with respect to the observability area.

3 Each TSO shall have the right to request all TSOs from its observability area to provide real-time snapshots of state estimated data from that TSO's control area if that is relevant for the operational security of the transmission system of the requesting TSO.

CHAPTER 3

Data exchange between TSOs and DSOs within the TSO's control area

Article 43

Structural data exchange

1 Each TSO shall determine the observability area of the transmission-connected distribution systems which is needed for the TSO to determine the system state accurately and efficiently, based on the methodology developed in accordance with Article 75.

2 If a TSO considers that a non-transmission-connected distribution system has a significant influence in terms of voltage, power flows or other electrical parameters for the representation of the transmission system's behaviour, such distribution system shall be defined by the TSO as being part of the observability area in accordance with Article 75.

3 The structural information related to the observability area referred to in paragraphs 1 and 2 provided by each DSO to the TSO shall include at least:

- a substations by voltage;
- b lines that connect the substations referred to in point (a);
- c transformers from the substations referred to in point (a);
- d SGUs; and
- e reactors and capacitors connected to the substations referred to in point (a).

4 Each transmission-connected DSO shall provide the TSO with an update of the structural information in accordance with paragraph 3 at least every 6 months.

5 At least once a year, each transmission-connected DSO shall provide the TSO, per primary energy sources, the total aggregated generating capacity of the type A power generating modules subject to requirements of Regulation (EU) 2016/631 and the best possible estimates of generating capacity of type A power generating modules not subject to or derogated from Regulation (EU) 2016/631, connected to its distribution system, and the related information concerning their frequency behaviour.

Article 44

Real-time data exchange

Unless otherwise provided by the TSO, each DSO shall provide its TSO, in real-time, the information related to the observability area of the TSO as referred to in Article 43(1) and (2), including:

- (a) the actual substation topology;
- (b) the active and reactive power in line bay;
- (c) the active and reactive power in transformer bay;
- (d) the active and reactive power injection in power generating facility bay;
- (e) the tap positions of transformers connected to the transmission system;
- (f) the busbar voltages;
- (g) the reactive power in reactor and capacitor bay;
- (h) the best available data for aggregated generation per primary energy source in the DSO area; and
- (i) the best available data for aggregated demand in the DSO area.

CHAPTER 4

Data exchange between TSOs, owners of interconnectors or other lines and power generating modules connected to the transmission system

Article 45

Structural data exchange

1 Each SGU which is a power generating facility owner of a type D power generating module connected to the transmission system shall provide the TSO with at least the following data:

- a general data of the power generating module, including installed capacity and primary energy source;
- b turbine and power generating facility data including time for cold and warm start;
- c data for short-circuit current calculation;
- d power generating facility transformer data;
- e FCR data of power generating modules offering or providing that service, in accordance with Article 154;
- f FRR data of power generating modules offering or providing that service, in accordance with Article 158;
- g RR data of power generating modules that offer or provide that service in accordance with Article 161;
- h data necessary for restoration of the transmission system;

- i data and models necessary for performing dynamic simulation;
 - j protection data;
 - k data necessary for determining the costs of remedial actions in accordance with Article 78(1)(b); where a TSO makes use of market based mechanisms in line with Article 4(2)(d), the provision of prices to be paid by the TSO shall be considered sufficient;
 - l voltage and reactive power control capability.
- 2 Each SGU which is a power generating facility owner of a type B or a type C power generating module connected to the transmission system shall provide the TSO with at least the following data:
 - a general data of the power generating module, including installed capacity and primary energy source;
 - b data for short-circuit current calculation;
 - c FCR data according to the definition and requirements of the Article 173 for power generating modules offering or providing that service;
 - d FRR data for power generating modules that offer or provide that service;
 - e RR data for power generating modules that offer or provide that service;
 - f protection data;
 - g reactive power control capability;
 - h data necessary for determining the costs of remedial actions in accordance with Article 78(1)(b); where a TSO makes use of market based mechanisms in line with Article 4(2)(d), the provision of prices to be paid by the TSO shall be considered sufficient;
 - i data necessary for performing dynamic stability assessment according to Article 38.
- 3 A TSO may request the power generating facility owner of a power generating module connected to the transmission system to provide further data where appropriate for operational security analysis in accordance with Title 2 of Part III.
- 4 Each HVDC system owner or interconnector owner shall provide the TSO with the following data regarding the HVDC system or interconnector:
 - a nameplate data of the installation;
 - b transformers data;
 - c data on filters and filter banks;
 - d reactive power compensation data;
 - e active power control capability;
 - f reactive power and voltage control capability;
 - g active or reactive operational mode prioritization, if existing;
 - h frequency response capability;
 - i dynamic models for dynamic simulation;
 - j protection data; and
 - k fault-ride-through capability.
- 5 Each AC interconnector owner shall provide the TSO with at least the following data:
 - a nameplate data of the installation;
 - b electrical parameters;
 - c associated protections.

Article 46

Scheduled data exchange

1 Each SGU which is a power generating facility owner of a type B, C or D power generating module connected to the transmission system shall provide the TSO with at least the following data:

- a active power output and active power reserves amount and availability, on a day-ahead and intra-day basis;
- b without any delay, any scheduled unavailability or active power restriction;
- c any forecasted restriction in the reactive power control capability; and
- d as an exception to points (a) and (b), in regions with a central dispatch system, data requested by the TSO for the preparation of its active power output schedule.

2 Each HVDC system operator shall provide the TSOs with at least the following data:

- a active power schedule and availability on a day-ahead and intra-day basis;
- b without delay its scheduled unavailability or active power restriction; and
- c any forecast restriction in the reactive power or voltage control capability.

3 Each AC interconnector or line operator shall provide its scheduled unavailability or active power restriction data to the TSOs.

Article 47

Real-time data exchange

1 Unless otherwise provided by the TSO, each significant grid user which is a power generating facility owner of type B, C or D power generating module shall provide the TSO, in real-time, at least the following data:

- a position of the circuit breakers at the connection point or another point of interaction agreed with the TSO;
- b active and reactive power at the connection point or another point of interaction agreed with the TSO; and
- c in the case of power generating facility with consumption other than auxiliary consumption net active and reactive power.

2 Unless otherwise provided by the TSO, each HVDC system or AC interconnector owner shall provide, in real-time, at least the following data regarding the connection point of the HVDC system or AC interconnector to the TSOs:

- a position of the circuit breakers;
- b operational status; and
- c active and reactive power.

CHAPTER 5

Data exchange between TSOs, DSOs and distribution-connected power generating modules

Article 48

Structural data exchange

1 Unless otherwise provided by the TSO, each power generating facility owner of a power generating module which is a SGU pursuant to Article 2(1)(a) and by aggregation of the SGUs pursuant to Article 2(1)(e) connected to the distribution system shall provide at least the following data to the TSO and to the DSO to which it has a connection point:

- a general data of the power generating module, including installed capacity and primary energy source or fuel type;
- b FCR data according to the definition and requirements of Article 173 for power generating facilities offering or providing the FCR service;
- c FRR data for power generating facilities offering or providing the FRR service;
- d RR data for power generating modules offering or providing the RR service;
- e protection data;
- f reactive power control capability;
- g capability of remote access to the circuit breaker;
- h data necessary for performing dynamic simulation according to the provisions in Regulation (EU) 2016/631; and
- i voltage level and location of each power generating module.

2 Each power generating facility owner of a power generating module which is a SGU in accordance with Article 2(1)(a) and (e) shall inform the TSO and the DSO to which it has a connection point, within the agreed time and not later than the first commissioning or any changes to the existing installation, about any change in the scope and the contents of the data listed in paragraph 1.

Article 49

Scheduled data exchange

Unless otherwise provided by the TSO, each power generating facility owner of a power generating module which is a SGU in accordance with Article 2(1)(a) and 2(1)(e) connected to the distribution system shall provide the TSO and the DSO to which it has the connection point, with at least the following data:

- (a) its scheduled unavailability, scheduled active power restriction and its forecasted scheduled active power output at the connection point;
- (b) any forecasted restriction in the reactive power control capability; and
- (c) as an exception to paragraphs (a) and (b), in regions with a central dispatch system, data requested by the TSO for the preparation of its active power output schedule.

Article 50

Real-time data exchange

1 Unless otherwise provided by the TSO, each power generating facility owner of a power generating module which is a SGU in accordance with Article 2(1)(a) and (e) connected to the distribution system shall provide the TSO and the DSO to which it has the connection point, in real-time, at least the following data:

- a status of the switching devices and circuit breakers at the connection point; and
- b active and reactive power flows, current, and voltage at the connection point.

2 Each TSO shall define in coordination with the responsible DSOs which SGUs may be exempted from providing the real-time data listed in paragraph 1 directly to the TSO. In such cases, the responsible TSOs and DSOs shall agree on the aggregated real-time data of the SGUs concerned to be delivered to the TSO.

Article 51

Data exchange between TSOs and DSOs concerning significant power generating modules

1 Unless otherwise provided by the TSO, each DSO shall provide to its TSO the information specified in Articles 48, 49 and 50 with the frequency and level of detail requested by the TSO.

2 Each TSO shall make available to the DSO, to whose distribution system SGUs are connected, the information specified in Articles 48, 49 and 50 as requested by the DSO.

3 A TSO may request further data from a power generating facility owner of a power generating module which is a SGU in accordance with Article 2(1)(a) and (e) connected to the distribution system, if it is necessary for the operational security analysis and for the validation of models.

CHAPTER 6

Data exchange between TSOs and demand facilities

Article 52

Data exchange between TSOs and transmission-connected demand facilities

1 Unless otherwise provided by the TSO, each transmission-connected demand facility owner shall provide the following structural data to the TSO:

- a electrical data of the transformers connected to the transmission system;
- b characteristics of the load of the demand facility; and
- c characteristics of the reactive power control.

2 Unless otherwise provided by the TSO, each transmission-connected demand facility owner shall provide the following data to the TSO:

- a scheduled active and forecasted reactive power consumption on a day-ahead and intraday basis, including any changes of those schedules or forecast;
 - b any forecasted restriction in the reactive power control capability;
 - c in case of participation in demand response, a schedule of its structural minimum and maximum power range to be curtailed; and
 - d by exception to point (a), in regions with a central dispatch system, the data requested by the TSO for the preparation of its active power output schedule.
- 3 Unless otherwise provided by the TSO, each transmission-connected demand facility owner shall provide the following data to the TSO in real-time:
- a active and reactive power at the connection point; and
 - b the minimum and maximum power range to be curtailed.
- 4 Each transmission-connected demand facility owner shall describe to its TSO its behaviour at the voltage ranges referred to in Article 27.

Article 53

Data exchange between TSOs and distribution-connected demand facilities or third parties participating in demand response

- 1 Unless otherwise provided by the TSO, each SGU which is a distribution-connected demand facility and which participates in demand response other than through a third party shall provide the following scheduled and real-time data to the TSO and to the DSO:
- a structural minimum and maximum active power available for demand response and the maximum and minimum duration of any potential usage of this power for demand response;
 - b a forecast of unrestricted active power available for demand response and any planned demand response;
 - c real-time active and reactive power at the connection point; and
 - d a confirmation that the estimations of the actual values of demand response are applied.
- 2 Unless otherwise provided by the TSO, each SGU which is a third party participating in demand response as defined in Article 27 of Regulation (EU) 2016/1388, shall provide the TSO and the DSO at the day-ahead and close to real-time and on behalf of all of its distribution-connected demand facilities, with the following data:
- a structural minimum and maximum active power available for demand response and the maximum and minimum duration of any potential activation of demand response in a specific geographical area defined by the TSO and DSO;
 - b a forecast of unrestricted active power available for the demand response and any planned level of demand response in a specific geographical area defined by the TSO and DSO;
 - c real-time active and reactive power; and
 - d a confirmation that the estimations of the actual values of demand response are applied.

TITLE 3

COMPLIANCE

CHAPTER 1

Roles and responsibilities

Article 54

Responsibility of the SGUs

1 Each SGU shall notify the TSO or DSO to which it has a connection point about any planned modification of its technical capabilities which could have an impact on its compliance with the requirements of this Regulation, prior to its execution.

2 Each SGU shall notify the TSO or DSO to which it has a connection point about any operational disturbance in its facility which could have an impact on its compliance with the requirements of this Regulation as soon as possible after its occurrence.

3 Each SGU shall notify the TSO or DSO to which it has a connection point of the planned test schedules and procedures to be followed for verifying the compliance of its facility with the requirements of this Regulation, in due time and prior to their launch. The TSO or DSO shall approve in advance and in a timely manner the planned test schedules and procedures and the approval shall not be unreasonably withheld. Where the SGU has a connection point to the DSO and interacts, pursuant to paragraph 2, only with the DSO, the TSO shall be entitled to request from the concerned DSO any compliance testing results, which are relevant for the operational security of its transmission system.

4 Upon request from the TSO or DSO, pursuant to Article 41(2) of Regulation (EU) 2016/631 and Article 35(2) of Regulation (EU) 2016/1388, the SGU shall carry out compliance tests and simulations in accordance with those Regulations at any time throughout the lifetime of its facility and in particular after any fault, modification or replacement of any equipment, which could have an impact on the facility's compliance with the requirements of this Regulation regarding the capability of the facility to achieve the values declared, the time requirements applicable to those values and the availability or contracted provision of ancillary services. Third parties providing demand response directly to the TSO, providers of redispatching of power generating modules or demand facilities by means of aggregation, and other providers of active power reserves shall ensure that the facilities in their portfolio comply with the requirements of this Regulation.

Article 55

Tasks of TSOs regarding system operation

Each TSO shall be responsible for the operational security of its control area and, in particular, it shall:

- (a) develop and implement network operation tools that are relevant for its control area and related to real-time operation and operational planning;
- (b) develop and deploy tools and solutions for the prevention and remedy of disturbances;

- (c) use services provided by third parties, through procurement when applicable, such as redispatching or countertrading, congestion management services, generation reserves and other ancillary services;
- (d) comply with the incidents classification scale adopted by ENTSO for Electricity in accordance with Article 8(3)(a) of Regulation (EC) No 714/2009 and submit to ENTSO for Electricity the information required to perform the tasks for producing the incidents classification scale; and
- (e) monitor on an annual basis the appropriateness of the network operation tools established pursuant to points (a) and (b) required to maintain operational security. Each TSO shall identify any appropriate improvements to those network operation tools, taking into account the annual reports prepared by ENTSO for Electricity based on the incidents classification scale in accordance with Article 15. Any identified enhancement shall be implemented subsequently by the TSO.

CHAPTER 2

Operational testing

Article 56

Purpose and responsibilities

1 Each TSO and each transmission-connected DSO or SGU may perform operational testing respectively of its transmission system elements and of their facilities under simulated operational conditions and for a limited period of time. When doing so, they shall provide notification in due time and prior to the test launch and shall minimise the effect on real-time system operation. The operational testing shall aim at providing:

- a proof of compliance with all relevant technical and organisational operational provisions of this Regulation for a new transmission system element at its first entry into operation;
- b proof of compliance with all relevant technical and organisational operational provisions of this Regulation for a new facility of the SGU or of DSO at its first entry into operation;
- c proof of compliance with all relevant technical and organisational operational provisions of this Regulation upon any change of a transmission system element or a facility of the SGU or of the DSO, which is relevant for system operation;
- d assessment of possible negative effects of a failure, short-circuit or other unplanned and unexpected incident in system operation, on the transmission system element, or on the facility of the SGU or of the DSO.

2 The results of the operational testing referred to in paragraph 1 shall be used by a TSO, DSO or a SGU, in order for:

- a the TSO to ensure correct functioning of transmission system elements;
- b the DSO and SGUs to ensure correct functioning of distribution systems and of the SGUs' facilities;
- c the TSO, DSO or SGU to maintain existing and develop new operational practices;
- d the TSO to ensure fulfilment of ancillary services;

- e the TSO, DSO or SGU to acquire information about performance of transmission system elements and facilities of the SGUs and DSOs under any conditions and in compliance with all relevant operational provisions of this Regulation, in terms of:
 - (i) controlled application of frequency or voltage variations aimed at gathering information on transmission system and elements' behaviour; and
 - (ii) tests of operational practices in emergency state and restoration state.

3 Each TSO shall ensure that operational testing does not endanger the operational security of its transmission system. Any operational testing may be postponed or interrupted due to unplanned system conditions, or due to safety of personnel, of the general public, of the plant or apparatus being tested, or of transmission system elements or of the facilities of the DSO or SGU.

4 In the event of degradation of the state of the transmission system in which the operational testing is performed, the TSO of that transmission system shall be entitled to interrupt the operational testing. If conducting a test affects another TSO and its system state is also degraded, the TSO or SGU or DSO conducting the test shall, upon being informed by the TSO concerned, immediately cease the operational test.

5 Each TSO shall ensure that the results of relevant operational tests carried out together with all related analyses are:

- a incorporated into the training and certification process of the employees in charge of real-time operation;
- b used as inputs to the research and development process of ENTSO for Electricity; and
- c used to improve operational practices including also those in emergency and restoration state.

Article 57

Performing operational tests and analysis

1 Each TSO or DSO to which the SGU has a connection point retains the right to test a SGU's compliance with the requirements of this Regulation, the SGU's expected input or output and the SGU's contracted provision of ancillary services at any time throughout the lifetime of the facility. The procedure for those operational tests shall be notified to the SGU by the TSO or DSO in due time prior to the launch of the operational test.

2 The TSO or DSO to which the SGU has a connection point shall publish the list of information and documents to be provided as well as the requirements to be fulfilled by the SGU for operational testing of compliance. Such list shall cover at least the following information:

- a all documentation and equipment certificates to be provided by the SGU;
- b details of the technical data of the SGU facility with relevance for the system operation;
- c requirements for models for dynamic stability assessment; and
- d studies by the SGU demonstrating expected outcome of the dynamic stability assessment, where applicable.

3 Where applicable, each TSO or DSO shall publish the allocation of responsibilities of the SGU and of the TSO or DSO for operational testing of compliance.

TITLE 4

TRAINING

Article 58

Training program

- 1 By 18 months after entry into force of this Regulation each TSO shall develop and adopt:
 - a an initial training program for the certification and a rolling program for the continuous training of its employees in charge of real-time operation of the transmission system;
 - b a training program for its employees in charge of operational planning. Each TSO shall contribute to developing and adopting training programs for employees of the relevant regional security coordinators;
 - c a training program for its employees in charge of balancing.
- 2 The TSO's training programs shall include the knowledge of the transmission system elements, the operation of the transmission system, use of the on-the-job systems and processes, inter-TSO operations, market arrangements, recognising of and responding to exceptional situations in system operation, operational planning activities and tools.
- 3 TSO employees in charge of real-time operation of transmission system shall, as a part of its initial training, undergo training on interoperability issues between transmission systems based upon operational experiences and feedback from the joint training carried out with neighbouring TSOs in accordance with Article 63. That training on interoperability issues shall include preparation and activation of coordinated remedial actions required in all system states.
- 4 Each TSO shall include in its training program for the employees in charge of real-time operation of the transmission system the frequency of the trainings and the following components:
 - a a description of the transmission system elements;
 - b operation of the transmission system in all system states including restoration;
 - c use of the on-the-job systems and processes;
 - d coordination of inter-TSO operations and market arrangements;
 - e recognition of and response to exceptional operational situations;
 - f relevant areas of electrical power engineering;
 - g relevant aspects of the Union internal electricity market;
 - h relevant aspects of the network codes or guidelines adopted according to Articles 6 and 18 of Regulation (EC) No 714/2009;
 - i safety and security of persons, nuclear and other equipment in transmission system operation;
 - j inter-TSO cooperation and coordination in real-time operation and in operational planning at the level of main control rooms which shall be given in English unless otherwise specified;
 - k joint training with transmission-connected DSOs and SGUs, where appropriate;
 - l behavioural skills with particular focus on stress management, human acting in critical situation, responsibility and motivation skills; and
 - m operational planning practices and tools, including those used with the relevant regional security coordinators in the operational planning.

5 The training program for employees in charge of operational planning shall include at least the aspects in points (c), (f), (g), (h), (j) and (m) of paragraph 4.

6 The training program for employees in charge of balancing shall include at least the aspects in points (c), (g) and (h) of paragraph 4.

7 Each TSO shall maintain records of employees' training programs for their period of employment. Upon request of the relevant regulatory authority, each TSO shall provide the scope and details of its training programs.

8 Each TSO shall review its training programs at least annually or following significant system changes. Each TSO shall update its training programs to reflect changing operational circumstances, market rules, network configuration and system characteristics, with particular focus on new technologies, changing generation and demand patterns and market evolution.

Article 59

Training conditions

1 Each TSO's training programs for employees in charge of real-time operation shall include on-the-job and offline training. On-the-job training shall be carried out under the supervision of an experienced employee in charge of real-time operation. Offline training shall be carried out in an environment which simulates the control room and with network modelling details at a level appropriate to the tasks being trained for.

2 Each TSO shall implement training for employees in charge of real-time operation based on a comprehensive database model of their network with respective data from other networks of, at least, the observability area, at a level of detail which is sufficient to replicate inter-TSO operational issues. Training scenarios shall be based on real and simulated system conditions. Where relevant, the role of other TSOs, transmission-connected DSOs and significant grid users shall also be simulated unless they can be directly represented in joint trainings.

3 Each TSO shall coordinate the offline training of the employees in charge of real-time operation with the transmission-connected DSOs and SGUs regarding the impact of their facilities on real-time operation of the transmission system, in a comprehensive and proportionate manner, reflecting the up-to-date network topology and characteristics of secondary equipment. When relevant, TSOs, transmission-connected DSOs and SGUs shall run joint offline training simulations or training workshops.

Article 60

Training coordinators and trainers

1 The training coordinator's responsibilities shall include the designing, monitoring and updating of the training programs, as well as the determination of:

- a the qualifications and selection process for TSO employees to be trained;
- b the training required for certification of the system operator employees in charge of real-time operation;
- c the processes, including relevant documentation, for the initial and the rolling training programs;
- d the process for certification of system operator employees in charge of real-time operation; and

- e the process for extension of a training period and certification period for the system operator employees in charge of real-time operation.
- 2 Each TSO shall determine the skills and the level of competence of on-the-job trainers. On-the-job trainers shall have an appropriate level of operational experience following their certification.
- 3 Each TSO shall have a register of the system operator employees in charge of real-time operation who carry out the functions of on-the-job trainers and review their capability to provide practical training when deciding upon the extension of their certification.

Article 61

Certification of system operator employees in charge of real-time operation

- 1 An individual may become a system operator employee in charge of real-time operation provided he or she is trained and subsequently certified by a nominated representative from his or her TSO for the concerned tasks within the timescale defined in the training programme. A system operator employee in charge of real-time operation shall not work unsupervised in the control room unless he or she is certified.
- 2 By 18 months after entry into force of this Regulation, each TSO shall define and implement a process, including the level of competence, for the certification of the system operator employees in charge of real-time operation.
- 3 TSO employees in charge of real-time operation shall be certified following a successful formal assessment which shall comprise an oral and/or a written exam, and/or a practical assessment with pre-defined success criteria.
- 4 The TSO shall keep a copy of the issued certificate and of the formal assessment results. Upon request by the regulatory authority, the TSO shall provide a copy of the certification examination records.
- 5 Each TSO shall record the period of validity of the certification issued to any employee in charge of real-time operation.
- 6 Each TSO shall determine the maximum period of the certification, which shall not exceed 5 years but which may be extended on the basis of criteria determined by each TSO, and may take into account the participation of employees in charge of real-time operation in a continuous training programme with sufficient practical experience.

Article 62

Common language for communication between the system operator employees in charge of real time operation

- 1 Unless otherwise agreed, the common contact language between the employees of a TSO and those of the neighbouring TSO shall be English.
- 2 Each TSO shall train its relevant system operator employees to achieve sufficient skills in the common contact languages agreed with the neighbouring TSOs.

Article 63

Cooperation between TSOs on training

1 Each TSO shall organise regular training sessions with its neighbouring TSOs to improve the knowledge of the characteristics of neighbouring transmission systems as well as the communication and coordination between employees of neighbouring TSOs in charge of real-time operation. The inter-TSO training shall include detailed knowledge of coordinated actions required under each system state.

2 Each TSO shall determine, in cooperation with at least the neighbouring TSO, the need and frequency for joint training sessions, including the minimum content and scope of those sessions, taking into account the level of mutual influence and operational cooperation needed. This inter-TSO training may include, but should not be limited to, joint training workshops and joint training simulator sessions.

3 Each TSO shall participate with other TSOs, at least once a year, in training sessions on the management of inter-TSO issues in real-time operation. The frequency shall be defined taking into account the level of mutual influence of transmission systems and the type of interconnection — DC/AC links.

4 Each TSO shall exchange experiences from real-time operation, including visits and the exchange of experiences between system operator employees in charge of real-time operation, with their neighbouring TSOs, with any TSO with which there is or has been inter-TSO operational interaction and with the relevant regional security coordinators.

PART III

OPERATIONAL PLANNING

TITLE 1

DATA FOR OPERATIONAL SECURITY ANALYSIS IN OPERATIONAL PLANNING

Article 64

General provisions regarding individual and common grid models

1 To perform operational security analysis pursuant to Title 2 of this Part, each TSO shall prepare individual grid models in accordance with the methodologies established in application of Article 17 of Regulation (EU) 2015/1222 and Article 18 of Regulation (EU) 2016/1719 for each of the following time-frames, applying the data format established pursuant to Article 114(2):

- a year-ahead, in accordance with Articles 66, 67 and 68;
- b where applicable, week-ahead, in accordance with Article 69;
- c day-ahead, in accordance with Article 70; and
- d intraday, in accordance with Article 70.

2 The individual grid models shall include the structural information and data set out in Article 41.

3 Each TSO shall build the individual grid models and each regional security coordinator shall contribute to building the common grid models applying the data format established pursuant to Article 114(2).

Article 65

Year-ahead scenarios

1 All TSOs shall jointly develop a common list of year-ahead scenarios against which they assess the operation of the interconnected transmission system for the following year. Those scenarios shall allow the identification and the assessment of the influence of the interconnected transmission system on operational security. The scenarios shall include the following variables:

- a electricity demand;
- b the conditions related to the contribution of renewable energy sources;
- c determined import/export positions, including agreed reference values allowing the merging task;
- d the generation pattern, with a fully available production park;
- e the year-ahead grid development.

2 When developing the common list of scenarios, TSOs shall take into account the following elements:

- a the typical cross-border exchange patterns for different levels of consumption and of renewable energy sources and conventional generation;
- b the probability of occurrence of the scenarios;
- c the potential deviations from operational security limits for each scenario;
- d the amount of power generated and consumed by the power generating facilities and demand facilities connected to distribution systems.

3 Where TSOs do not succeed in establishing the common list of scenarios referred to in paragraph 1, they shall use the following default scenarios:

- a Winter Peak, 3rd Wednesday of January current year, 10:30 CET;
- b Winter Valley, 2nd Sunday of January current year, 03:30 CET;
- c Spring Peak, 3rd Wednesday of April current year, 10:30 CET;
- d Spring Valley, 2nd Sunday of April current year, 03:30 CET;
- e Summer Peak, 3rd Wednesday of July previous year, 10:30 CET;
- f Summer Valley, 2nd Sunday of July previous year, 03:30 CET;
- g Autumn Peak, 3rd Wednesday of October previous year, 10:30 CET;
- h Autumn Valley, 2nd Sunday of October previous year, 03:30 CET.

4 ENTSO for Electricity shall publish every year, by 15 July, the common list of scenarios established for the following year, including the description of those scenarios and the period during which these scenarios are to be used.

Article 66

Year-ahead individual grid models

1 Each TSO shall determine a year-ahead individual grid model for each of the scenarios developed pursuant to Article 65, using its best estimates of the variables defined in Article 65(1). Each TSO shall publish its year-ahead individual grid models on the ENTSO for Electricity operational planning data environment in accordance with Article 114(1).

2 When defining its year-ahead individual grid model, each TSO shall:

- a agree with the neighbouring TSOs upon the estimated power flow on HVDC systems linking their control areas;
- b balance for each scenario the sum of:
 - (i) net exchanges on AC lines;
 - (ii) estimated power flows on HVDC systems;
 - (iii) load, including an estimation of losses; and
 - (iv) generation.

3 Each TSO shall include in its year-ahead individual grid models the aggregated power outputs for power generating facilities connected to distribution systems. Those aggregated power outputs shall:

- a be consistent with the structural data provided in accordance with the requirements of Articles 41, 43, 45 and 48;
- b be consistent with the scenarios developed in accordance with Article 65; and
- c distinguish the type of primary energy source.

Article 67

Year-ahead common grid models

1 By 6 months after entry into force of this Regulation, all TSOs shall jointly develop a proposal for the methodology for building the year-ahead common grid models from the individual grid models established in accordance with Article 66(1) and for saving them. The methodology shall take into account, and complement where necessary, the operational conditions of the common grid model methodology developed in accordance with Article 17 of Regulation (EU) 2015/1222 and Article 18 of Regulation (EU) 2016/1719, as regards the following elements:

- a deadlines for gathering the year-ahead individual grid models, for merging them into a common grid model and for saving the individual and common grid models;
- b quality control of the individual and common grid models to be implemented in order to ensure their completeness and consistency; and
- c correction and improvement of individual and common grid models, implementing at least the quality controls referred to in point (b).

2 Each TSO shall have the right to request from another TSO any information on modifications to the network topology or on operational arrangements, such as protection setpoints or system protection schemes, single line diagrams and configuration of substations

or additional grid models relevant for the provision of an accurate representation of the transmission system to undertake operational security analysis.

Article 68

Updates of year-ahead individual and common grid models

1 When a TSO modifies or notices a modification of its best estimates for the variables used for determining its year-ahead individual grid model established in accordance with Article 66(1), which is significant for operational security, it shall update its year-ahead individual grid model and publish it on the ENTSO for Electricity operational planning data environment.

2 Whenever an individual grid model is updated, the year-ahead common grid model shall be updated accordingly applying the methodology determined in accordance with Article 67(1).

Article 69

Week-ahead individual and common grid models

1 Where two or more TSOs consider it necessary, they shall determine the most representative scenarios for coordinating the operational security analysis of their transmission system for the week-ahead time-frame and shall develop a methodology for merging the individual grid models analogous to the methodology for building the year-ahead common grid model from year-ahead individual grid models in accordance with Article 67(1).

2 Each TSO referred to in paragraph 1 shall establish or update its week-ahead individual grid models pursuant to the scenarios determined in accordance with paragraph 1.

3 The TSOs referred to in paragraph 1 or the third parties to which the task referred to in paragraph 1 has been delegated, shall build the week-ahead common grid models following the methodology developed in accordance with paragraph 1 and using the individual grid models established in accordance with paragraph 2.

Article 70

Methodology for building day-ahead and intraday common grid models

1 By 6 months after entry into force of this Regulation, all TSOs shall jointly develop a proposal for the methodology for building the day-ahead and intraday common grid models from the individual grid models and for saving them. That methodology shall take into account, and complement where necessary, the operational conditions of the common grid model methodology developed in accordance with Article 17 of Regulation (EU) 2015/1222, as regards the following elements:

- a definition of timestamps;
- b deadlines for gathering the individual grid models, for merging them into a common grid model and for saving individual and common grid models. The deadlines shall be compatible with the regional processes established for preparing and activating remedial actions;
- c quality control of individual grid models and the common grid model to be implemented to ensure their completeness and consistency;

- d correction and improvement of individual and common grid models, implementing at least the quality controls referred to in point (c); and
 - e handling additional information related to operational arrangements, such as protection setpoints or system protection schemes, single line diagrams and configuration of substations in order to manage operational security.
- 2 Each TSO shall create day-ahead and intraday individual grid models in accordance with paragraph 1 and publish them on the ENTSO for Electricity operational planning data environment.
- 3 When creating the day-ahead or intraday individual grid models referred to in paragraph 2, each TSO shall include:
- a up-to-date load and generation forecasts;
 - b the available results of the day-ahead and intraday market processes;
 - c the available results of the scheduling tasks described in Title 6 of Part III;
 - d for power generating facilities connected to distribution systems, aggregated active power output differentiated on the basis of the type of primary energy source, in line with data provided in accordance with Articles 40, 43, 44, 48, 49 and 50;
 - e up-to-date topology of the transmission system.
- 4 All remedial actions already decided shall be included in the day-ahead and intraday individual grid models and shall be clearly distinguishable from the injections and withdrawals established in accordance with Article 40(4) and the network topology without remedial actions applied.
- 5 Each TSO shall assess the accuracy of the variables in paragraph 3 by comparing the variables with their actual values, taking into account the principles determined pursuant to Article 75(1)(c).
- 6 If, following the assessment referred to in paragraph 5, a TSO considers that the accuracy of the variables is insufficient to evaluate operational security, it shall determine the causes of the inaccuracy. If the causes depend on the TSO's processes for establishing the individual grid models, that TSO shall review those processes to obtain more accurate results. If the causes depend on variables provided by other parties, that TSO together with those other parties shall endeavour to ensure that the variables concerned are accurate.

Article 71

Quality control for grid models

When defining the quality controls in accordance with Articles 67(1)(b) and 70(1)(c), all TSOs shall jointly determine controls aimed at least to check:

- (a) the coherence of the connection status of interconnectors;
- (b) that voltage values are within the usual operational values for those transmission system elements having influence on other control areas;
- (c) the coherence of transitory admissible overloads of interconnectors; and
- (d) that active power and reactive power injections or withdrawals are compatible with usual operational values.

TITLE 2

OPERATIONAL SECURITY ANALYSIS

Article 72

Operational security analysis in operational planning

- 1 Each TSO shall perform coordinated operational security analyses for at least the following time-frames:
 - a year-ahead;
 - b week-ahead, when applicable in accordance with Article 69;
 - c day-ahead; and
 - d intraday.
- 2 When performing a coordinated operational security analysis, the TSO shall apply the methodology adopted pursuant to Article 75.
- 3 To perform operational security analyses, each TSO shall, in the N-Situation, simulate each contingency from its contingency list established in accordance with Article 33 and verify that, in the (N-1)-situation, the operational security limits defined in accordance with Article 25 are not exceeded in its control area.
- 4 Each TSO shall perform its operational security analyses using at least the common grid models established in accordance with Articles 67, 68, 70 and, where applicable, 69 and shall take into account the planned outages when carrying out those analyses.
- 5 Each TSO shall share the results of its operational security analysis with at least the TSOs whose elements are included in the TSO's observability area and are affected according to that operational security analysis, in order to allow those TSOs to verify that operational security limits are respected within their control areas.

Article 73

Year-ahead up to and including week-ahead operational security analysis

- 1 Each TSO shall perform year-ahead and, where applicable, week-ahead operational security analyses in order to detect at least the following constraints:
 - a power flows and voltages exceeding operational security limits;
 - b violations of stability limits of the transmission system identified in accordance with Article 38(2) and (6); and
 - c violations of short-circuit thresholds of the transmission system.
- 2 When a TSO detects a possible constraint, it shall design remedial actions in accordance with Articles 20 to 23. If remedial actions without costs are not available and the constraint is linked to the planned unavailability of some relevant assets, the constraint shall constitute an outage planning incompatibility and the TSO shall initiate outage coordination in accordance with Article 95 or 100 depending of the time of the year when this action is initiated.

Article 74

Day-ahead, intraday and close to real-time operational security analysis

- 1 Each TSO shall perform day-ahead, intraday and close to real-time operational security analyses to detect possible constraints and prepare and activate the remedial actions with any other concerned TSOs and, if applicable, affected DSOs or SGUs.
- 2 Each TSO shall monitor load and generation forecasts. When those forecasts indicate a significant deviation in load or generation, the TSO shall update its operational security analysis.
- 3 When performing close to real-time operational security analysis in its observability area, each TSO shall use state estimation.

Article 75

Methodology for coordinating operational security analysis

- 1 By 12 months after entry into force of this Regulation, all TSOs shall jointly develop a proposal for a methodology for coordinating operational security analysis. That methodology shall aim at the standardisation of operational security analysis at least per synchronous area and shall include at least:
 - a methods for assessing the influence of transmission system elements and SGUs located outside of a TSO's control area in order to identify those elements included in the TSO's observability area and the contingency influence thresholds above which contingencies of those elements constitute external contingencies;
 - b principles for common risk assessment, covering at least, for the contingencies referred to in Article 33:
 - (i) associated probability;
 - (ii) transitory admissible overloads; and
 - (iii) impact of contingencies;
 - c principles for assessing and dealing with uncertainties of generation and load, taking into account a reliability margin in line with Article 22 of Regulation (EU) 2015/1222;
 - d requirements on coordination and information exchange between regional security coordinators in relation to the tasks listed in Article 77(3);
 - e role of ENTSO for Electricity in the governance of common tools, data quality rules improvement, monitoring of the methodology for coordinated operational security analysis and of the common provisions for regional operational security coordination in each capacity calculation region.
- 2 The methods referred to in point (a) of paragraph 1 shall allow the identification of all elements of a TSO's observability area, being grid elements of other TSOs or transmission-connected DSOs, power generating modules or demand facilities. Those methods shall take into account the following transmission system elements and SGUs' characteristics:
 - a connectivity status or electrical values (such as voltages, power flows, rotor angle) which significantly influence the accuracy of the results of the state estimation for the TSO's control area, above common thresholds;

- b connectivity status or electrical values (such as voltages, power flows, rotor angle) which significantly influence the accuracy of the results of the TSO's operational security analysis, above common thresholds; and
- c requirement to ensure an adequate representation of the connected elements in the TSO's observability area.

3 The values referred to in points (a) and (b) of paragraph 2 shall be determined through situations representative of the various conditions which can be expected, characterised by variables such as generation level and pattern, level of electricity exchanges across the borders and asset outages.

4 The methods referred to in point (a) of paragraph 1 shall allow the identification of all elements of a TSO's external contingency list with the following characteristics:

- a each element has an influence factor on electrical values, such as voltages, power flows, rotor angle, in the TSO's control area greater than common contingency influence thresholds, meaning that the outage of this element can significantly influence the results of the TSO's contingency analysis;
- b the choice of the contingency influence thresholds shall minimize the risk that the occurrence of a contingency identified in another TSO's control area and not in the TSO's external contingency list could lead to a TSO's system behaviour deemed not acceptable for any element of its internal contingency list, such as an emergency state;
- c the assessment of such a risk shall be based on situations representative of the various conditions which can be expected, characterised by variables such as generation level and pattern, exchange levels, asset outages.

5 The principles for common risk assessment referred to in point (b) of paragraph 1 shall set out criteria for the assessment of interconnected system security. Those criteria shall be established with reference to a harmonised level of maximum accepted risk between the different TSO's security analysis. Those principles shall refer to:

- a the consistency in the definition of exceptional contingencies;
- b the evaluation of the probability and impact of exceptional contingencies; and
- c the consideration of exceptional contingencies in a TSO's contingency list when their probability exceeds a common threshold.

6 The principles for assessing and dealing with uncertainties referred to in point (c) of paragraph 1 shall provide for keeping the impact of the uncertainties regarding generation or demand below an acceptable and harmonised maximum level for each TSO's operational security analysis. Those principles shall set out:

- a harmonised conditions where one TSO shall update its operational security analysis. The conditions shall take into account relevant aspects such as the time horizon of the generation and demand forecasts, the level of change of forecasted values within the TSO's control area or within the control area of other TSOs, location of generation and demand, the previous results of its operational security analysis; and
- b minimum frequency of generation and demand forecast updates, depending on their variability and the installed capacity of non-dispatchable generation.

Article 76

Proposal for regional operational security coordination

1 By 3 months after the approval of the methodology for coordinating operational security analysis in Article 75(1), all TSOs of each capacity calculation region shall jointly

develop a proposal for common provisions for regional operational security coordination, to be applied by the regional security coordinators and the TSOs of the capacity calculation region. The proposal shall respect the methodologies for coordinating operational security analysis developed in accordance with Article 75(1) and complement where necessary the methodologies developed in accordance with Articles 35 and 74 of Regulation (EU) 2015/1222. The proposal shall determine:

- a conditions and frequency of intraday coordination of operational security analysis and updates to the common grid model by the regional security coordinator;
- b the methodology for the preparation of remedial actions managed in a coordinated way, considering their cross-border relevance as determined in accordance with Article 35 of Regulation (EU) 2015/1222, taking into account the requirements in Articles 20 to 23 and determining at least:
 - (i) the procedure for exchanging the information of the available remedial actions, between relevant TSOs and the regional security coordinator;
 - (ii) the classification of constraints and the remedial actions in accordance with Article 22;
 - (iii) the identification of the most effective and economically efficient remedial actions in case of operational security violations referred to in Article 22;
 - (iv) the preparation and activation of remedial actions in accordance with Article 23(2);
 - (v) the sharing of the costs of remedial actions referred to in Article 22, complementing where necessary the common methodology developed in accordance with Article 74 of Regulation (EU) 2015/1222. As a general principle, costs of non-cross-border relevant congestions shall be borne by the TSO responsible for the given control area and costs of relieving cross-border-relevant congestions shall be covered by TSOs responsible for the control areas in proportion to the aggravating impact of energy exchange between given control areas on the congested grid element.

2 In determining whether congestion have cross-border relevance, the TSOs shall take into account the congestion that would appear in the absence of energy exchanges between control areas.

Article 77

Organisation for regional operational security coordination

1 The proposal of all TSOs of a capacity calculation region for common provisions for regional operational security coordination pursuant to Article 76(1) shall also include common provisions concerning the organisation of regional operational security coordination, including at least:

- a the appointment of the regional security coordinator(s) that will perform the tasks in paragraph 3 for that capacity calculation region;
- b rules concerning the governance and operation of regional security coordinator(s), ensuring equitable treatment of all member TSOs;
- c where the TSOs propose to appoint more than one regional security coordinator in accordance with subparagraph (a):

- (i) a proposal for a coherent allocation of the tasks between the regional security coordinators who will be active in that capacity calculation region. The proposal shall take full account of the need to coordinate the different tasks allocated to the regional security coordinators;
- (ii) an assessment demonstrating that the proposed setup of regional security coordinators and allocation of tasks is efficient, effective and consistent with the regional coordinated capacity calculation established pursuant to Articles 20 and 21 of Regulation (EU) 2015/1222;
- (iii) an effective coordination and decision making process to resolve conflicting positions between regional security coordinators within the capacity calculation region.

2 When developing the proposal for common provisions concerning the organisation of regional operational security coordination in paragraph 1, the following requirements shall be met:

- a each TSO shall be covered by at least one regional security coordinator;
- b all TSOs shall ensure that the total number of regional security coordinators across the Union is not higher than six.

3 The TSOs of each capacity calculation region shall propose the delegation of the following tasks in accordance with paragraph 1:

- a regional operational security coordination in accordance with Article 78 in order to support TSOs fulfil their obligations for the year-ahead, day-ahead and intraday time-frames in Article 34(3) and Articles 72 and 74;
- b building of common grid model in accordance with Article 79;
- c regional outage coordination in accordance with Article 80, in order to support TSOs fulfil their obligations in Articles 98 and 100;
- d regional adequacy assessment in accordance with Article 81 in order to support TSOs fulfil their obligations under Article 107.

4 In executing its tasks, a regional security coordinator shall take account of data covering at least all capacity calculation regions for which it has been allocated tasks, including the observability areas of all TSOs in those capacity calculation regions..

5 All regional security coordinators shall coordinate the execution of their tasks in order to facilitate the fulfilment of the objectives of this Regulation. All regional security coordinators shall ensure the harmonization of processes and, where duplication is not justified by reasons of efficiency or by the need to ensure continuity of service, the creation of joint tools to ensure efficient cooperation and coordination between the regional security coordinators.

Article 78

Regional operational security coordination

1 Each TSO shall provide the regional security coordinator with all the information and data required to perform the coordinated regional operational security assessment, including at least:

- a the updated contingency list, established according to the criteria defined in the methodology for coordinating operational security analysis adopted in accordance with Article 75(1);

- b the updated list of possible remedial actions, among the categories listed in Article 22, and their anticipated costs provided in accordance with Article 35 of Regulation (EU) 2015/1222 if a remedial action includes redispatching or countertrading, aimed at contributing to relieve any constraint identified in the region; and
 - c the operational security limits established in accordance with Article 25.
- 2 Each regional security coordinator shall:
- a perform the coordinated regional operational security assessment in accordance with Article 76 on the basis of the common grid models established in accordance with Article 79, the contingency list and the operational security limits provided by each TSOs in paragraph 1. It shall deliver the results of the coordinated regional operational security assessment at least to all TSOs of the capacity calculation region. Where it detects a constraint, it shall recommend to the relevant TSOs the most effective and economically efficient remedial actions and may also recommend remedial actions other than those provided by the TSOs. This recommendation for remedial actions shall be accompanied by explanations as to its rationale;
 - b coordinate the preparation of remedial actions with and among TSOs in accordance with Article 76(1)(b), to enable TSOs achieve a coordinated activation of remedial actions in real-time.
- 3 When performing the coordinated regional operational security assessment and identifying the appropriate remedial actions, each regional security coordinator shall coordinate with other regional security coordinators.
- 4 When a TSO receives from the relevant regional security coordinator the results of the coordinated regional operational security assessment with a proposal for a remedial action, it shall evaluate the recommended remedial action for the elements involved in that remedial action and located in its control area. In so doing, it shall apply the provisions of Article 20. The TSO shall decide whether to implement the recommended remedial action. Where it decides not to implement the recommended remedial action, it shall provide an explanation for this decision to the RSC. Where the TSO decides to implement the recommended remedial action, it shall apply this action for the elements located in its control area provided that it is compatible with real-time conditions.

Article 79

Common grid model building

- 1 Each regional security coordinator shall check the quality of the individual grid models in order to contribute to building the common grid model for each mentioned time-frame in accordance with the methodologies referred to in Articles 67(1) and 70(1).
- 2 Each TSO shall make available to its regional security coordinator the individual grid model necessary to build the common grid model for each time-frame through the ENTSO for Electricity operational planning data environment.
- 3 Where necessary, each regional security coordinator shall request the TSOs concerned to correct their individual grid models in order to achieve their conformity with the quality controls and for their improvement.
- 4 Each TSO shall correct its individual grid models, after verifying the need for correction if applicable, on the basis of the requests of the regional security coordinator or another TSO.

5 In accordance with the methodologies referred to in Articles 67(1) and 70(1), and in accordance with Article 28 of Regulation (EU) 2015/1222, a regional security coordinator shall be appointed by all TSOs to build the common grid model for each time-frame and store it on the ENTSO for Electricity operational planning data environment.

Article 80

Regional outage coordination

1 The outage coordination regions within which the TSOs shall proceed to outage coordination shall be at least equal to the capacity calculation regions.

2 The TSOs of two or more outage coordination regions can agree to merge them into one unique outage coordination region. In that case they shall identify the regional security coordinator performing the tasks referred to in Article 77(3).

3 Each TSO shall provide the regional security coordinator with the information necessary to detect and solve regional outage planning incompatibilities, including at least:

- a the availability plans of its internal relevant assets, stored on the ENTSO for Electricity operational planning data environment;
- b the most recent availability plans for all non-relevant assets of its control area which are:
 - (i) capable of influencing the results of the outage planning incompatibility analysis;
 - (ii) modelled in the individual grid models which are used for the outage incompatibility assessment;
- c scenarios on which the outage planning incompatibilities have to be investigated and used to build the corresponding common grid models derived from the common grid models for different time-frames established in accordance with Articles 67 and 79.

4 Each regional security coordinator shall perform regional operational security analyses on the basis of the information provided by the relevant TSOs in order to detect any outage planning incompatibility. It shall provide all TSOs of the outage coordination region with a list of detected outage planning incompatibilities and the solutions it proposes to solve those outage planning incompatibilities.

5 In performing their obligations under paragraph 4, each regional security coordinator shall coordinate its analyses with other regional security coordinators.

6 In performing their obligations in accordance with Article 98(3) and Article 100(4)(b), all TSOs shall take into account the results of the assessment provided by the regional security coordinator in accordance with paragraph 3 and paragraph 4.

Article 81

Regional adequacy assessment

1 Each regional security coordinator shall perform regional adequacy assessments for at least the week-ahead time-frame.

2 Each TSO shall provide the regional security coordinator with the information necessary to perform the regional adequacy assessments referred to in paragraph 1, including:

- a the expected total load and available resources of demand response;

- b the availability of power generation modules; and
- c the operational security limits.

3 Each regional security coordinator shall perform adequacy assessments on the basis of the information provided by the relevant TSOs with the aim of detecting situations where a lack of adequacy is expected in any of the control areas or at regional level, taking into account possible cross-border exchanges and operational security limits. It shall deliver the results together with the actions it proposes to reduce risks to the TSOs of the capacity calculation region. Those actions shall include proposals for remedial actions that allow the increase of cross-border exchanges.

4 When performing a regional adequacy assessment, each regional security coordinator shall coordinate with other regional security coordinators.

TITLE 3

OUTAGE COORDINATION

CHAPTER 1

Outage coordination regions, relevant assets

Article 82

Outage coordination objective

Each TSO shall, with the support of the regional security coordinator for the instances specified in this Regulation, perform outage coordination in accordance with the principles of this Title in order to monitor the availability status of the relevant assets and coordinate the availability plans to ensure the operational security of the transmission system.

Article 83

Regional coordination

1 All TSOs of an outage coordination region shall jointly develop a regional coordination operational procedure, aimed at establishing operational aspects for the implementation of the outage coordination in each region, which includes:

- a frequency, scope and type of coordination for, at least, the year-ahead and week-ahead time-frames;
- b provisions concerning the use of the assessments carried out by the regional security coordinator in accordance with Article 80;
- c practical arrangements for the validation of the year-ahead relevant grid element availability plans, as required by Article 98.

2 Each TSO shall participate in the outage coordination of its outage coordination regions and apply the regional coordination operational procedures established in accordance with paragraph 1.

3 If outage planning incompatibilities arise between different outage coordination regions, all TSOs and regional security coordinators of those regions shall coordinate to resolve those outage planning incompatibilities.

4 Each TSO shall provide to the other TSOs from the same outage coordination region all relevant information at its disposal on the infrastructure projects related to the transmission system, distribution systems, closed distribution systems, power generating modules, or demand facilities that may have an impact on the operation of the control area of another TSO within the outage coordination region.

5 Each TSO shall provide the transmission-connected DSOs located in its control area with all relevant information at its disposal on the infrastructure projects related to the transmission system that may have an impact on the operation of the distribution system of these DSOs.

6 Each TSO shall provide the transmission-connected closed-DSOs ('CDSOs') located in its control area with all relevant information at its disposal on the infrastructure projects related to the transmission system that may have an impact on the operation of the closed distribution system of those CDSOs.

Article 84

Methodology for assessing the relevance of assets for outage coordination

1 By 12 months after entry into force of this Regulation, all TSOs shall jointly develop a methodology at least per synchronous area, for assessing the relevance for the outage coordination of power generating modules, demand facilities, and grid elements located in a transmission system or in a distribution system, including closed distribution systems.

2 The methodology referred to in paragraph 1 shall be based on qualitative and quantitative aspects that identify the impact on a TSO's control area of the availability status of either power generating modules, demand facilities, or grid elements which are located in a transmission system or in a distribution system including a closed distribution system, and which are connected directly or indirectly to another TSO's control area and in particular on:

- a quantitative aspects based on the evaluation of changes of electrical values such as voltages, power flows, rotor angle on at least one grid element of a TSO's control area, due to the change of availability status of a potential relevant asset located in another control area. That evaluation shall take place on the basis of year-ahead common grid models;
- b thresholds on the sensitivity of the electrical values referred to in point (a), against which to assess the relevance of an asset. Those thresholds shall be harmonised at least per synchronous area;
- c capacity of potential relevant power generating modules or demand facilities to qualify as SGUs;
- d qualitative aspects such as, but not limited to, the size and proximity to the borders of a control area of potential relevant power generating modules, demand facilities or grid elements;
- e systematic relevance of all grid elements located in a transmission system or in a distribution system which connect different control areas; and
- f systematic relevance of all critical network elements.

3 The methodology developed pursuant to paragraph 1 shall be consistent with the methods for assessing the influence of transmission system elements and SGUs located outside of a TSO's control area established in accordance with Article 75(1)(a).

Article 85

Lists of relevant power generating modules and relevant demand facilities

1 By 3 months after the approval of the methodology for assessing the relevance of assets for outage coordination in Article 84(1), all TSOs of each outage coordination region shall jointly assess the relevance of power generating modules and demand facilities for outage coordination on the basis of this methodology, and establish a single list, for each outage coordination region, of relevant power generating modules and relevant demand facilities.

2 All TSOs of an outage coordination region shall jointly make the list of relevant power generating modules and relevant demand facilities of that outage coordination region available on the ENTSO for Electricity operational planning data environment.

3 Each TSO shall notify to its regulatory authority the list of relevant power generating modules and relevant demand facilities for each outage coordination region in which it participates.

4 For each internal relevant asset which is a power generating module or demand facility, the TSO shall:

- a inform the owner of the relevant power generating module or relevant demand facility about its inclusion in the list;
- b inform DSOs about the relevant power generating modules and the relevant demand facilities which are connected to their distribution system; and
- c inform CDSOs about the relevant power generating modules and the relevant demand facilities which are connected to their closed distribution system.

Article 86

Update of the lists of relevant power generating modules and relevant demand facilities

1 Before 1 July of each calendar year, all TSOs of each outage coordination region shall jointly re-assess the relevance of power generating modules and demand facilities for outage coordination on the basis of the methodology developed in accordance with Article 84(1).

2 Where necessary, all TSOs of each outage coordination region shall jointly decide to update the list of relevant power generating modules and relevant demand facilities of that outage coordination region before 1 August of each calendar year.

3 All TSOs of an outage coordination region shall make the updated list of that outage coordination region available on the ENTSO for Electricity operational planning data environment.

4 Each TSO of an outage coordination region shall inform the parties referred to in Article 85(4) about the content of the updated list.

Article 87

Lists of relevant grid elements

1 By 3 months after the approval of the methodology for assessing the relevance of assets for outage coordination in Article 84(1), all TSOs of each outage coordination region shall jointly assess, on the basis of this methodology, the relevance for the outage coordination of grid elements located in a transmission system or in a distribution system including a closed distribution system and shall establish a single list, per outage coordination region, of relevant grid elements.

2 The list of relevant grid elements of an outage coordination region shall contain all grid elements of a transmission system or a distribution system, including a closed distribution system located in that outage coordination region, which are identified as relevant by application of the methodology established pursuant to Article 84(1).

3 All TSOs of an outage coordination region shall jointly make the list of relevant grid elements available on the ENTSO for Electricity operational planning data environment.

4 Each TSO shall notify to its regulatory authority the list of relevant grid elements for each outage coordination region in which it participates.

5 For each internal relevant asset which is a grid element, the TSO shall:

- a inform the owner of the relevant grid element about its inclusion in the list;
- b inform DSOs about the relevant grid elements which are connected to their distribution system; and
- c inform CDSOs about the relevant grid elements which are connected to their closed distribution system.

Article 88

Update of the list of relevant grid elements

1 Before 1 July of each calendar year, all TSOs of each outage coordination region shall jointly re-assess, on the basis of the methodology established pursuant to Article 84(1), the relevance for the outage coordination of grid elements located in a transmission system or a distribution system including a closed distribution system.

2 Where necessary, all TSOs of an outage coordination region shall jointly decide to update the list of relevant grid elements of that outage coordination region before 1 August of each calendar year.

3 All TSOs of an outage coordination region shall make the updated list available on the ENTSO for Electricity operational planning data environment.

4 Each TSO of an outage coordination region shall inform the parties referred to in Article 85(4) about the content of the updated list.

Article 89

Appointment of outage planning agents

- 1 Each TSO shall act as the outage planning agent for each relevant grid element it operates.
- 2 For all other relevant assets, the owner shall appoint, or act as, the outage planning agent for the concerned relevant asset and shall inform its TSO about that appointment.

Article 90

Treatment of relevant assets located in a distribution system or in a closed distribution system

- 1 Each TSO shall coordinate with the DSO the outage planning of internal relevant assets connected to its distribution system.
- 2 Each TSO shall coordinate with the CDSO the outage planning of internal relevant assets connected to its closed distribution system.

CHAPTER 2

Development and update of availability plans of relevant assets

Article 91

Variations to deadlines for the year-ahead outage coordination

All TSOs within a synchronous area may jointly agree to adopt and implement a time-frame for the year-ahead outage coordination that deviates from the time-frame defined in Articles 94, 97 and 99, provided that the outage coordination of other synchronous areas is not impacted.

Article 92

General provisions on availability plans

- 1 The availability status of a relevant asset shall be one of the following:
 - a 'available' where the relevant asset is capable of and ready for providing service regardless of whether it is or it is not in operation;
 - b 'unavailable' where the relevant asset is not capable of or ready for providing service;
 - c 'testing' where the capability of the relevant asset for providing service is being tested.
- 2 The 'testing' status shall only apply in case of a potential impact on the transmission system and for the following time periods:
 - a between first connection and final commissioning of the relevant asset; and
 - b directly following maintenance of the relevant asset.

- 3 The availability plans shall contain at least the following information:
 - a the reason for the ‘unavailable’ status of a relevant asset;
 - b where such conditions are identified, the conditions to be fulfilled before applying the ‘unavailable’ status of a relevant asset in real-time;
 - c the time required to restore a relevant asset back to service where necessary in order to maintain operational security.
- 4 The availability status for each relevant asset in the year-ahead time-frame shall be provided with daily resolution.
- 5 When generation schedules and consumption schedules are submitted to the TSO pursuant to Article 111, the time resolution of the availability statuses shall be consistent with those schedules.

Article 93

Long-term indicative availability plans

- 1 By 2 years before the start of any year-ahead outage coordination, each TSO shall assess the corresponding indicative availability plans for internal relevant assets, provided by the outage planning agents in accordance with Articles 4, 7 and 15 of Regulation (EU) No 543/2013, and shall provide its preliminary comments including any detected outage planning incompatibilities, to all affected outage planning agents.
- 2 Each TSO shall carry out the assessment concerning the indicative availability plans for internal relevant assets referred to in paragraph 1 every year until the start of the year-ahead outage coordination.

Article 94

Provision of year-ahead availability plan proposals

- 1 Before 1 August of each calendar year, an outage planning agent other than a TSO taking part in an outage coordination region, a DSO or a CDSO, shall submit to the TSO(s) taking part in an outage coordination region, and where relevant to the DSO(s) or CDSO(s), an availability plan covering the following calendar year for each of its relevant assets.
- 2 The TSO(s) referred to in paragraph 1 shall endeavour to examine the requests for amendment of an availability plan when received. Where this is not possible, it shall examine the requests for amendment of an availability plan after the year-ahead outage coordination has been finalised.
- 3 The TSO(s) referred to in paragraph 1 shall examine the requests for amendment of an availability plan after the year-ahead outage coordination has been finalised:
 - a following the order in which the requests were received; and
 - b applying the procedure established in accordance with Article 100.

Article 95

Year-ahead coordination of the availability status of relevant assets for which the outage planning agent is not a TSO taking part in an outage coordination region, nor a DSO or a CDSO

1 Each TSO shall assess on a year-ahead time-frame whether outage planning incompatibilities arise from the availability plans received pursuant to Article 94.

2 When a TSO detects outage planning incompatibilities, it shall implement the following process:

- a inform each affected outage planning agent of the conditions it shall fulfil to mitigate the detected outage planning incompatibilities;
- b the TSO may request that one or more outage planning agents submit an alternative availability plan fulfilling the conditions referred to in point (a); and
- c the TSO shall repeat the assessment pursuant to paragraph 1 to determine whether any outage planning incompatibilities remain.

3 Following a TSO's request in accordance with point (b) of paragraph 2, if the outage planning agent fails to submit an alternative availability plan aimed at mitigating all outage planning incompatibilities, the TSO shall develop an alternative availability plan which shall:

- a take into account the impact reported by the affected outage planning agents as well as the DSO or CDSO where relevant;
- b limit the changes in the alternative availability plan to what is strictly necessary to mitigate the outage planning incompatibilities; and
- c notify its regulatory authority, the affected DSOs and CDSOs if any, and the affected outage planning agents about the alternative availability plan, including the reasons for developing it, as well as the impact reported by the affected outage planning agents and, where relevant, the DSOs or CDSOs.

Article 96

Year-ahead coordination of the availability status of relevant assets for which the outage planning agent is a TSO taking part in an outage coordination region, a DSO or a CDSO

1 Each TSO shall plan the availability status of relevant grid elements interconnecting different control areas for which it acts as an outage planning agent in coordination with the TSOs of the same outage coordination region.

2 Each TSO, DSO and CDSO shall plan the availability status of the relevant grid elements for which they perform duties of outage planning agents and that are not interconnecting different control areas, using as a basis the availability plans developed in accordance with paragraph 1.

3 When establishing the availability status of relevant grid elements in accordance with paragraphs 1 and 2, the TSO, DSO and CDSO shall:

- a minimize the impact on the market while preserving operational security; and
- b use as a basis the availability plans submitted and developed in accordance with Article 94.

4 Where a TSO detects an outage planning incompatibility, the TSO shall be entitled to propose a change to the availability plans of the internal relevant assets for which the outage planning agent is neither a TSO taking part in an outage coordination region, nor a DSO or a CDSO and shall identify a solution in coordination with the outage planning agents, DSOs and CDSOs concerned, using the means at its disposal.

5 Where the ‘unavailable’ status of a relevant grid element has not been planned after taking the measures in paragraph 4 and the absence of such planning would threaten operational security, the TSO shall:

- a take the necessary actions to plan the ‘unavailable’ status while ensuring operational security, taking into account the impact reported to the TSO by affected outage planning agents;
- b notify the actions referred to in point (a) to all affected parties; and
- c notify the relevant regulatory authorities, the affected DSOs or CDSOs if any and the affected outage planning agents of the actions taken, including the rationale for such actions, the impact reported by affected outage planning agents and the DSOs or CDSOs where relevant.

6 Each TSO shall make available on the ENTSO for Electricity operational planning data environment all information at its disposal about grid-related conditions to be fulfilled and remedial actions to be prepared and activated before executing the ‘unavailable’ or ‘testing’ availability status of a relevant grid element.

Article 97

Provision of preliminary year-ahead availability plans

1 Before 1 November of each calendar year, each TSO shall provide to all other TSOs, via the ENTSO for Electricity operational planning data environment, the preliminary year-ahead availability plans for the following calendar year for all the internal relevant assets.

2 Before 1 November of each calendar year, for each internal relevant asset located in a distribution system, the TSO shall provide the DSO with the preliminary year-ahead availability plan.

3 Before 1 November of each calendar year, for every internal relevant asset located in a closed distribution system, the TSO shall provide the CDSO with the preliminary year-ahead availability plan.

Article 98

Validation of year-ahead availability plans within outage coordination regions

1 Each TSO shall analyse whether any outage planning incompatibility arises when taking into account all the preliminary year-ahead availability plans.

2 In the absence of outage planning incompatibilities, all TSOs of an outage coordination region shall jointly validate the year-ahead availability plans for all relevant assets of that outage coordination region.

3 If a TSO detects an outage planning incompatibility, the involved TSOs of the outage coordination region(s) concerned shall jointly identify a solution in coordination with the concerned outage planning agents, DSOs and CDSOs, using the means at their disposal, while

respecting to the extent possible the availability plans submitted by outage planning agents, which are neither a TSO taking part in an outage coordination region, nor a DSO or a CDSO, and developed in accordance with Articles 95 and 96. Where a solution is identified, all TSOs of the concerned outage coordination region(s) shall update and validate the year-ahead availability plans for all relevant assets.

4 Where no solution is found for an outage planning incompatibility each concerned TSO, subject to approval by the competent regulatory authority where the Member State so provides, shall:

- a force to 'available' status all the 'unavailable' or 'testing' statuses for the relevant assets involved in an outage planning incompatibility during the period concerned; and
- b notify to the relevant regulatory authorities, the affected DSOs or CDSOs, if any, and the affected outage planning agents of the actions taken including the rationale for such actions, the impact reported by affected outage planning agents and the DSOs or CDSOs where relevant.

5 All TSOs of the concerned outage coordination regions shall consequently update and validate the year-ahead availability plans for all relevant assets.

Article 99

Final year-ahead availability plans

1 Before 1 December of each calendar year, each TSO shall:

- a finalise the year-ahead outage coordination of internal relevant assets; and
- b finalise the year-ahead availability plans for internal relevant assets and store them on the ENTSO for Electricity operational planning data environment.

2 Before 1 December of each calendar year, the TSO shall provide to its outage planning agent the final year-ahead availability plan of each internal relevant asset.

3 Before 1 December of each calendar year, the TSO shall provide to the relevant DSO the final year-ahead availability plan for each internal relevant asset located in a distribution system.

4 Before 1 December of each calendar year, the TSO shall provide to the relevant CDSO the final year-ahead availability plan for each internal relevant asset located in a closed distribution system.

Article 100

Updates to the final year-ahead availability plans

1 An outage planning agent shall be able to launch a procedure for the amendment of the final year-ahead availability plan in the time between the finalisation of the year-ahead outage coordination and its real-time execution.

2 The outage planning agent which is not a TSO taking part in an outage coordination region shall be able to submit to the relevant TSO(s) a request for amendment of the final year-ahead availability plan of the relevant assets under its responsibility.

3 In case of a request for amendment pursuant to paragraph 2, the following procedure shall be applied:

- a the recipient TSO shall acknowledge the request and assess as soon as reasonably practicable whether the amendment leads to outage planning incompatibilities;
 - b where outage planning incompatibilities are detected, the involved TSOs of the outage coordination region shall jointly identify a solution in coordination with the outage planning agents concerned and, if relevant, the DSOs and CDSOs, using the means at their disposal;
 - c where no outage planning incompatibility has been detected or if no outage planning incompatibility remains, the recipient TSO shall validate the requested amendment, and the TSOs concerned shall consequently notify all affected parties and update the final year-ahead availability plan on the ENTSO for Electricity operational planning data environment; and
 - d where no solution is found for outage planning incompatibilities the recipient TSO shall reject the requested amendment.
- 4 When a TSO taking part in an outage coordination region intends to amend the final year-ahead availability plan of a relevant asset for which it acts as the outage planning agent, it shall initiate the following procedure:
- a the requesting TSO shall prepare a proposal for amendment to the year-ahead availability plan, including an assessment of whether it could lead to outage planning incompatibilities and shall submit its proposal to all other TSOs of its outage coordination region(s);
 - b where outage planning incompatibilities are detected, the involved TSOs of the outage coordination region shall jointly identify a solution in coordination with the concerned outage planning agents and, if relevant, the DSOs and the CDSOs, using the means at their disposal;
 - c where no outage planning incompatibility has been detected or if a solution to an outage planning incompatibility is found, the concerned TSOs shall validate the requested amendment and consequently they shall notify all affected parties and update the final year-ahead availability plan on the ENTSO for Electricity operational planning data environment;
 - d where no solution to outage planning incompatibilities are found, the requesting TSO shall retract the procedure for amendment.

CHAPTER 3

Execution of availability plans

Article 101

Management of the ‘testing’ status of relevant assets

- 1 The outage planning agent of a relevant asset the availability status of which has been declared as ‘testing’ shall provide the TSO, and, if connected to a distribution system, including closed distribution systems, the DSO or the CDSO within 1 month before the start of the ‘testing’ status, with:
- a a detailed test plan;
 - b an indicative generation or consumption schedule if the concerned relevant asset is a relevant power generating module or a relevant demand facility; and
 - c changes to the topology of the transmission system or distribution system if the concerned relevant asset is a relevant grid element.

2 The outage planning agent shall update the information referred to in paragraph 1 as soon as it is subject to any change.

3 The TSO of a relevant asset the availability status of which has been declared as 'testing' shall provide the information received in accordance with paragraph 1 to all other TSOs of its outage coordination region(s), upon their request.

4 Where the relevant asset referred to in paragraph 1 is a relevant grid element interconnecting two or more control areas, the TSOs of the concerned control areas shall agree on the information to be provided pursuant to paragraph 1.

Article 102

Procedure for handling forced outages

1 Each TSO shall develop a procedure to address the case where a forced outage would endanger its operational security. The procedure shall allow the TSO to ensure that the 'available' or 'unavailable' status of other relevant assets in its control area can be changed to 'unavailable' or 'available' respectively.

2 The TSO shall follow the procedure referred to in paragraph 1 only where no agreement is reached with outage planning agents regarding solutions to forced outages. The TSO shall notify the regulatory authority accordingly.

3 When undertaking the procedure, the TSO shall respect, to the extent possible, the technical limits of the relevant assets.

4 An outage planning agent shall notify the forced outage of one or more of its relevant assets to the TSO and, if connected to a distribution system or to a closed distribution system, the DSO or the CDSO respectively, as soon as possible following the start of the forced outage.

5 When notifying the forced outage, the outage planning agent shall provide the following information:

- a the reason for the forced outage;
- b the expected duration of the forced outage; and
- c where applicable, the impact of the forced outage on the availability status of other relevant assets for which it is the outage planning agent.

6 When the TSO detects that one or several forced outages referred to in paragraph 1 could lead the transmission system out of the normal state, it shall inform the affected outage planning agent(s) about the deadline at which operational security can no longer be maintained unless their relevant asset(s) in forced outage returns to 'available' status. The outage planning agents shall inform the TSO whether they are capable of respecting that deadline and shall provide reasoned justifications where they are unable to respect that deadline.

7 Following any amendments to the availability plan due to forced outages and in accordance with the time-frame established in Articles 7, 10 and 15 of Regulation (EU) No 543/2013, the concerned TSO shall update the ENTSO for Electricity operational planning data environment with the most recent information.

Article 103

Real-time execution of the availability plans

1 Each power generating facility owner shall ensure that all relevant power generating modules it owns and which are declared ‘available’ are ready to produce electricity pursuant to their declared technical capabilities when necessary to maintain operational security, except in case of forced outages.

2 Each power generating facility owner shall ensure that all relevant power generating modules it owns and which are declared ‘unavailable’ do not produce electricity.

3 Each demand facility owner shall ensure that all relevant demand facilities it owns and which are declared ‘unavailable’ do not consume electricity.

4 Each relevant grid element owner shall ensure that all relevant grid elements it owns and which are declared ‘available’ are ready to transport electricity pursuant to their declared technical capabilities when necessary to maintain operational security, except in case of forced outages.

5 Each relevant grid element owner shall ensure that all relevant grid elements it owns and which are declared ‘unavailable’ do not transport electricity.

6 Where specific grid-related conditions apply for the execution of the ‘unavailable’ or ‘testing’ status of a relevant grid element in accordance with Article 96(6), the TSO, DSO or CDSO concerned shall assess the fulfilment of those conditions before the execution of that status. If those conditions are not fulfilled, it shall instruct the relevant grid element owner to not execute the ‘unavailable’ or ‘testing’ status or a part thereof.

7 Where a TSO identifies that executing an ‘unavailable’ or ‘testing’ status of a relevant asset leads or could lead the transmission system out of normal state, it shall instruct the owner of the relevant asset when it is connected to the transmission system, or the DSO or CDSO if connected to a distribution system or to a closed distribution system, to delay the execution of that ‘unavailable’ or ‘testing’ status of that relevant asset according to its instructions and to the extent possible, while respecting the technical and safety limits.

TITLE 4

ADEQUACY

Article 104

Forecast for control area adequacy analysis

Each TSO shall make any forecast used for control area adequacy analyses pursuant to Articles 105 and 107 available to all other TSOs through the ENTSO for Electricity operational planning data environment.

Article 105

Control area adequacy analysis

1 Each TSO shall perform control area adequacy analysis by assessing the possibility for the sum of generation within its control area and cross-border import capabilities to meet the total load within its control area under various operational scenarios, taking into account the required level of active power reserves set out in Articles 118 and 119.

2 When performing a control area adequacy analysis pursuant to paragraph 1, each TSO shall:

- a use the latest availability plans and the latest available data for:
 - (i) the capabilities of power generating modules provided pursuant to Article 43(5) and Articles 45 and 51;
 - (ii) cross-zonal capacity;
 - (iii) possible demand response provided pursuant to Articles 52 and 53;
- b take into account the contributions of generation from renewable energy sources and load;
- c assess the probability and expected duration of an absence of adequacy and the expected energy not supplied as a result of such absence.

3 As soon as possible, following the assessment of an absence of adequacy within its control area, each TSO shall notify the absence to its regulatory authority or when explicitly foreseen in national law, another competent authority, and where applicable, any affected party.

4 As soon as possible, following the assessment of an absence of adequacy within its control area, each TSO shall inform all TSOs through the ENTSO for Electricity operational planning data environment.

Article 106

Control area adequacy up to and including week-ahead

1 Each TSO shall contribute to the pan-European annual summer and winter generation adequacy outlooks applying the methodology adopted by ENTSO for Electricity referred to in Article 8(3)(f) of Regulation (EC) No 714/2009.

2 Twice a year, each TSO shall perform a control area adequacy analysis for the following summer and winter respectively, taking into account pan-European scenarios consistent with the pan-European annual summer and winter generation adequacy outlooks.

3 Each TSO shall update its control area adequacy analyses if it detects any probable changes to the availability status of power generating modules, load estimations, renewable energy sources estimations or cross zonal capacities that could significantly affect the expected adequacy.

Article 107

Control area adequacy in day-ahead and intraday

- 1 Each TSO shall perform a control area adequacy analysis in a day-ahead and intraday time-frame on the basis of:
 - a schedules referred to in Article 111;
 - b forecasted load;
 - c forecasted generation from renewable energy sources;
 - d active power reserves in accordance with the data provided pursuant to Article 46(1)(a);
 - e control area import and export capacities consistent with cross-zonal capacities calculated where applicable in accordance with Article 14 of Regulation (EU) 2015/1222;
 - f capabilities of power generating modules in accordance with the data provided pursuant to Article 43(4) and Articles 45 and 51 and their availability statuses; and
 - g capabilities of demand facilities with demand response in accordance with the data provided pursuant to Articles 52 and 53 and their availability statuses.
- 2 Each TSO shall evaluate:
 - a the minimum level of import and the maximum level of export compatible with its control area adequacy;
 - b the expected duration of a potential absence of adequacy; and
 - c the amount of energy not supplied in the absence of adequacy.
- 3 Where, following the analysis in paragraph 1, adequacy is not fulfilled, each TSO shall notify the absence of adequacy to its regulatory authority or other competent authority. The TSO shall provide its regulatory authority or other competent authority with an analysis of the causes of the absence of adequacy and propose mitigating actions.

TITLE 5

ANCILLARY SERVICES

Article 108

Ancillary services

- 1 Each TSO shall monitor the availability of ancillary services.
- 2 With regard to active power and reactive power services, and in coordination with other TSOs where appropriate, each TSO shall:
 - a design, set up and manage the procurement of ancillary services;
 - b monitor, on the basis of data provided pursuant to Title 2 of Part II, whether the level and location of available ancillary services allows ensuring operational security; and
 - c use all available economically efficient and feasible means to procure the necessary level of ancillary services.
- 3 Each TSO shall publish the levels of reserve capacity necessary to maintain operational security.

4 Each TSO shall communicate the available level of active power reserves to other TSOs upon request.

Article 109

Reactive power ancillary services

1 For each operational planning time-frame, each TSO shall assess, against their forecasts, whether its available reactive power ancillary services are sufficient to maintain the operational security of the transmission system.

2 In order to increase the efficiency of operation of its transmission system elements, each TSO shall monitor:

- a the available reactive power capacities of power generating facilities;
- b the available reactive power capacities of transmission-connected demand facilities;
- c the available reactive power capacities of DSOs;
- d the available transmission-connected equipment dedicated to providing reactive power; and
- e the ratios of active power and reactive power at the interface between the transmission system and transmission-connected distribution systems.

3 Where the level of reactive power ancillary services is not sufficient for maintaining operational security, each TSO shall:

- a inform neighbouring TSOs; and
- b prepare and activate remedial actions pursuant to Article 23.

TITLE 6

SCHEDULING

Article 110

Establishment of scheduling processes

1 When establishing a scheduling process TSOs shall take into account and complement where necessary the operational conditions of the generation and load data methodology developed in accordance with Article 16 of Regulation (EU) 2015/1222.

2 Where a bidding zone covers only one control area, the geographical scope of the scheduling area is equal to the bidding zone. Where a control area covers several bidding zones, the geographical scope of the scheduling area is equal to the bidding zone. Where a bidding zone covers several control areas, TSOs within that bidding zone may jointly decide to operate a common scheduling process, otherwise, each control area within that bidding zone is considered a separate scheduling area.

3 For each power generating facility and demand facility subject to requirements for scheduling set out in the national terms and conditions, the concerned owner shall appoint or act as a scheduling agent.

4 Each market participant and shipping agent, subject to requirements for scheduling set out in the national terms and conditions, shall appoint or act as a scheduling agent.

5 Each TSO operating a scheduling area shall establish arrangements necessary to process the schedules provided by scheduling agents.

6 Where a scheduling area covers more than one control area, the TSOs responsible for the control areas shall agree about which TSO shall operate the scheduling area.

Article 111

Notification of schedules within scheduling areas

1 Each scheduling agent, except scheduling agents of shipping agents, shall submit to the TSO operating the scheduling area, if requested by the TSO, and, where applicable, to third party, the following schedules:

- a generation schedules;
- b consumption schedules;
- c internal commercial trade schedules; and
- d external commercial trade schedules.

2 Each scheduling agent of a shipping agent or, where applicable, a central counterparty shall submit to the TSO operating a scheduling area covered by market coupling, if requested by the concerned TSO, and where applicable to third party, the following schedules:

- a external commercial trade schedules as:
 - (i) multilateral exchanges between the scheduling area and a group of other scheduling areas;
 - (ii) bilateral exchanges between the scheduling area and another scheduling area;
- b internal commercial trade schedules between the shipping agent and central counter parties;
- c internal commercial trade schedules between the shipping agent and other shipping agents.

Article 112

Coherence of schedules

1 Each TSO operating a scheduling area shall check whether the generation, consumption, external commercial trade schedules and external TSO schedules in its scheduling area are in sum balanced.

2 For external TSO schedules, each TSO shall agree on the values of the schedule with the respective TSO. In the absence of an agreement, the lower value shall apply.

3 For bilateral exchanges between two scheduling areas, each TSO shall agree on the external commercial trade schedules with the respective TSO. In the absence of an agreement about the values of the commercial trade schedules, the lower value shall apply.

4 All TSOs operating scheduling areas shall verify that all aggregated netted external schedules between all scheduling areas within the synchronous area are balanced. If a mismatch occurs and the TSOs do not agree on the values of the aggregated netted external schedules, the lower values shall apply.

5 Each scheduling agent of a shipping agent or, where applicable, a central counterparty shall provide TSOs, upon their request, with the values of external commercial trade schedules of each scheduling area involved in market coupling in the form of aggregated netted external schedules.

6 Each scheduled exchange calculator shall provide to TSOs, upon their request, with the values of scheduled exchanges related to the scheduling areas involved in the market coupling in the form of aggregated netted external schedules, including bilateral exchanges between two scheduling areas.

Article 113

Provision of information to other TSOs

- 1 At the request of another TSO, the requested TSO shall calculate and provide:
 - a aggregated netted external schedules; and
 - b netted area AC position, where the scheduling area is interconnected to other scheduling areas via AC transmission links.
- 2 When required for the creation of common grid models, in accordance with Article 70(1), each TSO operating a scheduling area shall provide any requesting TSO with:
 - a generation schedules; and
 - b consumption schedules.

TITLE 7

ENTSO FOR ELECTRICITY OPERATIONAL PLANNING DATA ENVIRONMENT

Article 114

General provisions for ENTSO for Electricity operational planning data environment

- 1 By 24 months after entry into force of this Regulation, ENTSO for Electricity shall, pursuant to Articles 115, 116 and 117, implement and operate an ENTSO for Electricity operational planning data environment for the storage, exchange and management of all relevant information.
- 2 By 6 months after entry into force of this Regulation, all TSOs shall define a harmonised data format for data exchange, which shall be an integral part of the ENTSO for Electricity operational planning data environment.
- 3 All TSOs and regional security coordinators shall have access to all information contained on the ENTSO for Electricity operational planning data environment.
- 4 Until the ENTSO for Electricity operational planning data environment is implemented, all TSOs may exchange relevant data among themselves and regional security coordinators.
- 5 ENTSO for Electricity shall prepare a business continuity plan to be applied in case of unavailability of its operational planning data environment.

Article 115

Individual grid models, common grid models and operational security analysis

1 The ENTSO for Electricity operational planning data environment shall store all individual grid models and related relevant information for all the relevant time-frames set out in this Regulation, in Article 14(1) of Regulation (EU) 2015/1222 and in Article 9 of Regulation (EU) 2016/1719.

2 The information on individual grid models contained on the ENTSO for Electricity operational planning data environment shall allow for their merging into common grid models.

3 The common grid model established for each of the time-frames shall be made available on the ENTSO for Electricity operational planning data environment.

4 For the year-ahead time-frame, the following information shall be available on the ENTSO for Electricity operational planning data environment:

- a year-ahead individual grid model per TSO and per scenario determined in accordance with Article 66; and
- b year-ahead common grid model per scenario defined in accordance with Article 67.

5 For the day-ahead and intraday time-frames, the following information shall be available on the ENTSO for Electricity operational planning data environment:

- a day-ahead and intraday individual grid models per TSO and according to the time resolution defined pursuant to Article 70(1);
- b scheduled exchanges at the relevant time instances per scheduling area or per scheduling area border, whichever is deemed relevant by the TSOs, and per HVDC system linking scheduling areas;
- c day-ahead and intraday common grid models according to the time resolution defined pursuant to Article 70(1); and
- d a list of prepared and agreed remedial actions identified to cope with constraints having cross-border relevance.

Article 116

Outage coordination

1 The ENTSO for Electricity operational planning data environment shall contain a module for the storage and exchange of all relevant information for outage coordination.

2 The information referred to in paragraph 1 shall include at least availability status of relevant assets and the information about availability plans referred to in Article 92.

Article 117

System adequacy

1 The ENTSO for Electricity operational planning data environment shall contain a module for the storage and exchange of all relevant information for performing a coordinated adequacy analysis.

- 2 The information referred to in paragraph 1 shall include at least:
- a the season-ahead system adequacy data provided by each TSO;
 - b the season-ahead pan-European system adequacy analysis report;
 - c forecasts used for adequacy in line with Article 104; and
 - d information about a lack of adequacy in line with Article 105(4).

PART IV

LOAD-FREQUENCY CONTROL AND RESERVES

TITLE 1

OPERATIONAL AGREEMENTS

Article 118

Synchronous area operational agreements

- 1 By 12 months after entry into force of this Regulation, all TSOs of each synchronous area shall jointly develop common proposals for:
- a the dimensioning rules for FCR in accordance with Article 153;
 - b additional properties of FCR in accordance with Article 154(2);
 - c the frequency quality defining parameters and the frequency quality target parameters in accordance with Article 127;
 - d for the Continental Europe ('CE') and Nordic synchronous areas, the frequency restoration control error target parameters for each LFC block in accordance with Article 128;
 - e the methodology to assess the risk and the evolution of the risk of exhaustion of FCR of the synchronous area in accordance with Article 131(2);
 - f the synchronous area monitor in accordance with Article 133;
 - g the calculation of the control program from the netted area AC position with a common ramping period for ACE calculation for a synchronous area with more than one LFC area in accordance with Article 136;
 - h if applicable, restrictions for the active power output of HVDC interconnectors between synchronous areas in accordance with Article 137;
 - i the LFC structure in accordance with Article 139;
 - j if applicable, the methodology to reduce the electrical time deviation in accordance with Article 181;
 - k whenever the synchronous area is operated by more than one TSO, the specific allocation of responsibilities between TSOs in accordance with Article 141;
 - l operational procedures in case of exhausted FCR in accordance with Article 152(7);
 - m for the GB and IE/NI synchronous areas, measures to ensure the recovery of energy reservoirs in accordance with to Article 156(6)(b);
 - n operational procedures to reduce the system frequency deviation to restore the system state to normal state and to limit the risk of entering into the emergency state in accordance with Article 152(10);

- o the roles and responsibilities of the TSOs implementing an imbalance netting process, a cross-border FRR activation process or a cross-border RR activation process in accordance with Article 149(2);
 - p requirements concerning the availability, reliability and redundancy of the technical infrastructure in accordance with Article 151(2);
 - q common rules for the operation in normal state and alert state in accordance with Article 152(6) and the actions referred to in Article 152(15);
 - r for the CE and Nordic synchronous areas, the minimum activation period to be ensured by FCR providers in accordance with Article 156(10);
 - s for the CE and Nordic synchronous areas, the assumptions and methodology for a cost-benefit analysis in accordance with Article 156(11);
 - t if applicable, for synchronous areas other than CE, limits for the exchange of FCR between the TSOs in accordance with Article 163(2);
 - u the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO as regards the exchange of FRR and RR defined in accordance with Article 165(1);
 - v the roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of FRR and RR defined in accordance with Article 166(1);
 - w the roles and responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves between synchronous areas, and of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of reserves between synchronous areas defined in accordance with Article 171(2);
 - x the methodology to determine limits on the amount of sharing of FCR between synchronous areas defined in accordance with Article 174(2);
 - y for the GB and IE/NI synchronous areas, the methodology to determine the minimum provision of reserve capacity on FCR in accordance with Article 174(2)(b);
 - z the methodology to determine limits on the amount of exchange of FRR between synchronous areas defined in accordance with Article 176(1) and the methodology to determine limits on the amount of sharing of FRR between synchronous areas defined in accordance with Article 177(1); and
 - aa the methodology to determine limits on the amount of exchange of RR between synchronous areas defined in accordance with Article 178(1) and the methodology to determine limits on the amount of sharing of RR between synchronous areas defined in accordance with Article 179(1).
- 2 All TSOs of each synchronous area shall submit the methodologies and conditions listed in Article 6(3)(d) for approval by all the regulatory authorities of the concerned synchronous area. Within 1 month after the approval of these methodologies and conditions, all TSOs of each synchronous area shall conclude a synchronous area operational agreement which shall enter into force within 3 months after the approval of the methodologies and conditions.

Article 119

LFC block operational agreements

- 1 By 12 months after entry into force of this Regulation, all TSOs of each LFC block shall jointly develop common proposals for:

- a where the LFC block consists of more than one LFC area, FRCE target parameters for each LFC area defined in accordance with Article 128(4);
 - b LFC block monitor in accordance with Article 134(1);
 - c ramping restrictions for active power output in accordance with Article 137(3) and (4);
 - d where the LFC block is operated by more than one TSO, the specific allocation of responsibilities between TSOs within the LFC block in accordance with Article 141(9);
 - e if applicable, appointment of the TSO responsible for the tasks in Article 145(6);
 - f additional requirements for the availability, reliability and redundancy of technical infrastructure defined in accordance with Article 151(3);
 - g operational procedures in case of exhausted FRR or RR in accordance with Article 152(8);
 - h the FRR dimensioning rules defined in accordance with Article 157(1);
 - i the RR dimensioning rules defined in accordance with Article 160(2);
 - j where the LFC block is operated by more than one TSO, the specific allocation of responsibilities defined in accordance with Article 157(3), and, if applicable, the specific allocation of responsibilities defined in accordance Article 160(6);
 - k the escalation procedure defined in accordance with Article 157(4) and, if applicable, the escalation procedure defined in accordance with Article 160(7);
 - l the FRR availability requirements, the requirements on the control quality defined in accordance with Article 158(2), and if applicable, the RR availability requirements and the requirements on the control quality defined in accordance with Article 161(2);
 - m if applicable, any limits on the exchange of FCR between the LFC areas of the different LFC blocks within the CE synchronous area and the exchange of FRR or RR between the LFC areas of an LFC block of a synchronous area consisting of more than one LFC block defined in accordance with Article 163(2), Article 167 and Article 169(2);
 - n the roles and the responsibilities of the reserve connecting TSO, the reserve receiving TSO and of the affected TSO for the exchange of FRR and/or RR with TSOs of other LFC blocks defined in accordance with Article 165(6);
 - o the roles and the responsibilities of the control capability providing TSO, the control capability receiving TSO and of the affected TSO for the sharing of FRR and RR defined in accordance with Article 166(7);
 - p roles and the responsibilities of the control capability providing TSO, the control capability receiving TSO and of the affected TSO for the sharing of FRR and RR between synchronous areas in accordance with Article 175(2);
 - q coordination actions aiming to reduce the FRCE as defined in Article 152(14); and
 - r measures to reduce the FRCE by requiring changes in the active power production or consumption of power generating modules and demand units in accordance with Article 152(16).
- 2 All TSOs of each LFC block shall submit the methodologies and conditions listed in Article 6(3)(e) for approval by all the regulatory authorities of the concerned LFC block. Within 1 month after the approval of these methodologies and conditions, all TSOs of each LFC block shall conclude an LFC block operational agreement which shall enter into force within 3 months after the approval of the methodologies and conditions.

Article 120

LFC area operational agreement

By 12 months after entry into force of this Regulation, all TSOs of each LFC area shall establish an LFC area operational agreement that shall include at least:

- (a) the specific allocation of responsibilities between TSOs within the LFC area in accordance with Article 141(8);
- (b) the appointment of the TSO responsible for the implementation and operation of the frequency restoration process in accordance with Article 143(4).

Article 121

Monitoring area operational agreement

By 12 months after entry into force of this Regulation, all TSOs of each monitoring area shall establish a monitoring area operational agreement that shall include at least the allocation of responsibilities between TSOs within the same monitoring area in accordance with Article 141(7).

Article 122

Imbalance netting agreement

All TSOs participating in the same imbalance netting process shall establish an imbalance netting agreement that shall at least include the roles and responsibilities of the TSOs in accordance with Article 149(3).

Article 123

Cross-border FRR activation agreement

All TSOs participating in the same cross-border FRR activation process shall establish a cross-border FRR activation agreement that shall include at least the roles and responsibilities of the TSOs in accordance with Article 149(3).

Article 124

Cross-border RR activation agreement

All TSOs participating in the same cross-border RR activation process shall establish a cross-border RR activation agreement that shall include at least the roles and responsibilities of the TSOs in accordance with Article 149(3).

Article 125

Sharing agreement

All TSOs participating in the same sharing process of FCR, FRR or RR shall establish a sharing agreement that shall include at least:

- (a) in case of sharing FRR or RR within a synchronous area, the roles and responsibilities of the control capability receiving TSO and of the control capability providing TSO and the affected TSOs in accordance with Article 165(3); or
- (b) in case of sharing reserves between synchronous areas, the roles and responsibilities of the control capability receiving TSO and of the control capability providing TSO in accordance with Article 171(4) and the procedures in case the sharing of reserves between synchronous areas is not executed in real-time in accordance with Article 171(9).

Article 126

Exchange agreement

All TSOs participating in the same exchange of FCR, FRR or RR shall establish an exchange agreement that shall include at least:

- (a) in case of exchange of FRR or RR within a synchronous area, the roles and responsibilities of the reserve connecting and reserve receiving TSOs in accordance with to Article 165(3); or
- (b) in case of exchange of reserves between synchronous areas, the roles and responsibilities of the reserve connecting and reserve receiving TSOs in accordance with Article 171(4) and the procedures in case the exchange of reserves between synchronous areas is not executed in real-time in accordance with Article 171(9).

TITLE 2

FREQUENCY QUALITY

Article 127

Frequency quality defining and target parameters

- 1 The frequency quality defining parameters shall be:
 - a the nominal frequency for all synchronous areas;
 - b the standard frequency range for all synchronous areas;
 - c the maximum instantaneous frequency deviation for all synchronous areas;
 - d the maximum steady-state frequency deviation for all synchronous areas;
 - e the time to restore frequency for all synchronous areas;
 - f the time to recover frequency for the GB and IE/NI synchronous areas;
 - g the frequency restoration range for the GB, IE/NI and Nordic synchronous areas;

- h the frequency recovery range for the GB and IE/Ni synchronous areas; and
 - i the alert state trigger time for all synchronous areas.
- 2 The nominal frequency shall be 50 Hz for all synchronous areas.
- 3 The default values of the frequency quality defining parameters listed in paragraph 1 are set out in Table 1 of Annex III.
- 4 The frequency quality target parameter shall be the maximum number of minutes outside the standard frequency range per year per synchronous area and its default value per synchronous area are set out in Table 2 of Annex III.
- 5 The values of the frequency quality defining parameters in Table 1 of Annex III and of the frequency quality target parameter in Table 2 of Annex III shall apply unless all TSOs of a synchronous area propose different values pursuant to paragraphs 6, 7 and 8.
- 6 All TSOs of CE and Nordic synchronous areas shall have the right to propose in the synchronous area operational agreement values different from those set out in Tables 1 and 2 of Annex III regarding:
 - a the alert state trigger time;
 - b the maximum number of minutes outside the standard frequency range.
- 7 All TSOs of the GB and IE/Ni synchronous areas shall have the right to propose in the synchronous area operational agreement values different from those set out in Tables 1 and 2 of Annex III regarding:
 - a time to restore frequency;
 - b the alert state trigger time; and
 - c the maximum number of minutes outside the standard frequency range.
- 8 The proposal for modification of the values pursuant to paragraph 6 and 7 shall be based on an assessment of the recorded values of the system frequency for a period of at least 1 year and the synchronous area development and it shall meet the following conditions:
 - a the proposed modification of the frequency quality defining parameters in Table 1 of Annex III or the frequency quality target parameter in Table 2 of Annex III takes into account:
 - (i) the system's size, based on the consumption and generation of the synchronous area and the inertia of the synchronous area;
 - (ii) the reference incident;
 - (iii) grid structure and/or network topology;
 - (iv) load and generation behaviour;
 - (v) the number and response of power generating modules with limited frequency sensitive mode — over frequency and limited frequency sensitive mode — under frequency as defined in Article 13(2) and Article 15(2)(c) of Regulation (EU) 2016/631;
 - (vi) the number and response of demand units operating with activated demand response system frequency control or demand response very fast active power control as defined in Articles 29 and 30 of Regulation (EU) 2016/1388; and
 - (vii) the technical capabilities of power generating modules and demand units;

- b all TSOs of the synchronous area shall conduct a public consultation concerning the impact on stakeholders of the proposed modification of the frequency quality defining parameters in Table 1 of Annex III or the frequency quality target parameter in Table 2 of Annex III.

9 All TSOs shall endeavour to comply with the values for the frequency quality defining parameters or for the frequency quality target parameter. All TSOs shall verify the fulfilment of the frequency quality target parameter at least annually.

Article 128

FRCE target parameters

1 All TSOs of the CE and Nordic synchronous areas shall specify in the synchronous area operational agreement the values of the level 1 FRCE range and the level 2 FRCE range for each LFC block of the CE and Nordic synchronous areas at least annually.

2 All TSOs of the CE and Nordic synchronous areas, if consisting of more than one LFC block, shall ensure that the Level 1 FRCE ranges and the Level 2 FRCE ranges of the LFC blocks of those synchronous areas are proportional to the square root of the sum of the initial FCR obligations of the TSOs constituting the LFC blocks in accordance with Article 153.

3 All TSOs of the CE and Nordic synchronous areas shall endeavour to comply with the following FRCE target parameters for each LFC block of the synchronous area:

- a the number of time intervals per year outside the Level 1 FRCE range within a time interval equal to the time to restore frequency shall be less than 30 % of the time intervals of the year; and
- b the number of time intervals per year outside the Level 2 FRCE range within a time interval equal to the time to restore frequency shall be less than 5 % of the time intervals of the year.

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

5 For the GB and IE/NI synchronous areas the Level 1 FRCE range shall be equal to or larger than 200 mHz and the Level 2 FRCE range shall be equal to or larger than 500 mHz.

6 All TSOs of the GB and IE/NI synchronous areas shall endeavour to comply with the following FRCE target parameters of a synchronous area:

- a the maximum number of time intervals outside the Level 1 FRCE range shall be less than or equal to the value in the Table of Annex IV as a percentage of the time intervals per year;
- b the maximum number of time intervals outside the Level 2 FRCE range shall be less than or equal to the value in the Table of Annex IV as a percentage of the time intervals per year.

7 All TSOs shall verify, at least annually, that the FRCE target parameters are fulfilled.

Article 129

Criteria application process

The criteria application process shall comprise:

- (a) the collection of frequency quality evaluation data; and
- (b) the calculation of frequency quality evaluation criteria.

Article 130

Frequency quality evaluation data

- 1 The frequency quality evaluation data shall be:
 - a for the synchronous area:
 - (i) the instantaneous frequency data; and
 - (ii) the instantaneous frequency deviation data;
 - b for each LFC block of the synchronous area, the instantaneous FRCE data.
- 2 The measurement accuracy of the instantaneous frequency data and of the instantaneous FRCE data, where measured in Hz, shall be 1 mHz or better.

Article 131

Frequency quality evaluation criteria

- 1 The frequency quality evaluation criteria shall comprise:
 - a for the synchronous area during operation in normal state or alert state as determined by Article 18(1) and (2), on a monthly basis, for the instantaneous frequency data:
 - (i) the mean value;
 - (ii) the standard deviation;
 - (iii) the 1-,5-,10-, 90-,95- and 99-percentile;
 - (iv) the total time in which the absolute value of the instantaneous frequency deviation was larger than the standard frequency deviation, distinguishing between negative and positive instantaneous frequency deviations;
 - (v) the total time in which the absolute value of the instantaneous frequency deviation was larger than the maximum instantaneous frequency deviation, distinguishing between negative and positive instantaneous frequency deviations;
 - (vi) the number of events in which the absolute value of the instantaneous frequency deviation of the synchronous area exceeded 200 % of the standard frequency deviation and the instantaneous frequency deviation was not returned to 50 % of the standard frequency deviation for the CE synchronous area and to the frequency restoration range for the GB, IE/NI and Nordic

- synchronous areas, within the time to restore frequency. The data shall distinguish between negative and positive frequency deviations;
- (vii) for the GB and IE/Ni synchronous areas, the number of events for which the absolute value of the instantaneous frequency deviation was outside of the frequency recovery range and was not returned to the frequency recovery range within the time to recover frequency, distinguishing between negative and positive frequency deviations;
- b for each LFC block of the CE or Nordic synchronous areas during operation in normal state or alert state in accordance with Article 18(1) and (2), on a monthly basis:
 - (i) for a data-set containing the average values of the FRCE of the LFC block over time intervals equal to the time to restore frequency:
 - the mean value,
 - the standard deviation,
 - the 1-,5-,10-, 90-,95- and 99-percentile,
 - the number of time intervals in which the average value of the FRCE was outside the Level 1 FRCE range, distinguishing between negative and positive FRCE, and
 - the number of time intervals in which the average value of the FRCE was outside the Level 2 FRCE range, distinguishing between negative and positive FRCE;
 - (ii) for a data-set containing the average values of the FRCE of the LFC block over time intervals with a length of one minute: the number of events on a monthly basis for which the FRCE exceeded 60 % of the reserve capacity on FRR and was not returned to 15 % of the reserve capacity on FRR within the time to restore frequency, distinguishing between negative and positive FRCE;
 - c for the LFC blocks of the GB or IE/Ni synchronous area, during operation in normal state or alert state in accordance with Article 18(1) and (2), on a monthly basis and for a data-set containing the average values of the FRCE of the LFC block over time intervals with a length of one minute: the number of events for which the absolute value of the FRCE exceeded the maximum steady-state frequency deviation and the FRCE was not returned to 10 % of the maximum steady-state frequency deviation within the time to restore frequency, distinguishing between negative and positive FRCE.
- 2 All TSOs of each synchronous area shall specify in the synchronous area operational agreement a common methodology to assess the risk and the evolution of the risk of exhaustion of FCR in the synchronous area. That methodology shall be performed at least annually and shall be based at least on historical instantaneous system frequency data for not less than 1 year. All TSOs of each synchronous area shall provide the required input data for this assessment.

Article 132

Data collection and delivery process

- 1 The data collection and delivery process shall comprise the following:
 - 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 The data collection and delivery process shall be implemented by the synchronous area monitor appointed in accordance with Article 133.

Article 133

Synchronous area monitor

1 All TSOs of a synchronous area shall appoint one TSO of that synchronous area in the synchronous area operational agreement as synchronous area monitor.

2 The synchronous area monitor shall implement the data collection and delivery process of the synchronous area referred to in Article 132.

3 The synchronous area monitor shall implement the criteria application process referred to in Article 129.

4 The synchronous area monitor shall collect the frequency quality evaluation data of its synchronous area and perform the criteria application process, including the calculation of the frequency quality evaluation criteria, once every 3 months and within 3 months after the end of the analysed period.

Article 134

LFC block monitor

1 All TSOs of a LFC block shall appoint one TSO of that LFC block in the LFC block operational agreement as LFC block monitor.

2 The LFC block monitor shall collect the frequency quality evaluation data for the LFC block in accordance with the criteria application process referred to in Article 129.

3 Each TSO of a LFC area shall provide the LFC block monitor with the LFC area measurements necessary for collecting frequency quality evaluation data for the LFC block.

4 The LFC block monitor shall deliver the frequency quality evaluation data of the LFC block and its LFC areas once every 3 months and within 2 months after the end of the analysed period.

Article 135

Information on load and generation behaviour

In accordance with Article 40, each connecting TSO shall have the right to request the information necessary from SGUs to monitor the load and generation behaviour related to imbalances. That information may include:

- (a) the time-stamped active power setpoint for real-time and future operation; and
- (b) the time-stamped total active power output.

Article 136

Ramping period within the synchronous area

All TSOs of each synchronous area with more than one LFC area shall specify in the synchronous area operational agreement a common ramping period of aggregated netted schedules between the LFC areas in the synchronous area. The calculation of the control program from the netted area AC position for ACE calculation shall be performed with the common ramping period.

Article 137

Ramping restrictions for active power output

1 All TSOs of two synchronous areas shall have the right to specify in the synchronous area operational agreement restrictions for the active power output of HVDC interconnectors between synchronous areas to limit their influence on the fulfilment of the frequency quality target parameters of the synchronous area by determining a combined maximum ramping rate for all HVDC interconnectors connecting one synchronous area to another synchronous area.

2 The restrictions in paragraph 1 shall not apply for imbalance netting, frequency coupling as well as cross-border activation of FRR and RR over HVDC interconnectors.

3 All connecting TSOs of an HVDC interconnector shall have the right to determine in the LFC block operational agreement common restrictions for the active power output of that HVDC interconnector to limit its influence on the fulfilment of the FRCE target parameter of the connected LFC blocks by agreeing on ramping periods and/or maximum ramping rates for this HVDC interconnector. Those common restrictions shall not apply for imbalance netting, frequency coupling as well as cross-border activation of FRR and RR over HVDC interconnectors. All TSOs of a synchronous area shall coordinate these measures within the synchronous area.

4 All TSOs of an LFC block shall have the right to determine in the LFC block operational agreement the following measures to support the fulfilment of the FRCE target parameter of the LFC block and to alleviate deterministic frequency deviations, taking into account the technological restrictions of power generating modules and demand units:

- a obligations on ramping periods and/or maximum ramping rates for power generating modules and/or demand units;
- b obligations on individual ramping starting times for power generating modules and/or demand units within the LFC block; and
- c coordination of the ramping between power generating modules, demand units and active power consumption within the LFC block.

Article 138

Mitigation

Where the values calculated for the period of one calendar year concerning the frequency quality target parameters or the FRCE target parameters are outside the targets set for the synchronous area or for the LFC block, all TSOs of the relevant synchronous area or of the relevant LFC block shall:

- (a) analyse whether the frequency quality target parameters or the FRCE target parameters will remain outside the targets set for the synchronous area or for the LFC block and in case of a justified risk that this may happen, analyse the causes and develop recommendations; and
- (b) develop mitigation measures to ensure that the targets for the synchronous area or for the LFC block can be met in the future.

TITLE 3

LOAD-FREQUENCY CONTROL STRUCTURE

Article 139

Basic structure

- 1 All TSOs of each synchronous area shall specify the load-frequency-control structure for the synchronous area in the synchronous area operational agreement. Each TSO shall be responsible for implementing the load-frequency-control structure of its synchronous area and operating in accordance with it.
- 2 The load-frequency control structure of each synchronous area shall include:
 - a a process activation structure in accordance with Article 140; and
 - b a process responsibility structure in accordance with Article 141.

Article 140

Process activation structure

- 1 The process activation structure shall include:
 - a a FCP pursuant to Article 142;
 - b a FRP pursuant to Article 143; and
 - c for the CE synchronous area, a time control process pursuant to Article 181.
- 2 The process activation structure may include:
 - a a RRP pursuant to Article 144;
 - b an imbalance netting process in accordance with Article 146;
 - c a cross-border FRR activation process in accordance with Article 147;
 - d a cross-border RR activation process in accordance with Article 148; and
 - e for synchronous areas other than CE, a time control process pursuant to Article 181.

Article 141

Process responsibility structure

- 1 When specifying the process responsibility structure, all TSOs of each synchronous area shall take into account at least the following criteria:
 - a the size and the total inertia, including synthetic inertia, of the synchronous area;
 - b the grid structure and/or network topology; and

- c the load, generation and HVDC behaviour.
- 2 By 4 months after entry into force of this Regulation, all TSOs of a synchronous area shall jointly develop a common proposal regarding the determination of the LFC blocks, which shall comply with the following requirements:
- a a monitoring area corresponds to or is part of only one LFC area;
 - b a LFC area corresponds to or is part of only one LFC block;
 - c a LFC block corresponds to or is part of only one synchronous area; and
 - d each network element is part of only one monitoring area, only one LFC area and only one LFC block.
- 3 All TSOs of each monitoring area shall continuously calculate and monitor the real-time active power interchange of the monitoring area.
- 4 All TSOs of each LFC area shall:
- a continuously monitor the FRCE of the LFC area;
 - b implement and operate a FRP for the LFC area;
 - c endeavour to fulfil the FRCE target parameters of the LFC area as defined in Article 128; and
 - d have the right to implement one or several of the processes referred to in Article 140(2).
- 5 All TSOs of each LFC block shall:
- a endeavour to fulfil the FRCE target parameters of the LFC block as defined in Article 128; and
 - b comply with the FRR dimensioning rules in accordance with Article 157 and the RR dimensioning rules in accordance with Article 160.
- 6 All TSOs of each synchronous area shall:
- a implement and operate a FCP for the synchronous area;
 - b comply with FCR dimensioning rules in accordance with Article 153; and
 - c endeavour to fulfil the frequency quality target parameters in accordance with Article 127.
- 7 All TSOs of each monitoring area shall specify in the monitoring area operational agreement the allocation of responsibilities between TSOs in the monitoring area for the implementation of the obligation set out in paragraph 3.
- 8 All TSOs of each LFC area shall specify in the LFC area operational agreement the allocation of responsibilities between TSOs in the LFC area for the implementation of the obligations set out in paragraph 4.
- 9 All TSOs of each LFC block shall specify in the LFC block operational agreement the allocation of responsibilities between TSOs in the LFC block for the implementation of the obligations set out paragraph 5.
- 10 All TSOs of each synchronous area shall specify in the synchronous area operational agreement the allocation of responsibilities between TSOs in the synchronous area for the implementation of the obligations set out in paragraph 6.
- 11 All TSOs of two or more LFC areas connected by interconnections shall have the right to form an LFC block if the requirements for the LFC block set out in paragraph 5 are fulfilled.

Article 142

Frequency containment process

- 1 The control target of FCP shall be the stabilization of the system frequency by activation of FCR.
- 2 The overall characteristic for FCR activation in a synchronous area shall reflect a monotonic decrease of the FCR activation as a function of the frequency deviation.

Article 143

Frequency restoration process

- 1 The control target of the FRP shall be to:
 - a regulate the FRCE towards zero within the time to restore frequency;
 - b for the CE and Nordic synchronous areas, to progressively replace the activated FCR by activation of FRR in accordance with Article 145.
- 2 The FRCE is:
 - a the ACE of an LFC area, where there is more than one LFC area in a synchronous area; or
 - b the frequency deviation, where one LFC area corresponds to the LFC block and the synchronous area.
- 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 plus de subtraction of:
 - a the total interconnector and virtual tie-line active power flow; and
 - b the control program in accordance with Article 136.
- 4 Where a LFC area consists of more than one monitoring area, all TSOs of the LFC area shall appoint one TSO in the LFC area operational agreement responsible for the implementation and operation of the frequency restoration process.
- 5 Where a LFC area consists of more than one monitoring area, 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 analysis.

Article 144

Reserve replacement process

- 1 The control target of the RRP shall be to fulfil at least one of the following goals by activation of RR:
 - a progressively restore the activated FRR;
 - b support FRR activation;
 - c for the GB and IE/NI synchronous areas, to progressively restore the activated FCR and FRR.

2 The RRP shall be operated through instructions for manual RR activation in order to fulfil the control target in accordance with paragraph 1.

Article 145

Automatic and manual frequency restoration process

1 Each TSO of each LFC area shall implement an automatic frequency restoration process ('aFRP') and a manual frequency restoration process ('mFRP').

2 By 2 years after entry into force of this regulation, the TSOs of GB and IE/NI synchronous areas may each submit a proposal to their competent regulatory authorities requesting not to implement an aFRP. Those proposals shall include a cost-benefit analysis demonstrating that implementation of an aFRP would lead to higher costs than benefits. In case the proposal is approved by the competent regulatory authorities, the respective TSOs and regulatory authorities shall re-evaluate such decision at least every 4 years.

3 If an LFC area consists of more than one monitoring area, all TSOs of the LFC area shall set out a process for the implementation of an aFRP and an mFRP in the LFC area operational agreement. Where an LFC block consists of more than one LFC area, all TSOs of the LFC areas shall set out a process for the implementation of an mFRP in the LFC block operational agreement.

4 The aFRP shall be operated in a closed-loop manner where the FRCE is an input and the setpoint for automatic FRR activation is an output. The setpoint for automatic FRR activation shall be calculated by a single frequency restoration controller operated by a TSO within its LFC area. For the CE and Nordic synchronous areas, the frequency restoration controller shall:

- a be an automatic control device designed to reduce the FRCE to zero;
- b have proportional-integral behaviour;
- c have a control algorithm which prevents the integral term of a proportional-integral controller from accumulating the control error and overshooting; and
- d have functionalities for extraordinary operational modes for the alert and emergency states.

5 The mFRP shall be operated through instructions for manual FRR activation in order to fulfil the control target in accordance with Article 143(1).

6 In addition to the aFRP implementation in the LFC areas, all TSOs of an LFC block which consists of more than one LFC area shall have the right to appoint one TSO of the LFC block in the LFC block operational agreement to:

- a calculate and monitor the FRCE of the whole LFC block; and
- b take the FRCE of the whole LFC block into account for the calculation of the setpoint value for aFRR activation in accordance with Article 143(3) in addition to the FRCE of its LFC area.

Article 146

Imbalance netting process

1 The control target of the imbalance netting process shall aim at reducing the amount of simultaneous counteracting FRR activations of the different participating LFC areas by imbalance netting power interchange.

- 2 Each TSO shall have the right to implement the imbalance netting process for the LFC areas in the same LFC block, between different LFC blocks or between different synchronous areas, by concluding an imbalance netting agreement.
- 3 TSOs shall implement the imbalance netting process in a way which does not affect:
 - a the stability of the FCP of the synchronous area or synchronous areas involved in the imbalance netting process;
 - b the stability of the FRP and the RRP of each LFC area operated by participating or affected TSOs; and
 - c operational security.
- 4 TSOs shall implement the imbalance netting power interchange between LFC areas of a synchronous area in at least one of the following ways:
 - a by defining an active power flow over a virtual tie-line which shall be part of the FRCE calculation;
 - b by adjusting the active power flows over HVDC interconnectors.
- 5 TSOs shall implement the imbalance netting power interchange between LFC areas of different synchronous areas by adjusting the active power flows over HVDC interconnectors.
- 6 TSOs shall implement the imbalance netting power interchange of a LFC area in a way which does not exceed the actual amount of FRR activation necessary to regulate the FRCE of that LFC area to zero without imbalance netting power interchange.
- 7 All TSOs participating in the same imbalance netting process shall ensure that the sum of all imbalance netting power interchanges is equal to zero.
- 8 The imbalance netting process shall include a fallback mechanism which shall ensure that the imbalance netting power interchange of each LFC area is zero or limited to a value for which operational security can be guaranteed.
- 9 Where a LFC block consists of more than one LFC area and the reserve capacity on FRR as well as the reserve capacity on RR 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 defined in paragraph 6 with other LFC areas of the same LFC block.
- 10 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 defined in paragraph 6 with other TSOs of the same synchronous area participating in that imbalance netting process.
- 11 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 involved shall comply with the obligations in Article 141(5) regardless of imbalance netting power interchange.

Article 147

Cross-border FRR activation process

- 1 The control target of the cross-border FRR activation process shall aim at enabling a TSO to perform the FRP by frequency restoration power interchange between LFC areas.

2 Each 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 by concluding a cross-border FRR activation agreement.

3 TSOs shall implement the cross-border FRR activation process in a way which does not affect:

- a the stability of the FCP of the synchronous area or synchronous areas involved in the cross-border FRR activation process;
- b the stability of the FRP and the RRP of each LFC area operated by participating or affected TSOs; and
- c operational security.

4 TSOs shall implement the frequency restoration power interchange between LFC areas of the same synchronous area through one of the following actions:

- a defining an active power flow over a virtual tie-line which shall be part of the FRCE 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.

5 TSOs shall implement the frequency restoration power interchange between LFC areas of different synchronous areas by adjusting the active power flows over HVDC interconnectors.

6 All TSOs participating in the same cross-border FRR activation process shall ensure that the sum of all frequency restoration power interchanges is equal to zero.

7 The cross-border FRR activation process shall include a fallback mechanism which shall ensure that the frequency restoration power interchange of each LFC area is zero or limited to a value for which operational security can be guaranteed.

Article 148

Cross-border RR activation process

1 The control target of the cross-border RR activation process shall aim at enabling a TSO to perform the RRP through control program between LFC areas.

2 Each 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 by concluding a cross-border RR activation agreement.

3 TSOs shall implement the cross-border RR activation process in a way which does not affect:

- a the stability of the FCP of the synchronous area or synchronous areas involved in the cross-border RR activation process;
- b the stability of the FRP and the RRP of each LFC area operated by participating or affected TSOs; and
- c the operational security.

4 TSOs shall implement the control program between LFC areas of the same synchronous area by carrying out at least one of the following actions:

- a determining an active power flow over a virtual tie-line which shall be part of the FRCE calculation;
- b adjusting a control program; or
- c adjusting active power flows over HVDC interconnectors.

5 TSOs shall implement the control program between LFC areas of different synchronous areas by adjusting active power flows over HVDC interconnectors.

6 All TSOs participating in the same cross-border RR activation process shall ensure that the sum of all control programs is equal to zero.

7 The cross-border RR activation process shall include a fall-back mechanism which shall ensure that the control program of each LFC area is zero or limited to a value for which operational security can be guaranteed.

Article 149

General requirements for cross-border control processes

1 All TSOs participating in an exchange or sharing of FRR or RR shall implement a cross-border FRR or RR activation process, as appropriate.

2 All TSOs of a synchronous area shall specify in the synchronous area operational agreement the roles and responsibilities of the TSOs implementing an imbalance netting process, a cross-border FRR activation process or a cross-border RR activation process between LFC areas of different LFC blocks or of different synchronous areas.

3 All TSOs participating in the same imbalance netting process, in the same cross-border FRR activation process or in the same cross-border RR activation process shall specify in the respective agreements, the roles and responsibilities of all TSOs including:

- a the provision of all input data necessary for:
 - (i) the calculation of the power interchange with respect to the operational security limits; and
 - (ii) the performance of real-time operational security analysis by participating and affected TSOs;
- b the responsibility of calculating the power interchange; and
- c the implementation of operational procedures to ensure the operational security.

4 Without prejudice to Article 146(9), (10) and (11) and as part of the agreements referred to in Articles 122, 123 and 124, all TSOs participating in the same imbalance netting process, cross-border FRR activation process or cross-border RR activation process shall have the right to specify a sequential approach for calculation of the power interchange. The sequential calculation of the power interchange shall allow any group of TSOs operating LFC areas or LFC blocks connected by interconnections to interchange imbalance netting, frequency restoration or reserve replacement power among themselves ahead of an interchange with other TSOs.

Article 150

TSO notification

1 TSOs who intend to exercise the right to implement an imbalance netting process, a cross-border FRR activation process, a cross-border RR activation process, an exchange of reserves or a sharing of reserves shall, 3 months before exercising such right, notify all other TSOs of the same synchronous area about:

- a the TSOs involved;
- b the expected amount of power interchange due to the imbalance netting process, cross-border FRR activation process or cross-border RR activation process;
- c the reserve type and maximum amount of exchange or sharing of reserves; and
- d the timeframe of exchange or sharing of reserves.

2 Where an imbalance netting process, a cross-border FRR activation process or a cross-border RR activation process is implemented for LFC areas that are not part of the same LFC block, each TSO of the concerned synchronous areas shall have the right to declare itself as an affected TSO to all TSOs of the synchronous area based on an operational security analysis and within 1 month after receipt of the notification pursuant to paragraph 1.

3 The affected TSO shall have the right to:

- a require the provision of real-time values of imbalance netting power interchange, frequency restoration power interchange and control program necessary for real-time operational security analysis; and
- b require the implementation of an operational procedure enabling the affected TSO to set limits for the imbalance netting power interchange, frequency restoration power interchange and control program between the respective LFC areas based on operational security analysis in real-time.

Article 151

Infrastructure

1 All TSOs shall assess what technical infrastructure is necessary to implement and operate the processes referred to in Article 140 and considered critical pursuant to the security plan referred to in Article 26.

2 All TSOs of a synchronous area shall specify, in the synchronous area operational agreement, minimum requirements for the availability, reliability and redundancy of the technical infrastructure referred to in paragraph 1 including:

- a the accuracy, resolution, availability and redundancy of active power flow and virtual tie-line measurements;
- b the availability and redundancy of digital control systems;
- c the availability and redundancy of communication infrastructure; and
- d communication protocols.

3 All TSOs of a LFC block shall set out additional requirements for the availability, reliability and redundancy of the technical infrastructure in the LFC block operational agreement.

4 Each TSO of a LFC area shall:

- a ensure a sufficient quality and availability of the FRCE calculation;
- b perform real-time quality monitoring of the FRCE calculation;
- c take action in case of FRCE miscalculation; and
- d where the FRCE is determined by the ACE, perform an *ex-post* quality monitoring of the FRCE calculation by comparing FRCE to reference values at least on an annual basis.

TITLE 4

OPERATION OF LOAD-FREQUENCY CONTROL

Article 152

System states related to system frequency

1 Each TSO shall operate its control area with sufficient upward and downward active power reserve, which may include shared or exchanged reserves, to face imbalances between demand and supply within its control area. Each TSO shall control the FRCE as defined in the Article 143 in order to reach the required frequency quality within the synchronous area in cooperation with all TSOs in the same synchronous area.

2 Each TSO shall monitor close to real-time generation and exchange schedules, power flows, node injections and withdrawals and other parameters within its control area relevant for anticipating a risk of a frequency deviation and shall take, in coordination with other TSOs of its synchronous area, measures to limit their negative effects on the balance between generation and demand.

3 All TSOs of each synchronous area shall specify a real-time data exchange in accordance with Article 42 which shall include:

- a the system state of the transmission system in accordance with Article 18; and
- b the real-time measurement data of the FRCE of the LFC blocks and LFC areas of the synchronous area.

4 The synchronous area monitor shall determine the system state with regard to the system frequency in accordance with Article 18(1) and (2).

5 The synchronous area monitor shall ensure that all TSOs of all synchronous areas are informed in case the system frequency deviation fulfils one of the criteria for the alert state referred to in Article 18.

6 All TSOs of a synchronous area shall define in the synchronous area operational agreement common rules for the operation of load-frequency control in the normal state and alert state.

7 All TSOs of the GB and IE/NI synchronous areas shall specify in the synchronous area operational agreement operational procedures for case of exhausted FCR. In those operational procedures the TSOs of a synchronous area shall have the right to require changes in the active power production or consumption of power generating modules and demand units.

8 All TSOs of a LFC block shall specify operational procedures for cases of exhausted FRR or RR in the LFC block operational agreement. In those operational procedures the TSOs of a LFC block shall have the right to require changes in the active power production or consumption of power generating modules and demand units.

9 The TSOs of a LFC block shall endeavour to avoid FRCEs which last longer than the time to restore frequency.

10 All TSOs of a synchronous area shall specify in the synchronous area operational agreement the operational procedures for the alert state due to a violation of system frequency limits. The operational procedures shall aim at reducing the system frequency deviation in order to restore the system state to the normal state and to limit the risk of entering the emergency state. The operational procedures shall include the right of TSOs to deviate from the obligation set in Article 143(1).

11 If the system state is in the alert state due to insufficient active power reserves in accordance with Article 18, the TSOs of the concerned LFC blocks shall, in close cooperation with the other TSOs of the synchronous area and the TSOs of other synchronous areas, act to restore and replace the necessary levels of active power reserves. For that purpose, the TSOs of a LFC block shall have the right to require changes in the active power production or consumption of power generating modules or demand units within its control area to reduce or to remove the violation of the requirements concerning active power reserve.

12 If the 1-minute average of the FRCE of a LFC block is above the Level 2 FRCE range at least during the time necessary to restore frequency and where the TSOs of a LFC block do not expect that FRCE will be sufficiently reduced by undertaking the actions in paragraph 15, TSOs shall have the right to require changes in the active power production or consumption of power generating modules and demand units within their respective areas to reduce the FRCE as specified in paragraph 16.

13 For the CE and Nordic synchronous areas, where the FRCE of a LFC block exceeds 25 % of the reference incident of the synchronous area for more than 30 consecutive minutes and if the TSOs of that LFC block do not expect to reduce sufficiently the FRCE with the actions taken pursuant to paragraph 15, the TSOs shall require changes in the active power production or consumption of power generating modules and demand units within their respective areas to reduce the FRCE as specified in paragraph 16.

14 The LFC block monitor shall be responsible for identifying any violation of the limits in paragraphs 12 and 13 and:

- a shall inform the other TSOs of the LFC block; and
- b together with the TSOs of the LFC block shall implement coordinated actions to reduce the FRCE which shall be specified in the LFC block operational agreement.

15 For the cases referred to in paragraphs 11 to 13 all the TSOs of each synchronous area shall specify in the synchronous area operational agreement actions to enable the TSOs of a LFC block to actively reduce the frequency deviation with the cross-border activation of reserves. In cases referred to in paragraphs 11 to 13 the TSOs of the synchronous area shall endeavour to enable the TSOs of the concerned LFC block to reduce their FRCE.

16 The TSOs of a LFC block shall specify, in the LFC block operational agreement, measures to reduce the FRCE by means of changes in the active power production or consumption of power generating modules and demand units within their area.

TITLE 5

FREQUENCY CONTAINMENT RESERVES

Article 153

FCR dimensioning

- 1 All TSOs of each synchronous area shall determine, at least annually, the reserve capacity for FCR required for the synchronous area and the initial FCR obligation of each TSO in accordance with paragraph 2.
- 2 All TSOs of each synchronous area shall specify dimensioning rules in the synchronous area operational agreement in accordance with the following criteria:
 - a the reserve capacity for FCR required for the synchronous area shall cover at least the reference incident and, for the CE and Nordic synchronous areas, the results of the probabilistic dimensioning approach for FCR carried out pursuant to point (c);
 - b the size of the reference incident shall be determined in accordance with the following conditions:
 - (i) for the CE synchronous area, the reference incident shall be 3 000 MW in positive direction and 3 000 MW in negative direction;
 - (ii) for the GB, IE/NL, and Nordic synchronous areas, the reference incident shall be the largest imbalance that may result from an instantaneous change of active power such as that of a single power generating module, single demand facility, or single HVDC interconnector or from a tripping of an AC line, or it shall be the maximum instantaneous loss of active power consumption due to the tripping of one or two connection points. The reference incident shall be determined separately for positive and negative direction;
 - c for the CE and Nordic synchronous areas, all TSOs of the synchronous area shall have the right to define a probabilistic dimensioning approach for FCR taking into account the pattern of load, generation and inertia, including synthetic inertia as well as the available means to deploy minimum inertia in real-time in accordance with the methodology referred to in Article 39, with the aim of reducing the probability of insufficient FCR to below or equal to once in 20 years; and
 - d the shares of the reserve capacity on FCR required for each TSO as initial FCR obligation shall be based on the sum of the net generation and consumption of its control area divided by the sum of net generation and consumption of the synchronous area over a period of 1 year.

Article 154

FCR technical minimum requirements

- 1 Each reserve connecting TSO shall ensure that the FCR fulfils the properties listed for its synchronous area in the Table of Annex V.
- 2 All TSOs of a synchronous area shall have the right to specify, in the synchronous area operational agreement, common additional properties of the FCR required to ensure operational security in the synchronous area, by means of a set of technical parameters and within the ranges in Article 15(2)(d) of Regulation (EU) 2016/631 and Articles 27 and 28 of Regulation (EU)

2016/1388. Those common additional properties of FCR shall take into account the installed capacity, structure and pattern of consumption and generation of the synchronous area. The TSOs shall apply a transitional period for the introduction of additional properties, defined in consultation with the affected FCR providers.

3 The reserve connecting TSO shall have the right to set out additional requirements for FCR providing groups within the ranges in Article 15(2)(d) of Regulation (EU) 2016/631 and Articles 27 and 28 of Regulation (EU) 2016/1388 in order to ensure operational security. Those additional requirements shall be based on technical reasons such as the geographical distribution of the power generating modules or demand units belonging to an FCR providing group. The FCR provider shall ensure that the monitoring of the FCR activation of the FCR providing units within a reserve providing group is possible.

4 The reserve connecting TSO shall have the right to exclude FCR providing groups from the provision of FCR in order to ensure operational security. This exclusion shall be based on technical reasons such as the geographical distribution of the power generating modules or demand units belonging to an FCR providing group.

5 Each FCR providing unit and each FCR providing group shall have only one reserve connecting TSO.

6 Each FCR providing unit and each FCR providing group shall comply with the properties required for FCR in the Table of Annex V and with any additional properties or requirements specified in accordance with paragraphs 2 and 3 and activate the agreed FCR by means of a proportional governor reacting to frequency deviations or alternatively based on a monotonic piecewise linear power-frequency characteristic in case of relay activated FCR. They shall be capable of activating FCR within the frequency ranges specified in Article 13(1) of Regulation (EU) 2016/631.

7 Each TSO of the CE synchronous area shall ensure that the combined reaction of FCR of a LFC area comply with the following requirements:

- a the activation of FCR shall not be artificially delayed and begin as soon as possible after a frequency deviation;
- b in case of a frequency deviation equal to or larger than 200 mHz, at least 50 % of the full FCR capacity shall be delivered at the latest after 15 seconds;
- c in case of a frequency deviation equal to or larger than 200 mHz, 100 % of the full FCR capacity shall be delivered at the latest after 30 seconds;
- d in case of a frequency deviation equal to or larger than 200 mHz, the activation of the full FCR capacity shall rise at least linearly from 15 to 30 seconds; and
- e in case of a frequency deviation smaller than 200 mHz the related activated FCR capacity shall be at least proportional with the same time behaviour referred to in points (a) to (d).

8 Each reserve connecting TSO shall monitor its contribution to the FCP and its FCR activation with respect to its FCR obligation, including FCR providing units and FCR providing groups. Each FCR provider shall make available to the reserve connecting TSO, for each of its FCR providing units and FCR providing groups, at least the following information:

- a time-stamped status indicating if FCR is on or off;
- b time-stamped active power data needed to verify FCR activation, including time-stamped instantaneous active power;
- c droop of the governor for type C and type D power generating modules as defined in Article 5 of Regulation (EU) 2016/631 acting as FCR providing units, or its equivalent parameter for FCR providing groups consisting of type A and/or type B

power generating modules as defined in Article 5 of Regulation (EU) 2016/631, and/or demand units with demand response active power control as defined in Article 28 of Regulation (EU) 2016/1388.

9 Each FCR provider shall have the right to aggregate the respective data for more than one FCR providing unit if the maximum power of the aggregated units is below 1,5 MW and a clear verification of activation of FCR is possible.

10 At the request of the reserve connecting TSO, the FCR provider shall make the information listed in paragraph 9 available in real-time, with a time resolution of at least 10 seconds.

11 At the request of the reserve connecting TSO and where necessary for the verification of the activation of FCR, a FCR provider shall make available the data listed in paragraph 9 concerning technical installations that are part of the same FCR providing unit.

Article 155

FCR prequalification process

1 By 12 months after entry into force of this regulation, each TSO shall develop an FCR prequalification process and shall make publicly available the details of the FCR prequalification process.

2 A potential FCR provider shall demonstrate to the reserve connecting TSO that it complies with the technical and the additional requirements set out in Article 154 by completing successfully the prequalification process of potential FCR providing units or FCR providing groups, described in paragraphs 3 to 6 of this Article.

3 A potential FCR provider shall submit a formal application to the reserve connecting TSO together with the required information of potential FCR providing units or FCR providing groups. Within 8 weeks from receipt of the application, the reserve connecting TSO shall confirm whether the application is complete. Where the reserve connecting TSO considers that the application is incomplete, the potential FCR provider shall submit the additional required information within 4 weeks from receipt of the request for additional information. Where the potential FCR provider does not supply the requested information within that deadline, the application shall be deemed withdrawn.

4 Within 3 months from confirmation that the application is complete, the reserve connecting TSO shall evaluate the information provided and decide whether the potential FCR providing units or FCR providing groups meet the criteria for an FCR prequalification. The reserve connecting TSO shall notify its decision to the potential FCR provider.

5 Where the compliance with certain requirements of this Regulation has already been verified by the reserve connecting TSO, it will be recognised in the prequalification.

6 The qualification of FCR providing units or FCR providing groups shall be re-assessed:

- a at least once every 5 years;
- b in case the technical or availability requirements or the equipment have changed; and
- c in case of modernisation of the equipment related to FCR activation.

Article 156

FCR provision

1 Each TSO shall ensure the availability of at least its FCR obligations agreed between all TSOs of the same synchronous area in accordance with Articles 153, 163, 173 and 174.

2 All 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 at least the following factors:

- a the reserve capacity on FCR divided by the maximum steady-state frequency deviation;
- b the auto-control of generation;
- c the self-regulation of load, taking into account the contribution in accordance with Articles 27 and 28 of Regulation (EU) 2016/1388;
- d the frequency response of HVDC interconnectors referred to in Article 172; and
- e the LFSM and FSM activation in accordance with Articles 13 and 15 of Regulation (EU) 2016/631.

3 All TSOs of a synchronous area consisting of more than one LFC area shall, in the synchronous area operational agreement, determine the shares of the K-factor for each LFC area, which shall be based on at least:

- a the initial FCR obligations;
- b auto-control of generation;
- c the self-regulation of load;
- d frequency coupling via HVDC between synchronous areas;
- e exchange of FCR.

4 An FCR provider shall guarantee the continuous availability of FCR, with the exception of a forced outage of a FCR providing unit, during the period of time in which it is obliged to provide FCR.

5 Each FCR provider shall inform its reserve connecting TSO, as soon as possible, about any changes in the actual availability of its FCR providing unit and/or its FCR providing group, in whole or in part, relevant for the results of prequalification.

6 Each TSO shall ensure, or shall require its FCR providers to ensure that the loss of a FCR providing unit does not endanger the operational security by:

- a limiting the share of the FCR provided per FCR providing unit to 5 % of the reserve capacity of FCR required for each of the whole CE and Nordic synchronous areas;
- b excluding the FCR provided by the unit defining the reference incident of the synchronous area from the dimensioning process for GB, IE/NI and Nordic synchronous areas; and
- c replacing the FCR which is made unavailable due to a forced outage or the unavailability of an FCR providing unit or FCR providing group as soon as technically possible and in accordance with the conditions that shall be defined by the reserve connecting TSO.

7 An FCR providing unit or FCR providing group with an energy reservoir that does not limit its capability to provide FCR shall activate its FCR for as long as the frequency deviation persists. For the GB and IE/NI synchronous areas, a FCR providing unit or FCR providing group with an energy reservoir that does not limit its capability to provide FCR shall activate its FCR until it activates its FRR or for the period specified in the synchronous area operational agreement.

8 A FCR providing unit or FCR providing group with an energy reservoir that limits its capability to provide FCR shall activate its FCR for as long as the frequency deviation persists, unless its energy reservoir is exhausted in either the positive or negative direction. For the GB and IE/NI synchronous areas, a FCR providing unit or FCR providing group with an energy reservoir that limits its capability to provide FCR shall activate its FCR until it activates its FRR or for the period specified in the synchronous area operational agreement.

9 For the CE and Nordic synchronous areas, each FCR provider shall ensure that the FCR from its FCR providing units or groups with limited energy reservoirs are continuously available during normal state. For the CE and Nordic synchronous areas, as of triggering the alert state and during the alert state, each FCR provider shall ensure that its FCR providing units or groups with limited energy reservoirs are able to fully activate FCR continuously for a time period to be defined pursuant to paragraphs 10 and 11. Where no period has been determined pursuant to paragraphs 10 and 11, each FCR provider shall ensure that its FCR providing units or groups with limited energy reservoirs are able to fully activate FCR continuously for at least 15 minutes or, in case of frequency deviations that are smaller than a frequency deviation requiring full FCR activation, for an equivalent length of time, or for a period defined by each TSO, which shall not be greater than 30 or smaller than 15 minutes.

10 For the CE and Nordic synchronous areas, all TSOs shall develop a proposal concerning the minimum activation period to be ensured by FCR providers. The period determined shall not be greater than 30 or smaller than 15 minutes. The proposal shall take full account of the results of the cost-benefit analysis conducted pursuant to paragraph 11.

11 By 6 months after entry into force of this regulation, the TSOs of the CE and Nordic synchronous areas shall propose assumptions and methodology for a cost-benefit analysis to be conducted, in order to assess the time period required for FCR providing units or groups with limited energy reservoirs to remain available during alert state. By 12 months after approval of the assumptions and methodology by all regulatory authorities of the concerned region, the TSOs of the CE and Nordic synchronous areas shall submit the results of their cost-benefit analysis to the concerned regulatory authorities, suggesting a time period which shall not be greater than 30 or smaller than 15 minutes. The cost-benefit analysis shall take into account at least:

- a experiences gathered with different timeframes and shares of emerging technologies in different LFC blocks;
- b the impact of a defined time period on the total cost of FCR reserves in the synchronous area;
- c the impact of a defined time period on system stability risks, in particular through prolonged or repeated frequency events;
- d the impact on system stability risks and total cost of FCR in case of increasing total volume of FCR;
- e the impact of technological developments on costs of availability periods for FCR from its FCR providing units or groups with limited energy reservoirs.

12 The FCR provider shall specify the limitations of the energy reservoir of its FCR providing units or FCR providing groups in the prequalification process in accordance with Article 155.

13 A FCR provider using FCR providing units or FCR providing group with an energy reservoir that limits their capability to provide FCR shall ensure the recovery of the energy reservoirs in the positive or negative directions in accordance with the following criteria:

- a for the GB and IE/NI synchronous areas, the FCR provider shall use the methods specified in the synchronous area operational agreement;

- b for the CE and Nordic synchronous areas, the FCR provider shall ensure the recovery of the energy reservoirs as soon as possible, within 2 hours after the end of the alert state.

TITLE 6

FREQUENCY RESTORATION RESERVES

Article 157

FRR dimensioning

- 1 All TSOs of a LFC Block shall set out FRR dimensioning rules in the LFC Block operational agreement.
- 2 The FRR dimensioning rules shall include at least the following:
- a all TSOs of a LFC block in the CE and Nordic synchronous areas shall determine the required reserve capacity of FRR of the LFC block based on consecutive historical records comprising at least the historical LFC block imbalance values. The sampling of those historical records shall cover at least the time to restore frequency. The time period considered for those records shall be representative and include at least one full year period ending not earlier than 6 months before the calculation date;
 - b all TSOs of a LFC block in the CE and Nordic synchronous areas shall determine the reserve capacity on FRR of the LFC block sufficient to respect the current FRCE target parameters in Article 128 for the time period referred to in point (a) based at least on a probabilistic methodology. In using that probabilistic methodology, the TSOs shall take into account the restrictions defined in the agreements for the sharing or exchange of reserves due to possible violations of operational security and the FRR availability requirements. All TSOs of a LFC block shall take into account any expected significant changes to the distribution of LFC block imbalances or take into account other relevant influencing factors relative to the time period considered;
 - c all TSOs of a LFC block shall determine the ratio of automatic FRR, manual FRR, the automatic FRR full activation time and manual FRR full activation time in order to comply with the requirement of paragraph (b). For that purpose, the automatic FRR full activation time of a LFC block and the manual FRR full activation time of the LFC block shall not be more than the time to restore frequency;
 - d the TSOs of a LFC block shall determine the size of the reference incident which shall be the largest imbalance that may result from an instantaneous change of active power of a single power generating module, single demand facility, or single HVDC interconnector or from a tripping of an AC line within the LFC block;
 - e all TSOs of a LFC block shall determine the positive reserve capacity on FRR, which shall not be less than the positive dimensioning incident of the LFC block;
 - f all TSOs of a LFC block shall determine the negative reserve capacity on FRR, which shall not be less than the negative dimensioning incident of the LFC block;
 - g all TSOs of a LFC block shall determine the reserve capacity on FRR of a LFC block, any possible geographical limitations for its distribution within the LFC block and any possible geographical limitations for any exchange of reserves or sharing of reserves with other LFC blocks to comply with the operational security limits;
 - h all TSOs of a LFC block shall ensure that the positive reserve capacity on FRR or a combination of reserve capacity on FRR and RR is sufficient to cover the positive LFC

- block imbalances for at least 99 % of the time, based on the historical records referred to in point (a);
- i all TSOs of a LFC block shall ensure that the negative reserve capacity on FRR or a combination of reserve capacity on FRR and RR is sufficient to cover the negative LFC block imbalances for at least 99 % of the time, based on the historical record referred to in point (a);
 - j all TSOs of a LFC block may reduce the positive reserve capacity on FRR of the LFC block resulting from the FRR dimensioning process by concluding a FRR sharing agreement with other LFC blocks in accordance with provisions in Title 8. The following requirements shall apply to that sharing agreement:
 - (i) for the CE and Nordic synchronous areas, the reduction of the positive reserve capacity on FRR of a LFC block shall be limited to the difference, if positive, between the size of the positive dimensioning incident and the reserve capacity on FRR required to cover the positive LFC block imbalances during 99 % of the time, based on the historical records referred to in point (a). The reduction of the positive reserve capacity shall not exceed 30 % of the size of the positive dimensioning incident;
 - (ii) for the GB and IE/NI synchronous areas, the positive reserve capacity on FRR and the risk of non-delivery due to sharing shall be assessed continually by the TSOs of the LFC block;
 - k all TSOs of a LFC block may reduce the negative reserve capacity on FRR of the LFC block, resulting from the FRR dimensioning process by concluding a FRR sharing agreement with other LFC blocks in accordance with the provisions of Title 8. The following requirements shall apply to that sharing agreement:
 - (i) for the CE and Nordic synchronous areas, the reduction of the negative reserve capacity on FRR of a LFC block shall be limited to the difference, if positive, between the size of the negative dimensioning incident and the reserve capacity on FRR required to cover the negative LFC block imbalances during 99 % of the time, based on the historical records referred to in point (a);
 - (ii) for the GB and IE/NI synchronous areas, the negative reserve capacity on FRR and the risk of non-delivery due to sharing shall be assessed continually by the TSOs of the LFC block.
- 3 All TSOs of a LFC block where the LFC block comprises more than one TSO shall set out, in the LFC block operational agreement, the specific allocation of responsibilities between the TSOs of the LFC areas for the implementation of the obligations established in paragraph 2.
- 4 All TSOs of a LFC block shall have sufficient reserve capacity on FRR at any time in accordance with the FRR dimensioning rules. The TSOs of a LFC block shall specify in the LFC block operational agreement an escalation procedure for cases of severe risk of insufficient reserve capacity on FRR in the LFC block.

Article 158

FRR minimum technical requirements

- 1 The FRR minimum technical requirements shall be the following:
 - a each FRR providing unit and each FRR providing group shall be connected to only one reserve connecting TSO;

- b a FRR providing unit or FRR providing group shall activate FRR in accordance with the setpoint received from the reserve instructing TSO;
 - c the reserve instructing TSO shall be the reserve connecting TSO or a TSO designated by the reserve connecting TSO in an FRR exchange agreement pursuant to Article 165(3) or 171(4);
 - d a FRR providing unit or FRR providing group for automatic FRR shall have an automatic FRR activation delay not exceeding 30 seconds;
 - e a FRR provider shall ensure that the FRR activation of the FRR providing units within a reserve providing group can be monitored. For that purpose, the FRR provider shall be capable of supplying to the reserve connecting TSO and the reserve instructing TSO real-time measurements of the connection point or another point of interaction agreed with the reserve connecting TSO concerning:
 - (i) time-stamped scheduled active power output;
 - (ii) time-stamped instantaneous active power for:
 - each FRR providing unit,
 - each FRR providing group, and
 - each power generating module or demand unit of a FRR providing group with a maximum active power output larger than or equal to 1,5 MW;
 - f a FRR providing unit or FRR providing group for automatic FRR shall be capable of activating its complete automatic reserve capacity on FRR within the automatic FRR full activation time;
 - g a FRR providing unit or FRR providing group for manual FRR shall be capable of activating its complete manual reserve capacity on FRR within the manual FRR full activation time;
 - h a FRR provider shall fulfil the FRR availability requirements; and
 - i a FRR providing unit or FRR providing group shall fulfil the ramping rate requirements of the LFC block.
- 2 All TSOs of a LFC block shall specify FRR availability requirements and requirements on the control quality of FRR providing units and FRR providing groups for their LFC block in the LFC block operational agreement pursuant to Article 119.
- 3 The reserve connecting TSO shall adopt the technical requirements for the connection of FRR providing units and FRR providing groups to ensure the safe and secure delivery of FRR.
- 4 Each FRR provider shall:
- a ensure that its FRR providing units and FRR providing groups fulfil the FRR technical minimum requirements, the FRR availability requirements and the ramping rate requirements in paragraphs 1 to 3; and
 - b inform its reserve instructing TSO about a reduction of the actual availability of its FRR providing unit or its FRR providing group or a part of its FRR providing group as soon as possible.
- 5 Each reserve instructing TSO shall ensure the monitoring of the compliance with the FRR minimum technical requirements in paragraph 1, the FRR availability requirements in paragraph 2, the ramping rate requirements in paragraph 1 and the connection requirements in paragraph 3 by its FRR providing units and FRR providing groups.

Article 159

FRR prequalification process

1 By 12 months after entry into force of this Regulation each TSO shall develop a FRR prequalification process and shall clarify and make publicly available its details.

2 A potential FRR provider shall demonstrate to the reserve connecting TSO or the TSO designated by the reserve connecting TSO in the FRR exchange agreement that it complies with the FRR minimum technical requirements in Article 158(1), the FRR availability requirements in Article 158(2), the ramping rate requirements in Article 158(1) and the connection requirements in Article 158(3) by completing successfully the prequalification process of potential FRR providing units or FRR providing groups, described in paragraphs 3 to 6 of this Article.

3 A potential FRR provider shall submit a formal application to the relevant reserve connecting TSO or the designated TSO together with the required information of potential FRR providing units or FRR providing groups. Within 8 weeks from receipt of the application, the reserve connecting TSO or the designated TSO shall confirm whether the application is complete. Where the reserve connecting TSO or the designated TSO considers that the application is incomplete they shall request additional information and the potential FRR provider shall submit the additional required information within 4 weeks from the receipt of the request. Where the potential FRR provider does not supply the requested information within that deadline, the application shall be deemed to be withdrawn.

4 Within 3 months after the reserve connecting TSO or the designated TSO confirms that the application is complete, the reserve connecting TSO or the designated TSO shall evaluate the information provided and decide whether the potential FRR providing units or FRR providing groups meet the criteria for a FRR prequalification. The reserve connecting TSO or the designated TSO shall notify their decision to the potential FRR provider.

5 The qualification of FRR providing units or FRR providing groups by the reserve connecting TSO or the designated TSO shall be valid for the entire LFC Block.

6 The qualification of FRR providing units or FRR providing groups shall be re-assessed:

- a at least once every 5 years; and
- b where the technical or availability requirements or the equipment have changed.

7 To ensure operational security, the reserve connecting TSO shall have the right to exclude FRR providing groups from the provision of FRR based on technical arguments such as the geographical distribution of the power generating modules or demand units belonging to a FRR providing group.

TITLE 7

REPLACEMENT RESERVES*Article 160***RR dimensioning**

1 All TSOs of an LFC block shall have the right to implement a reserve replacement process.

2 To comply with the FRCE target parameters referred to in Article 128, all TSOs of a LFC block with a RRP, performing a combined dimensioning process of FRR and RR to fulfil the requirements of Article 157(2), shall define RR dimensioning rules in the LFC block operational agreement.

3 The RR dimensioning rules shall comprise at least the following requirements:

- a for the Nordic and CE synchronous areas there shall be sufficient positive reserve capacity on RR to restore the required amount of positive FRR. For the GB and IE/NI synchronous areas there shall be sufficient positive reserve capacity on RR to restore the required amount of positive FCR and positive FRR;
- b for the Nordic and CE synchronous areas, there shall be sufficient negative reserve capacity on RR to restore the required amount of negative FRR. For the GB and IE/NI synchronous areas, there shall be sufficient negative reserve capacity on RR to restore the required amount of negative FCR and negative FRR;
- c there shall be sufficient reserve capacity on RR, where this is taken into account to dimension the reserve capacity on FRR in order to respect the FRCE quality target for the period of time concerned; and
- d compliance with the operational security within a LFC block to determine the reserve capacity on RR.

4 All TSOs of an LFC block may reduce the positive reserve capacity on RR of the LFC block, resulting from the RR dimensioning process, by developing a RR sharing agreement for that positive reserve capacity on RR with other LFC blocks in accordance with the provisions of Title 8 of Part IV. The control capability receiving TSO shall limit the reduction of its positive reserve capacity on RR in order to:

- a guarantee that it can still meet its FRCE target parameters set out in Article 128;
- b ensure that operational security is not endangered; and
- c ensure that the reduction of the positive reserve capacity on RR does not exceed the remaining positive reserve capacity on RR of the LFC block.

5 All TSOs of a LFC block may reduce the negative reserve capacity on RR of the LFC block, resulting from the RR dimensioning process, by developing a RR sharing agreement for that negative reserve capacity on RR with other LFC blocks in accordance with the provisions of Title 8 of Part IV. The control capability receiving TSO shall limit the reduction of its negative reserve capacity on RR in order to:

- a guarantee that it can still meet its FRCE target parameters set out in Article 128;
- b ensure that operational security is not endangered; and
- c ensure that the reduction of the negative reserve capacity on RR does not exceed the remaining negative reserve capacity on RR of the LFC block.

6 Where a LFC block is operated by more than one TSO and if the process is necessary for the LFC block, all TSOs of that LFC block shall specify in the LFC block operational agreement the allocation of responsibilities between the TSOs of different LFC areas for the implementation of the dimensioning rules set out in paragraph 3.

7 A TSO shall have sufficient reserve capacity on RR in accordance with the RR dimensioning rules at any time. The TSOs of a LFC block shall specify in the LFC block operational agreement an escalation procedure for cases of severe risk of insufficient reserve capacity on RR in the LFC block.

Article 161

RR minimum technical requirements

1 RR providing units and RR providing groups shall comply with the following minimum technical requirements:

- a connection to only one reserve connecting TSO;
- b RR activation according to the setpoint received from the reserve instructing TSO;
- c the reserve instructing TSO shall be the reserve connecting TSO or a TSO that shall be designated by the reserve connecting TSO in the RR exchange agreement pursuant to Article 165(3) or 171(4);
- d activation of complete reserve capacity on RR within the activation time defined by the instructing TSO;
- e de-activation of RR according to the setpoint received from the reserve instructing TSO;
- f a RR provider shall ensure that the RR activation of the RR providing units within a reserve providing group can be monitored. For that purpose, the RR provider shall be capable of supplying to the reserve connecting TSO and the reserve instructing TSO real-time measurements of the connection point or another point of interaction agreed with the reserve connecting TSO concerning:
 - (i) the time-stamped scheduled active power output, for each RR providing unit and group and for each power generating module or demand unit of a RR providing group with a maximum active power output larger than or equal to 1,5 MW;
 - (ii) the time-stamped instantaneous active power, for each RR providing unit and group, and for each power generating module or demand unit of a RR providing group with a maximum active power output larger than or equal to 1,5 MW;
- g fulfilment of the RR availability requirements.

2 All TSOs of a LFC block shall specify RR availability requirements and requirements on the control quality of RR providing units and RR providing groups in the LFC block operational agreement.

3 The reserve connecting TSO shall adopt the technical requirements for the connection of RR providing units and RR providing groups to ensure the safe and secure delivery of RR in the prequalification process description.

4 Each RR provider shall:

- a ensure that its RR providing units and RR providing groups fulfil the RR technical minimum requirements and the RR availability requirements referred to in paragraphs 1 to 3; and

- b inform its reserve instructing TSO about a reduction of the actual availability or a forced outage of its RR providing unit or its RR providing group or a part of its RR providing group as soon as possible.

5 Each reserve instructing TSO shall ensure compliance with the RR technical requirements, the RR availability requirements and the connection requirements referred to in this Article with regard to its RR providing units and RR providing groups.

Article 162

RR prequalification process

1 Each TSO of a LFC block which has implemented a RRP shall develop a RR prequalification process within 12 months after entry into force of this Regulation and shall clarify and make publicly available the details thereof.

2 A potential RR provider shall demonstrate to the reserve connecting TSO or the TSO designated by the reserve connecting TSO in the RR exchange agreement that it complies with the RR technical minimum requirements, the RR availability requirements and the connection requirements referred to in Article 161 by completing successfully the prequalification process of potential RR providing units or RR providing groups, described in paragraphs 3 to 6.

3 A potential RR provider shall submit a formal application to the relevant reserve connecting TSO or the designated TSO together with the required information of potential RR providing units or RR providing groups. Within 8 weeks from receipt of the application, the reserve connecting TSO or the designated TSO shall confirm whether the application is complete. Where the reserve connecting TSO or the designated TSO considers that the application is incomplete, the potential RR provider shall submit the additional required information within 4 weeks from the receipt of the request for additional information. Where the potential RR provider does not supply the requested information within that deadline, the application shall be deemed withdrawn.

4 Within 3 months from confirmation of the completeness of the application, the reserve connecting TSO or the designated TSO shall evaluate the information provided and decide whether the potential RR providing units or RR providing groups meet the criteria for a RR prequalification. The reserve connecting TSO or the designated TSO shall notify its decision to the potential RR provider.

- 5 The qualification of RR providing units or RR providing groups shall be reassessed:
- a at least once every 5 years; and
 - b where the technical or availability requirements or the equipment have changed.

6 To ensure operational security, the reserve connecting TSO shall have the right to reject the provision of RR by RR providing groups, based on technical arguments such as the geographical distribution of the power generating modules or demand units establishing a RR providing group.

TITLE 8

EXCHANGE AND SHARING OF RESERVES

CHAPTER 1

Exchange and sharing of reserves within a synchronous area

Article 163

Exchange of FCR within a synchronous area

1 All TSOs involved in the exchange of FCR within a synchronous area shall comply with the requirements set out in paragraphs 2 to 9. The exchange of FCR implies a transfer of a FCR obligation from the reserve receiving TSO to the reserve connecting TSO for the corresponding reserve capacity on FCR.

2 All TSOs involved in the exchange of FCR within a synchronous area shall respect the limits and requirements for the exchange of FCR within the synchronous area specified in the Table of Annex VI.

3 In case of exchange of FCR, the reserve connecting TSO and reserve receiving TSO shall notify it in accordance with Article 150.

4 Any reserve connecting TSO, reserve receiving TSO or affected TSO involved in the exchange of FCR may refuse the exchange of FCR where it would result in power flows that violate the operational security limits when activating the reserve capacity on FCR subject to the exchange of FCR.

5 Each affected TSO shall verify that its reliability margin, established in accordance with Article 22 of Regulation (EU) 2015/1222, is sufficient to accommodate the power flows resulting from the activation of the reserve capacity on FCR subject to the exchange of FCR.

6 All TSOs of a LFC area shall adjust the parameters of their FRCE calculation to account for the exchange of FCR.

7 The reserve connecting TSO shall be responsible for the requirements referred to in Articles 154 and 156 as regards the reserve capacity on FCR subject to the exchange of FCR.

8 The FCR providing unit or group shall be responsible towards its reserve connecting TSO for FCR activation.

9 The concerned TSOs shall ensure that exchange of FCR does not prevent any TSO from fulfilling the reserve requirements in Article 156.

Article 164

Sharing of FCR within a synchronous area

A TSO shall not share FCR with other TSOs of its synchronous area to fulfil its FCR obligation and to reduce the total amount of FCR of the synchronous area in accordance with Article 153.

Article 165

General requirements for the exchange of FRR and RR within a synchronous area

1 All TSOs of a synchronous area shall define in the synchronous area operational 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.

2 Where an exchange of FRR/RR takes place, the reserve connecting TSO and reserve receiving TSO shall notify that exchange pursuant to the notification requirements in Article 150.

3 The reserve connecting and reserve receiving TSOs participating in the exchange of FRR/RR shall specify in a FRR or RR exchange agreement their roles and responsibilities, including:

- a the responsibility of the reserve instructing TSO for the reserve capacity on FRR and RR subject to the exchange of FRR/RR;
- b the amount of the reserve capacity on FRR and RR subject to the exchange of FRR/RR;
- c the implementation of the cross-border FRR/RR activation process in accordance with Articles 147 and 148;
- d FRR/RR technical minimum requirements related to the cross-border FRR/RR activation process where the reserve connecting TSO is not the reserve instructing TSO;
- e the implementation of the FRR/RR prequalification for the reserve capacity on FRR and RR subject to exchange in accordance with Articles 159 and 162;
- f the responsibility to monitor the fulfilment of the FRR/RR technical requirements and FRR/RR availability requirements for the reserve capacity on FRR and RR subject to exchange in accordance with Articles 158(5) and 161(5); and
- g procedures to ensure that the exchange of FRR/RR does not lead to power flows which violate the operational security limits.

4 Any reserve connecting TSO, reserve receiving TSO or affected TSO involved in the exchange of FRR or RR may refuse the exchange referred to in paragraph 2 where it would result in power flows that violate the operational security limits when activating the reserve capacity on FRR and RR subject to the exchange of FRR or RR.

5 The concerned TSOs shall ensure that exchange of FRR/RR does not prevent any TSO from complying with the reserve requirements established in the FRR or RR dimensioning rules in Articles 157 and 160.

6 All TSOs of a LFC block shall specify in the LFC block operational 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 with TSOs of other LFC blocks.

Article 166

General requirements for sharing FRR and RR within a synchronous area

1 All TSOs of a synchronous area shall specify in the synchronous area operational agreement the roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for sharing FRR/RR.

2 Where FRR/RR sharing takes place, the control capability providing TSO and control capability receiving TSO shall notify that sharing pursuant to the notification requirements in Article 150.

3 The control capability receiving TSO and the control capability providing TSO participating in the sharing of FRR/RR shall specify in a FRR or RR sharing agreement their roles and responsibilities, including:

- a the amount of reserve capacity on FRR and RR subject to the sharing of FRR/RR;
- b the implementation of the cross-border FRR/RR activation process in accordance with Articles 147 and 148;
- c procedures to ensure that the activation of the reserve capacity on FRR and RR subject to the sharing of FRR/RR does not lead to power flows that violate the operational security limits.

4 Any control capability providing TSO, control capability receiving TSO or affected TSO involved in the sharing of FRR/RR may refuse sharing of FRR/RR where it would result in power flows that violate the operational security limits when activating the reserve capacity on FRR and RR subject to the sharing of FRR/RR.

5 In case of sharing of FRR/RR, the control capability providing TSO shall make available to the control capability receiving TSO a share of its own reserve capacity on FRR and RR required to comply with its reserve requirements for FRR and/or RR resulting from the FRR/RR dimensioning rules in Articles 157 and 160. The control capability providing TSO can be either:

- a the reserve instructing TSO for the reserve capacity on FRR and RR subject to the sharing of FRR/RR; or
- b the TSO having access to its reserve capacity on FRR and RR subject to the sharing of FRR/RR through an implemented cross-border FRR/RR activation process as part of an FRR/RR exchange agreement.

6 Each control capability receiving TSO shall be responsible for coping with incidents and imbalances in case the reserve capacity on FRR and RR subject to the sharing of FRR/RR are unavailable due to:

- a restrictions to provide frequency restoration or adjust the control program related to operational security; and
- b partial or full usage of the reserve capacity on FRR and RR by the control capability providing TSO.

7 All TSOs of a LFC block shall specify in the LFC block operational agreement their roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of FRR and RR with TSOs of other LFC blocks.

Article 167

Exchange of FRR within a synchronous area

All TSOs in a synchronous area consisting of more than one LFC block involved in the exchange of FRR within the synchronous area shall comply with the requirements and limits for the exchange of FRR set out in the Table of Annex VII.

Article 168

Sharing of FRR within a synchronous area

Each TSO of a LFC block shall have the right to share FRR with other LFC blocks of its synchronous area within the limits set by the FRR dimensioning rules in Article 157(1) and in accordance with Article 166.

Article 169

Exchange of RR within a synchronous area

All TSOs in a synchronous area consisting of more than one LFC block involved in the exchange of RR within the synchronous area shall comply with the requirements and limits for the exchange of RR set out in the Table of Annex VIII.

Article 170

Sharing of RR within a synchronous area

Each TSO of a LFC block shall have the right to share RR with other LFC blocks of the same synchronous area within the limits set by the RR dimensioning rules in Article 160(4) and (5) and in accordance with Article 166.

CHAPTER 2

Exchange and sharing of reserves between synchronous areas

Article 171

General requirements

1 Each operator and/or owner of an HVDC interconnector which interconnects synchronous areas shall provide to the connecting TSOs the capability to perform the exchange and sharing of FCR, FRR and RR if this technology is installed.

2 All TSOs of the synchronous area shall specify in the synchronous area operational agreement the roles and the responsibilities of the reserve connecting TSO, the reserve receiving TSO and the affected TSO for the exchange of reserves as well as for the control capability providing TSO, control capability receiving TSO and affected TSO for the sharing of reserves between synchronous areas.

3 The reserve connecting TSO and reserve receiving TSO or the control capability providing TSO and the control capability receiving TSO shall notify the exchange or sharing of FCR, FRR or RR in accordance with Article 150.

4 The reserve connecting TSO and reserve receiving TSO involved in the exchange of reserves shall specify, in an exchange agreement, their roles and responsibilities, including:

- a the responsibility of the reserve instructing TSO for the reserve capacity of the reserve exchange;

- b the amount of the reserve capacity subject to the exchange of reserves;
- c the implementation of the cross-border FRR/RR activation process in accordance with Articles 147 and 148;
- d the implementation of the prequalification for the reserve capacity subject to the exchange of reserves in accordance with Articles 155, 159 and 162;
- e the responsibility to monitor compliance with the technical requirements and availability requirements of the reserve capacity subject to the exchange of reserves pursuant to Articles 158(5) and 161(5); and
- f procedures to ensure that the exchange of reserves does not lead to power flows that violate the operational security limits.

5 The control capability providing and control capability receiving TSO involved in the sharing of reserves shall specify their roles and responsibilities in a sharing agreement, including:

- a the amount of reserve capacity subject to the sharing of reserves;
- b the implementation of the cross-border FRR/RR activation process in accordance with Articles 147 and 148; and
- c the procedures to ensure that the sharing of reserves does not lead to power flows that violate the operational security limits.

6 The reserve connecting TSO and reserve receiving TSO involved in the exchange of reserves, or the control capability providing and control capability receiving TSO involved in the sharing of reserves shall develop and adopt an HVDC operating and coordination agreement with the HVDC interconnector owners and/or HVDC interconnector operators or with legal entities comprising HVDC interconnector owners and/or HVDC interconnector operators, including:

- a the interactions across all timescales, including planning and activation;
- b the MW/Hz sensitivity factor, linearity/dynamic or static/step response function of each HVDC interconnector connecting synchronous areas; and
- c the share/interaction of these functions across multiple HVDC paths between the synchronous areas.

7 Any reserve connecting TSO, reserve receiving TSO, control capability providing TSO, control capability receiving TSO or affected TSO involved in the exchange or sharing of reserves may refuse the exchange or sharing of reserve where it would result in power flows that violate the operational security limits when activating the reserve capacity subject to the exchange or sharing of reserve.

8 The involved TSOs shall ensure that exchange of reserves between synchronous areas does not prevent any TSO from complying with the reserve requirements in Articles 153, 157 and 160.

9 The reserve connecting TSO and reserve receiving TSO and the control capability providing and control capability receiving TSO shall specify procedures in an exchange agreement or sharing agreement for cases when the exchange or the sharing of reserves between synchronous areas cannot be executed in real-time.

Article 172

Frequency coupling between synchronous areas

1 All TSOs of the synchronous areas connected via an HVDC interconnector shall have the right to implement a frequency coupling process to provide linked frequency response. The frequency coupling process may be used by TSOs to enable FCR exchange and/or sharing between synchronous areas.

2 All TSOs of each synchronous area shall specify the technical design of the frequency coupling process in the synchronous area operational agreement. The frequency coupling process shall take into account:

- a the operational impact between the synchronous areas;
- b the stability of the FCP of the synchronous area;
- c the ability of the TSOs of the synchronous area to comply with the frequency quality target parameters defined in accordance with Article 127; and
- d the operational security.

3 Each HVDC interconnector operator shall control the active power flow over the HVDC interconnector in accordance with the implemented frequency coupling process.

Article 173

Exchange of FCR between synchronous areas

1 All TSOs of a synchronous area involved in a frequency coupling process shall have the right to use the FCR exchange process to exchange FCR between synchronous areas.

2 All TSOs of synchronous areas involved in the exchange of FCR between synchronous areas shall organise that exchange so that the TSOs of one synchronous area receive from another synchronous area a share of the total reserve capacity on FCR required for their synchronous area pursuant to Article 153.

3 The share of the total reserve capacity on FCR required for synchronous area where it is exchanged shall be provided in the second synchronous area in addition to the total reserve capacity on FCR required for that second synchronous area in accordance with Article 153.

4 All TSOs of the synchronous area shall specify in the synchronous area operational agreement the limits for FCR exchange.

5 All TSOs of the involved synchronous areas shall develop an FCR exchange agreement whereby they specify conditions for the exchange of FCR.

Article 174

Sharing of FCR between synchronous areas

1 All TSOs of a synchronous area involved in a frequency coupling process shall have the right to use that process to share FCR between the synchronous areas.

2 All TSOs of the synchronous area shall specify the limits for FCR sharing in the synchronous area operational agreement, in accordance with the following criteria:

Status: This is the original version (as it was originally adopted).

- a for the CE and Nordic synchronous area, all TSOs shall ensure that the sum of FCR provided within the synchronous area and from other synchronous areas as part of exchange of FCR covers at least the reference incident;
 - b for the GB and IE/NI synchronous areas, all TSOs shall specify a methodology to determine the minimum provision of reserve capacity on FCR in the synchronous area.
- 3 All TSOs of the involved synchronous areas shall specify the conditions for sharing FCR between the involved synchronous areas in their respective synchronous area operational agreements.

Article 175

General requirements for sharing of FRR and RR between synchronous areas

- 1 In case of sharing of FRR or RR, the control capability providing TSO shall make available to the control capability receiving TSO a share of its own reserve capacity on FRR and RR required to comply with the reserve requirements for FRR and/or RR resulting from the FRR/RR dimensioning rules referred to in Articles 157 and 160. The control capability providing TSO can be either:
- a the reserve instructing TSO for the reserve capacity on FRR and RR subject to the sharing of FRR or RR; or
 - b the TSO having access to its reserve capacity on FRR and RR subject to the sharing of FRR/RR through an implemented cross-border FRR/RR activation process as part of a FRR/RR exchange agreement.
- 2 All TSOs of an LFC block shall specify in the LFC block operational agreement their roles and responsibilities of the control capability providing TSO, the control capability receiving TSO and the affected TSO for the sharing of FRR and RR with TSOs of other LFC blocks in other synchronous areas.

Article 176

Exchange of FRR between synchronous areas

- 1 All TSOs of each synchronous area shall specify in the synchronous area operational agreement a method to determine the limits for the exchange of FRR with other synchronous areas. That method shall take into account:
- a the operational impact between the synchronous areas;
 - b the stability of the FRP of the synchronous area;
 - c the ability of TSOs of the synchronous area to comply with the frequency quality target parameters defined in accordance with Article 127 and the FRCE target parameters defined in accordance with Article 128; and
 - d the operational security.
- 2 All TSOs of the LFC blocks involved in the exchange of FRR between synchronous areas shall organise that exchange so that the TSOs of a LFC block in the first synchronous area may receive a share of the total reserve capacity on FRR required for their LFC block as determined in accordance with the Article 157(1) from a LFC block in the second synchronous area.
- 3 The share of the total reserve capacity on FRR required for the LFC block in the synchronous area where it is exchanged shall be provided from the LFC block in the second

synchronous area in addition to the total reserve capacity on FRR required for that second LFC block in accordance with Article 157(1).

4 Each operator of a HVDC interconnector shall control the active power flow over the HVDC interconnector following the instructions provided by either the reserve connecting TSO or reserve receiving TSO in accordance with the FRR technical minimum requirements referred to in Article 158.

5 All TSOs of the LFC blocks to which the reserve connecting TSO and the reserve receiving TSO belong shall specify the conditions for exchange of FRR in an FRR exchange agreement.

Article 177

Sharing of FRR between synchronous areas

1 All TSOs of each synchronous area shall specify in the synchronous area operational agreement a methodology to determine limits for the sharing of FRR with other synchronous areas. That methodology shall take into account:

- a the operational impact between the synchronous areas;
- b the stability of the FRP of the synchronous area;
- c the maximum reduction of FRR that can be taken into account in the FRR dimensioning in accordance with Article 157 as a result of the FRR sharing;
- d the ability of the synchronous area to comply with the frequency quality target parameters defined in accordance with Article 127 and the FRCE target parameters defined in accordance with Article 128; and
- e the operational security.

2 All TSOs of the LFC blocks involved in the sharing of FRR between synchronous areas shall organise that sharing so that the TSOs of a LFC block in the first synchronous area may receive a share of the total reserve capacity on FRR required for their LFC block as defined in accordance with the Article 157(1) from a LFC block in the second synchronous area.

3 Each operator of a HVDC interconnector shall control the active power flow over the HVDC interconnector following the instructions provided by either the control capability providing TSO or control capability receiving TSO in accordance with the FRR technical minimum requirements in Article 158(1).

4 All TSOs of the LFC blocks to which the control capability providing TSO and the control capability receiving TSOs belong shall specify the conditions for sharing FRR in an FRR sharing agreement.

Article 178

Exchange of RR between synchronous areas

1 All TSOs of each synchronous area shall define in the synchronous area operational agreement a method to determine limits for the exchange of RR with other synchronous areas. That method shall take into account:

- a the operational impact between the synchronous areas;
- b the stability of the RRP of the synchronous area;

- c the ability of the synchronous area to comply with the frequency quality target parameters defined in accordance with Article 127 and the FRCE target parameters defined in accordance with Article 128; and
- d the operational security.

2 All TSOs of the LFC blocks involved in the exchange of RR between synchronous areas shall organise that exchange so that the TSOs of a LFC block in the first synchronous area may receive a share of the total reserve capacity on RR required for their LFC block as defined in Article 160(2) from a LFC block in the second synchronous area.

3 The share of the total reserve capacity on RR required for the LFC block in the synchronous area where it is exchanged shall be provided from the LFC block in the second synchronous area in addition to the total reserve capacity on RR required for that second LFC block in accordance with Article 160(2).

4 Each operator of a HVDC interconnector shall control the active power flow over the HVDC interconnector following the instructions provided by either the reserve connecting TSO or the reserve receiving TSO in accordance with the RR technical minimum requirements in Article 161.

5 All TSOs of the LFC blocks to which the reserve connecting TSO and the reserve receiving TSO belong shall specify the conditions for the exchange of RR in an RR exchange agreement.

Article 179

Sharing of RR between synchronous areas

1 All TSOs of each synchronous area shall define in the synchronous area operational agreement a method for determining the limits for sharing of RR with other synchronous areas. That method shall take into account:

- a the operational impact between the synchronous areas;
- b the stability of the RRP of the synchronous area;
- c the maximum reduction of RR that can be taken into account in the RR dimensioning rules in accordance with Article 160 as a result of the RR sharing;
- d the ability of the TSOs of the synchronous area to comply with the frequency quality target parameters defined in accordance with Article 127 and the ability of the LFC blocks to comply with the FRCE error target parameters defined in accordance with Article 128; and
- e the operational security.

2 All TSOs of the LFC blocks involved in the sharing of RR between synchronous areas shall organise that sharing so that the TSOs of an LFC block in the first synchronous area may receive a share of the total reserve capacity on RR required for their LFC block as defined in accordance with Article 160(2) from a LFC block in the second synchronous area.

3 Each operator of an HVDC interconnector shall control the active power flow over the HVDC interconnector following the instructions provided by either the control capability providing TSO or the control capability receiving TSO in accordance with the RR technical minimum requirements in Article 161.

4 All TSOs of each LFC block to which the reserve control capability providing TSO and reserve control capability receiving TSO belong to, shall specify the conditions for the sharing of RR in an RR sharing agreement.

CHAPTER 3

Cross-border activation process for FRR/RR

Article 180

Cross-border activation process for FRR/RR

All TSOs involved in the cross-border activation of FRR and RR in the same or different synchronous areas shall comply with the requirements set out in Articles 147 and 148.

TITLE 9

TIME CONTROL PROCESS

Article 181

Time control process

- 1 The control target of the electrical time control process shall be to control the average value of the system frequency to the nominal frequency.
- 2 Where applicable, all TSOs of a synchronous area shall define in the synchronous area operational agreement the methodology to correct the electrical time deviation, which shall include:
 - a the time ranges within which TSOs shall endeavour to maintain the electrical time deviation;
 - b the frequency setpoint adjustments to return electrical time deviation to zero; and
 - c the actions to increase or decrease the average system frequency by means of active power reserves.
- 3 The synchronous area monitor shall:
 - a monitor the electrical time deviation;
 - b calculate the frequency setpoint adjustments; and
 - c coordinate the actions of the time control process.

TITLE 10

COOPERATION WITH DSOS

Article 182

Reserve providing groups or units connected to the DSO grid

- 1 TSOs and DSOS shall cooperate in order to facilitate and enable the delivery of active power reserves by reserve providing groups or reserve providing units located in the distribution systems.

2 For the purposes of the prequalification processes for FCR in Article 155, FRR in Article 159 and RR in Article 162, each TSO shall develop and specify, in an agreement with its reserve connecting DSOs and intermediate DSOs, the terms of the exchange of information required for these prequalification processes for reserve providing units or groups located in the distribution systems and for the delivery of active power reserves. The prequalification processes for FCR in Article 155, FRR in Article 159 and RR in Article 162 shall specify the information to be provided by the potential reserve providing units or groups, which shall include:

- a voltage levels and connection points of the reserve providing units or groups;
- b the type of active power reserves;
- c the maximum reserve capacity provided by the reserve providing units or groups at each connection point; and
- d the maximum rate of change of active power for the reserve providing units or groups.

3 The prequalification process shall rely on the agreed timeline and rules concerning information exchanges and the delivery of active power reserves between the TSO, the reserve connecting DSO and the intermediate DSOs. The prequalification process shall have a maximum duration of 3 months from the submission of a complete formal application by the reserve providing unit or group.

4 During the prequalification of a reserve providing unit or group connected to its distribution system, each reserve connecting DSO and each intermediate DSO, in cooperation with the TSO, shall have the right to set limits to or exclude the delivery of active power reserves located in its distribution system, based on technical reasons such as the geographical location of the reserve providing units and reserve providing groups.

5 Each reserve connecting DSO and each intermediate DSO shall have the right, in cooperation with the TSO, to set, before the activation of reserves, temporary limits to the delivery of active power reserves located in its distribution system. The respective TSOs shall agree with their reserve connecting DSOs and intermediate DSOs on the applicable procedures.

TITLE 11

TRANSPARENCY OF INFORMATION

Article 183

General transparency requirements

1 All TSOs shall ensure that the information listed in this Title is published at a time and in a format that does not create an actual or potential competitive advantage or disadvantage to any individual party or category of party and taking due account of sensitive commercial information.

2 Each TSO shall use available knowledge and tools to overcome technical limits and to ensure the availability and the accuracy of the information made available to ENTSO for Electricity in accordance with Article 16 and Article 185(3).

3 Each TSO shall ensure the availability and the accuracy of the information made available to ENTSO for Electricity in accordance with Articles 184 to 190.

4 All material for publication mentioned in Articles 184 to 190 shall be made available to ENTSO for Electricity at least in English. ENTSO for Electricity shall publish this material

on the information transparency platform established in accordance with Article 3 of Regulation (EU) No 543/2013.

Article 184

Information on operational agreements

- 1 Each TSO shall share the contents of its synchronous area operational agreement with its regulatory authority or, where applicable, with another competent authority no later than 1 month before its entry into force.
- 2 All TSOs of each synchronous area shall notify the contents of their synchronous area operational agreement to ENTSO for Electricity for publication no later than 1 week after its entry into force.
- 3 Each TSO of each LFC block shall share the contents of its LFC block operational agreement with its regulatory authority or, where applicable, with another competent authority.

Article 185

Information on frequency quality

- 1 Where the TSOs of a synchronous area propose to modify the values for the frequency quality defining parameters or the frequency quality target parameter in accordance with Article 127, they shall notify the modified values to ENTSO for Electricity for publication at least 1 month before the entry into force of the synchronous area operational agreement.
- 2 Where applicable, all TSOs of each synchronous area shall notify the values of the FRCE target parameters for each LFC block and each LFC area to ENTSO for Electricity for publication at least 1 month before their applicability.
- 3 All TSOs of each synchronous area shall notify the methodology used to determine the risk of exhaustion of FCR to ENTSO for Electricity for publication at least 3 months before the application of the synchronous area operational agreement.
- 4 The synchronous area monitor of each synchronous area shall notify the results of the criteria application process for their synchronous area to ENTSO for Electricity for publication within 3 months after the last time-stamp of the measurement period and at least four times a year. Those results shall include at least:
 - a the values of the frequency quality evaluation criteria calculated for the synchronous area and for each LFC block within the synchronous area in accordance with Article 133(3); and
 - b the measurement resolution, measurement accuracy and calculation method specified in accordance with Article 132;
- 5 All TSOs of each synchronous area shall notify the ramping period specified in accordance with Article 136 to ENTSO for Electricity for publication at least 3 months before their applicability.

Article 186

Information on the load-frequency control structure

- 1 All TSOs of each synchronous area shall notify the following information to ENTSO for Electricity for publication at least 3 months before the application of the synchronous area operational agreement:
 - a information on the process activation structure of the synchronous area, including at least information on the monitoring areas, LFC areas and LFC blocks defined and their respective TSOs; and
 - b information on the process responsibility structure of the synchronous area, including at least information on the processes developed in accordance with Article 140(1) and (2).
- 2 All TSOs implementing an imbalance netting process shall publish information regarding that process which shall include at least the list of participating TSOs and the starting date of the imbalance netting process.

Article 187

Information on FCR

- 1 All TSOs of each synchronous area shall notify the dimensioning approach for FCR for their synchronous area in accordance with Article 153(2) to ENTSO for Electricity for publication at least 1 month before its applicability.
- 2 Where applicable, all TSOs of each synchronous area shall notify the total amount of reserve capacity on FCR and the shares of reserve capacity on FCR required for each TSO specified in accordance with Article 153(1) as the initial FCR obligation to ENTSO for Electricity for publication at least 1 month before their applicability.
- 3 All TSOs of each synchronous area shall notify the FCR properties established for their synchronous area in accordance with Article 154(2) and the additional requirements for FCR providing groups in accordance with Article 154(3) to ENTSO for Electricity for publication at least 3 months before their applicability.

Article 188

Information on FRR

- 1 All TSOs of each LFC block shall notify the FRR availability requirements and requirements for the control quality specified in accordance with Article 158(2) and the technical requirements for the connection specified in accordance with Article 158(3) for their LFC block to ENTSO for Electricity for publication at least 3 months before their applicability.
- 2 All TSOs of each LFC block shall notify the FRR dimensioning rules specified for their LFC block in accordance with Article 157(1) to ENTSO for Electricity for publication at least 3 months before the applicability of the LFC block operational agreement.
- 3 All TSOs of each synchronous area shall notify, by 30 November of each year, an outlook of the reserve capacities on FRR of each LFC block for the next year to ENTSO for Electricity for publication.

4 All TSOs of each synchronous area shall notify, within 30 days after the end of the quarter, the actual reserve capacities on FRR of each LFC block of the past quarter to ENTSO for Electricity for publication.

Article 189

Information on RR

1 All TSOs of each LFC block that operates a reserve replacement process shall notify the RR availability requirements specified in accordance with Article 161(2) and the technical requirements for the connection specified in accordance with Article 161(3) for their LFC block available to ENTSO for Electricity for publication within 3 months before their applicability.

2 All TSOs of each synchronous area shall notify, by 30 November of each year, an outlook of the reserve capacities RR of each LFC block for the following year to ENTSO for Electricity for publication.

3 All TSOs of each synchronous area shall notify, within 30 days after the end of the quarter, the actual reserve capacities RR of each LFC block of the past quarter to ENTSO for Electricity for publication.

Article 190

Information on sharing and exchange

1 All TSOs of each synchronous area shall notify the annual compilations of the agreements for the sharing of FRR and for the sharing of RR for each LFC block within the synchronous area to ENTSO for Electricity for publication in accordance with Articles 188(3) and 189(2). Those compilations shall include the following information:

- a the identity of the LFC blocks where there is an agreement for the sharing of FRR or RR; and
- b the share of FRR and RR reduced due to each agreement for the sharing of FRR or RR.

2 All TSOs of each synchronous area shall notify the information on the sharing of FCR between synchronous areas to ENTSO for Electricity for publication in accordance with Article 187(1). That information shall include the following:

- a the amount of shared reserve capacity on FCR between TSOs that entered into agreements for the sharing of FCR; and
- b the effects of the sharing of FCR on the reserve capacity on FCR of the involved TSOs.

3 Where applicable, all TSOs shall publish the information on the exchange of FCR, FRR and RR.

PART V

FINAL PROVISIONS

Article 191

Amendments to contracts and general terms and conditions

All relevant clauses in contracts and general terms and conditions of TSOs, DSOs and significant grid users relating to system operation shall comply with the requirements of this Regulation. To that effect, those contracts and general terms and conditions shall be modified accordingly.

Article 192

Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

Articles 41 to 53 shall apply 18 months after the entry into force of this Regulation. Where other articles foresee the provision or use of data as described in Articles 41 to 53, in the period between entry into force of this Regulation and Articles 41 to 53 becoming applicable, the latest available equivalent data shall be used, in a data format as determined by the entity responsible for the delivery of data, unless otherwise agreed.

Article 54(4) shall apply as of the date of application of Article 41(2) of Commission (EU) 2016/631 and as of the date of application of Article 35(2) of Regulation (EU) 2016/1388.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels, 2 August 2017.

For the Commission

The President

Jean-Claude JUNCKER

ANNEX I

Provisions not applicable to the TSOs of Lithuania, Latvia and Estonia in accordance with Article 2(4):

- (1) Article 16 subparagraphs (d), (e) and (f) of paragraph 2;
- (2) Article 38(2);
- (3) Article 39(3);
- (4) Article 118;
- (5) Article 119;
- (6) Article 125;
- (7) Article 126;
- (8) Article 127 paragraphs 1(i), 3, 4, 5, and 9;
- (9) Article 128, paragraphs 4 and 7;
- (10) Article 130(1)(b);
- (11) Article 131
- (12) Article 132(2);
- (13) from Article 133 to Article 140;
- (14) Article 141 paragraphs 1, 2, 4(c), 5, 6, 9, 10 and 11;
- (15) Article 142;
- (16) Article 143(3);
- (17) Article 145 paragraphs 1, 2, 3, 4 and 6;
- (18) Article 149(3);
- (19) Article 150;
- (20) Article 151(2);
- (21) from Article 152 to Article 181;
- (22) Article 184(2);
- (23) Article 185;
- (24) Article 186(1);
- (25) Article 187;
- (26) Article 188 paragraphs 1 and 2; and
- (27) Article 189(1).

ANNEX II

Voltage ranges referred to in Article 27:

TABLE 1

Voltage ranges at the connection point between 110 kV and 300 kV

Synchronous area	Voltage range
Continental Europe	0,90 pu-1,118 pu
Nordic	0,90 pu-1,05 pu
Great Britain	0,90 pu-1,10 pu
Ireland and Northern Ireland	0,90 pu-1,118 pu
Baltic	0,90 pu-1,118 pu

TABLE 2

Voltage ranges at the connection point between 300 kV and 400 kV

Synchronous area	Voltage range
Continental Europe	0,90 pu-1,05 pu
Nordic	0,90 pu-1,05 pu
Great Britain	0,90 pu-1,05 pu
Ireland and Northern Ireland	0,90 pu-1,05 pu
Baltic	0,90 pu-1,097 pu

ANNEX III

Frequency quality defining parameters referred to in Article 127:

TABLE 1

Frequency quality defining parameters of the synchronous areas

	CE	GB	IE/NI	Nordic
standard frequency range	± 50 mHz	± 200 mHz	± 200 mHz	± 100 mHz
maximum instantaneous frequency deviation	800 mHz	800 mHz	1 000 mHz	1 000 mHz
maximum steady-state frequency deviation	200 mHz	500 mHz	500 mHz	500 mHz

Status: This is the original version (as it was originally adopted).

time to recover frequency	not used	1 minute	1 minute	not used
frequency recovery range	not used	± 500 mHz	± 500 mHz	not used
time to restore frequency	15 minutes	15 minutes	15 minutes	15 minutes
frequency restoration range	not used	± 200 mHz	± 200 mHz	± 100 mHz
alert state trigger time	5 minutes	10 minutes	10 minutes	5 minutes

Frequency quality target parameters referred to in Article 127:

TABLE 2

Frequency quality target parameters of the synchronous areas

	CE	GB	IE/NI	Nordic
maximum number of minutes outside the standard frequency range	15 000	15 000	15 000	15 000

ANNEX IV

FRCE target parameters referred to in Article 128:

TABLE

FRCE target parameters for GB and IE/NI

	GB	IE/NI
Level 1	3 %	3 %
Level 2	1 %	1 %

ANNEX V

FCR technical minimum requirements referred to in Article 154:

TABLE

FCR properties in the different synchronous areas

Minimum accuracy of frequency measurement	CE, GB, IE/NI and Nordic	10 mHz or the industrial standard if better
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Status: This is the original version (as it was originally adopted).

Maximum combined effect of inherent frequency response insensitivity and possible intentional frequency response dead band of the governor of the FCR providing units or FCR providing groups.	CE	10 mHz
	GB	15 mHz
	IE/NL	15 mHz
	Nordic	10 mHz
FCR full activation time	CE	30 s
	GB	10 s
	IE/NL	15 s
	Nordic	30 s if system frequency is outside standard frequency range
FCR full activation frequency deviation.	CE	± 200 mHz
	GB	± 500 mHz
	IE/NL	Dynamic FCR ± 500 mHz
		Static FCR ± 1 000 mHz
	Nordic	± 500 mHz

ANNEX VI

Limits and requirements for the exchange of FCR referred to in Article 163:

TABLE

Limits and requirements for the exchange of FCR

Synchronous area	Exchange of FCR allowed between:	Limits for the exchange of FCR
CE synchronous area	TSOs of adjacent LFC blocks	<ul style="list-style-type: none"> — the TSOs of an LFC block shall ensure that at least 30 % of their total combined initial FCR obligations, is physically provided inside their LFC block; and — the amount of reserve capacity on FCR, physically located in an LFC block as a result of the exchange of FCR with other

Status: This is the original version (as it was originally adopted).

	<p>LFC blocks, shall be limited to the maximum of:</p> <ul style="list-style-type: none"> — 30 % of the total combined initial FCR obligations of the TSOs of the LFC block to which the reserve capacity on FCR is physically connected; and — 100 MW of reserve capacity on FCR.
TSOs of the LFC areas of the same LFC block	<ul style="list-style-type: none"> — the TSOs of the LFC areas constituting a LFC block shall have the right to specify in the LFC block operational agreement internal limits for the exchange of FCR between the LFC areas of the same LFC block in order to: <ul style="list-style-type: none"> — avoid internal congestions in case of the activation of FCR; — ensure an even distribution of reserve capacity on FCR for the

Status: This is the original version (as it was originally adopted).

		<ul style="list-style-type: none"> — case of network splitting; and avoid that the stability of the FCP or the operational security is affected.
Other synchronous areas	TSOs of the synchronous area	<ul style="list-style-type: none"> — The TSOs of the synchronous area shall have the right to specify in the synchronous area operational agreement limits for the exchange of FCR in order to: <ul style="list-style-type: none"> — avoid internal congestions in case of the activation of FCR; — ensure an even distribution of FCR in case of network splitting; and — avoid that the stability of the FCP or the operational security is affected.

ANNEX VII

Requirements and limits for the exchange of FRR within the synchronous area referred to in Article 167:

TABLE

Requirements and limits for the exchange of FRR within a synchronous area

Synchronous area	Exchange of FRR allowed between	Limits for the exchange of FRR
All synchronous areas consisting of more than one LFC block	TSOs of different LFC blocks	<p>— The TSOs of a LFC block shall ensure that at least 50 % of their total combined reserve capacity on FRR resulting from the FRR dimensioning rules in Article 157(1) and before any reduction due to the sharing of FRR in accordance with Article 157(2) remains located within their LFC block.</p>
	TSOs of the LFC areas of the same LFC block	<p>— The TSOs of the LFC areas constituting a LFC block shall have the right, if needed, to specify internal limits, for the exchange of FRR between the LFC areas of the LFC block in the LFC block operational agreement to:</p> <ul style="list-style-type: none"> — avoid internal congestions due to the activation of the reserve capacity on FRR subject to the exchange of FRR; — ensure an even distribution of FRR

		—	throughout the synchronous area and LFC blocks in case of network splitting; avoid that the stability of the FRP or the operational security is affected.
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ANNEX VIII

Requirements and limits for the exchange of RR within the synchronous area referred to in Article 169:

TABLE

Requirements and limits for the exchange of RR within the synchronous area

Synchronous area	Exchange of RR allowed between	Limits for the exchange of RR
All synchronous areas consisting of more than one LFC block	TSOs of different LFC blocks	— The TSOs of the LFC areas constituting a LFC block shall ensure that at least 50 % of their total combined reserve capacity on RR resulting from the RR dimensioning rules according to Article 160(3) and before any reduction of reserve capacity on RR as a result of the sharing of RR according to Article 160(4) and Article 160(5) remains located within their LFC block.

Status: This is the original version (as it was originally adopted).

TSOs of the LFC areas of the same LFC block	<p>— The TSOs of the LFC areas constituting a LFC block shall have the right, if required, to define internal limits for the exchange of RR between LFC areas of the LFC block in the LFC block operational agreement as to:</p> <ul style="list-style-type: none"> — avoid internal congestions due to the activation of reserve capacity on RR subject to the exchange of RR; — ensure an even distribution of RR throughout the synchronous area in case of network splitting; and — avoid that the stability of the RRP or the operational security is affected.
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- (1) [OJ L 211, 14.8.2009, p. 15.](#)
- (2) 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 ([OJ L 211, 14.8.2009, p. 1.](#)).
- (3) Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators ([OJ L 112, 27.4.2016, p. 1.](#)).
- (4) Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a Network Code on Demand Connection ([OJ L 223, 18.8.2016, p. 10.](#)).
- (5) Commission Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules ([OJ L 241, 8.9.2016, p. 1.](#)).
- (6) Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management ([OJ L 197, 25.7.2015, p. 24.](#)).
- (7) Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on forward capacity allocation ([OJ L 259, 27.9.2016, p. 42.](#)).
- (8) Commission Regulation (EU) No 543/2013 of 14 June 2013 on submission and publication of data in electricity markets and amending Annex I to Regulation (EC) No 714/2009 of the European Parliament and of the Council ([OJ L 163, 15.6.2013, p. 1.](#)).
- (9) 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 ([OJ L 211, 14.8.2009, p. 55.](#)).
- (10) Council Directive 2008/114/EC of 8 December 2008 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection ([OJ L 345, 23.12.2008, p. 75.](#)).