

# ENTSO-E Working Draft Network Code on Emergency and Restoration

16 June 2014

## **Notice**

This document reflects the status of the work of Transmission System Operator experts as of 16 June 2014 in line with the ACER Framework Guidelines on Electricity System Operation published on 02 December 2011 after the EC mandate letter was received by ENTSO-E on 1 April 2014 .

The document does not in any case represent a firm, binding or definitive ENTSO-E position on the content, the structure or the prerogatives of the Network Code on Emergency and Restoration.

Such version of the draft Network Code is released for the first public workshop organised by ENTSO-E.

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 and in particular Article 6 (11) thereof,

Whereas:

- (1) Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC and Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 underline the need for an increased cooperation and coordination among transmission system operators within a European Network of Transmission System Operators for Electricity (ENTSO-E) to create Network Codes for providing and managing effective and transparent access to the transmission networks across borders, and to ensure coordinated and sufficiently forward-looking planning and sound technical evolution of the transmission system in the European Union, including the creation of interconnection capacities, with due regard to the environment.
- (2) Transmission System Operators (TSOs) are according to Article 2 and 12 of Directive 2009/72/EC responsible for the Operational Security in their Responsibility Areas and together in the Synchronous Areas and in the whole European Union, with a high level of reliability and quality.
- (3) Secure Transmission System operation can be made possible only if there is an obligation for the TSOs, Distribution System Operators (DSOs) and Significant Grid Users to cooperate and to meet the relevant minimum technical requirements for the operation of the interconnected Transmission Systems as one entity.
- (4) This Network Code on Emergency and Restoration was drafted aiming at setting out clear and objective requirements for TSOs, DSOs and Significant Grid Users in order to contribute to non-discrimination, effective competition and the efficient functioning of the internal electricity market and to ensure system security.
- (5) This Network Code sets the requirements for technical and organisational measures to be undertaken to prevent the propagation or deterioration of an incident in the Transmission System, in order to avoid a widespread disturbance and Blackout State, and the procedures to be implemented to restore the Alert or Normal Start after a widespread disturbance and Blackout State.
- (6) [Further elements explaining the philosophy of the Network Code. What is the NC trying to achieve:]

(7) [Further elements explaining the main principles of the Network Code, in order of appearance. What are the main tools which are supporting the philosophy of the Network Code?]

(8) [Further elements explaining important deviations to the main principles of the Network Code.]

HAS ADOPTED THIS REGULATION:

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# CHAPTER 1

## GENERAL PROVISIONS

### Article 1

#### Subject-matter and scope

1. This Regulation aims at:
  - (a) determining common requirements and principles to manage Transmission and Distribution Systems when in Emergency, Blackout and Restoration System States;
  - (b) coordinating system operation in Emergency, Blackout and Restoration System States in a common and coherent way throughout the EU and in 3<sup>rd</sup> countries where applicable; and
  - (c) determining common requirements for simulations and tests for the purpose of reliable, efficient and rapid restoration from Emergency or Blackout System States.
2. The provisions of this Network Code shall not apply to the Aland Islands.
3. In Member States where more than one TSO exists, this Regulation shall apply to all TSOs within that Member State. Where a TSO does not have a function relevant to one or some obligations under this Regulation, Member States may under the national regulatory regime provide that the responsibility to comply with one or some obligations under this Regulation is assigned to one or more different transmission system operators. In case of such assignment, the Regulation shall apply accordingly to the transmission system operator(s) to which responsibilities have been assigned.
4. For the purpose of this Network Code, Significant Grid Users shall be classified according to the Article 1(5) of [NC OS].

### Article 2

#### Definitions

For the purpose of this Regulation, the definitions in Article 2 of Regulation (EC) N° 714/2009, Commission Regulations establishing Network Codes that have been adopted according to Article 6(11) of Regulation (EC) N°714/2009, as well as Article 2 of directive 2009/72/EC shall apply. In addition, the following definitions shall apply:

**Demand** means the netted value of power consumption at a given point of the system;

**Implementation** means the preparatory phase after the design phase. It includes the installation of all necessary means for the purposes of the System Defence Plan and Restoration Plan, procurement of services, deployment of Procedures defined in the System Defence Plan or Restoration Plan;

**Procedure** means a series of actions conducted in a certain order or manner within a specified time frame to prevent the propagation or deterioration of an incident in the Transmission System;

**Reference load** means the total load of a LFC Area including all consumption connected to both transmission and distribution systems and the losses on both transmission and distribution systems. It is usually calculated as the sum of all generation on the transmission and distribution systems (measured or estimated), excluding house load of power plants and importation balance of the control area;

**Restoration Plan Instruction** means instruction to be issued by the TSO to a DSO or to a Significant Grid User for the purpose of Restoration Plan activation;

**System Defence Plan Instruction** means instruction to be issued by the TSO to a DSO or to a Significant Grid User for the purpose of System Defence Plan activation;

**Pre-requisites** means a set of actions that need to be completed before a System Defence Plan or Restoration Plan can be implemented.

### Article 3

#### Collective decisions and regulatory approvals

1. For those terms and conditions or methodologies in this Regulation which need to be developed and agreed by more than one TSO, the TSOs shall closely coordinate to ensure the development of harmonised terms and conditions or methodologies. All TSOs, with the assistance of ENTSO-E, and all NEMOs shall regularly inform the competent NRAs and the Agency about the progress of developing these terms and conditions or methodologies.
2. TSOs deciding on proposals for terms and conditions and methodologies pursuant to Articles [X], [XX], [XXX] shall decide with qualified majority as a last resort [BE].
3. If TSOs fail to submit a proposal for terms and conditions or methodologies for approval which needs to be agreed by more than one TSO within the respective deadline for the development of the proposal, the Agency shall, if the Commission requests so, investigate the reasons for the failure and issue an opinion within four months after the expiry of the deadline. The opinion may include recommendations to the European Commission to take legislative or other appropriate measures. For this purpose the TSOs shall provide the Agency with the relevant drafts and an explanation what prevents an agreement. The European Commission shall take a decision within four months on the appropriate steps to harmonise the required terms and conditions or methodologies.
4. In line with Article 37 of Directive 2009/72/EC, each National Regulatory Authority shall be responsible for approving the terms and conditions or at least the methodologies referred to in Article [XX] and Article [XX].
5. The following terms and conditions or methodologies need the joint approval by all National Regulatory Authorities:

- (a) [item 1 + cross-reference];
  - (b) [item 2+ cross-reference]; and
  - (c) [item 3 + cross-reference].
6. The following terms and conditions or methodologies need the joint approval by all National Regulatory Authorities of the concerned [mention here the region at stake]:
- (a) [item 1 + cross-reference];
  - (b) [item 2+ cross-reference]; and
  - (c) [item 3 + cross-reference].
7. The following terms and conditions or methodologies need the approval by each National Regulatory Authority of the Member State concerned:
- (a) [item 1 + cross-reference];
  - (b) [item 2+ cross-reference]; and
  - (c) [item 3 + cross-reference].
8. TSOs shall submit to the competent NRA the terms and conditions or methodologies subject to approval pursuant to paragraphs 5 to 7 at the latest by the deadlines provided in this Regulation for the development of those terms and conditions or methodologies. The submitted terms and conditions or methodologies shall include a proposed timescale for implementation and a description of their expected impact on the objectives of this Regulation. Terms and conditions or methodologies subject to the approval by several or all NRAs shall be submitted to the Agency in parallel to the submission to NRAs. The Agency shall issue an opinion within three months on such terms and conditions or methodologies if the Commission requests so; otherwise it may issue an opinion on its own initiative.
9. NRAs concerned shall closely consult, cooperate and coordinate with each other in order to find the necessary common position required for the approval of terms and conditions or methodologies pursuant to paragraph 5 and 6, taking into account the opinion of the Agency. NRAs shall take decisions on approvals pursuant to paragraphs 5 to 7 within four months.
10. Where the NRAs have not been able to reach an agreement within the period referred to in paragraph 9, or upon their joint request, the Agency shall decide upon those regulatory issues within three months according to Article 8(1) of Regulation (EC) No 713/2009.
11. In the event that one or several NRA decide not to approve the terms and conditions or methodologies submitted pursuant to paragraph 5 to 7 but to require an amendment to them before their approval, the relevant TSOs shall submit a proposal for amended terms and conditions or methodologies for approval within two months following the requirement from the NRAs. The NRAs shall decide on the amended terms and conditions or methodologies within two months after their submission. If the relevant TSOs fail to submit a

proposal for amended terms and conditions or methodologies, the procedure described in paragraph 3 shall apply.

#### Article 4

##### **Recovery of costs**

1. The costs related to the obligations referred to in this Regulation which have to be borne by regulated Network Operators shall be assessed by National Regulatory Authorities.
2. Costs assessed as efficient, reasonable and proportionate shall be recovered as determined by National Regulatory Authorities.
3. If requested by National Regulatory Authorities, regulated Network Operators shall, within three months of such a request, use best endeavours to provide such additional information as reasonably requested by National Regulatory Authorities to facilitate the assessment of the costs incurred.

#### Article 5

##### **Confidentiality obligations**

1. Each TSO, DSO and Significant Grid User shall preserve the confidentiality of the information and data submitted to them in connection with this Regulation and shall use them exclusively for the purpose they have been submitted in compliance with the Regulation.
2. Without prejudice to the obligation to preserve the confidentiality of commercially sensitive information obtained in the course of carrying out its activities, each TSO shall provide to the operator of any other transmission system with which its system is interconnected, sufficient information to ensure the secure and efficient operation, coordinated development and interoperability of the interconnected system.



## CHAPTER 2 SYSTEM DEFENCE PLAN

### SECTION 1 GENERAL PRINCIPLES

#### Article 6

#### Design of the System Defence Plan

1. Each TSO shall design a System Defence Plan, in coordination with relevant TSOs, DSOs and Significant Grid Users, in accordance with Article 8 [NC OS], covering technical and organisational measures for at least the following situations:
  - a) System Frequency exceed the frequency limits for Normal and Alert State as defined in Article 42 [NC LFCR];
  - b) Transmission System steady-state voltage at the Connection Points exceed the ranges of Operational Security Limits as defined in Article 10 [NC OS];
  - c) Power flows exceed Operational Security Limits as defined in Article 12 [NC OS]; and
  - d) Absence of Adequacy in its Responsibility Area in D-1 and intraday as defined in Article 49 [NC OPS].
  
2. Each TSO shall consider in the design of its System Defence Plan at least:
  - a) the consequences of Exceptional Contingencies defined according to Article 13(5) [NC OS];
  - b) Stability Limits defined according to Article 15(3) [NC OS];
  - c) Short-circuit current limits as defined according to Article 11(1) [NC OS]; and
  - d) the technical requirements and characteristics of Significant Grid Users and existing and new type A Power Generating Modules.
  
3. In the design of its System Defence Plan, each TSO shall ensure that:
  - a) the impact for grid users is minimal;
  - b) the System Defence Plan measures are economically efficient;
  - c) the minimum System Defence Plan measures necessary are activated;
  - d) the requirements set in relation with specific grid users needs according to Article 9 are fulfilled; and
  - e) the measures of the System Defence Plan do not introduce additional risks on the Operational Security.
  
4. In the design of its System Defence Plan, each TSO shall use the capabilities required in [NC RfG] for Significant Grid Users which are Power Generating Modules, in [NC DC] for Significant Grid Users which are Demand Facilities and Closed Distribution Networks, in [NC HVDC] for Significant Grid Users which are HVDC Systems and the capabilities required in the national grid codes for those Significant Grid Users who are not subject or are derogated from [NC RfG], [NC DC] and [NC HVDC]. If it is necessary for the design of System Defence Plan, each TSO shall require modifications of the capability of Significant Grid Users according to the Article 33 of [NC RfG] and Article 36 of [NC DC].

5. The System Defence Plan shall consist of at least:
  - a) The System Defence Plan Pre-requisites;
  - b) System Protection Schemes including at least:
    - i. Automatic Low Frequency Demand Disconnection scheme.
  - c) System Defence Plan Procedures, consisting at least of:
    - i. Frequency deviation management Procedure;
    - ii. Voltage management Procedure;
    - iii. Power flow management Procedure;
    - iv. Assistance for Active Power Procedure; and
    - v. Manual Demand Disconnection Procedure.
6. Each TSO shall define at least in its System Defence Plan Procedures:
  - a) the conditions under which the Procedure is activated, according to Article 8;
  - b) the relevant set of measures; and
  - c) System Defence Plan Instructions to be issued by the TSO.
7. Each TSO shall submit the concept of the System Defence Plan to its National Regulatory Authority or, when explicitly foreseen in national law, other relevant national authorities, for notification, after entry into force of this Network Code and after major changes to the System Defence Plan.

#### Article 7

#### **Implementation of the System Defence Plan**

1. Each TSO shall ensure the Implementation and availability of the measures of its System Defence Plan, according to the principles developed in this chapter, as long as these measures are to be implemented on the Transmission System.
2. Each TSO shall communicate to DSOs and Significant Grid Users the measures of the System Defence Plan to be implemented on their installations. This communication shall include:
  - a) the measures to be implemented; and
  - b) the periods of time in which the Implementation shall be started and completed.

Each DSO and Significant Grid User shall ensure the Implementation of these measures within the period of time requested by TSO and shall confirm to the relevant TSO the Implementation of these measures. Each DSO and Significant Grid User shall ensure the availability of these measures.

## Article 8

### Activation of the System Defence Plan

1. Each TSO shall ensure that each System Protection Scheme of System Defence Plan will automatically operate when the relevant operational parameter outlined in the System Defence plan is outside its respective limit.
2. In addition, each TSO shall activate a Procedure of the System Defence Plan, in collaboration with relevant TSOs, DSOs and Significant Grid Users, in the following situations:
  - a) when the system is in Emergency State due to at least one deviation from the Operational Security Limits and there is no available Remedial Action to restore the system to Normal State; or
  - b) according to forecast studies, the safety of the Transmission System requires the activation of a measure before any Operational Security Limit is violated. Such activation concerns but is not limited to manual Demand Disconnection in case of absence of Adequacy in its Responsibility Area in D-1 and intraday as defined in Article 49 [NC OPS];
  - c) or in application of a specific procedure defined by the TSO and subject to NRA approval.
3. Each DSO and Significant Grid User shall execute System Defence Plan Instructions issued by the TSO, according to System Defence Plan Procedures.
4. If the System Defence Plan measures have a potential cross-border impact, the TSO shall coordinate with the impacted TSOs.
5. Manual measures of a TSO's System Defence Plan may need a preparation phase before activation. This preparation phase can be launched while a TSO is in a different System State than Emergency State. Such preparation concerns, but is not limited to, assistance for Active Power and manual Demand Disconnection.

In case a TSO needs to launch a preparation phase before activation of a System Defence Plan measure with potential impact on the interconnected Transmission Systems, the concerned TSO shall:

- a) Provide to all concerned TSOs the relevant information, including the expected time of activation and potential cross-border impact; and
- b) Coordinate with the TSOs with which this TSO has a multi-party agreement for Emergency and Restoration according to Article 10 for the activation of this System Defence Plan measure.

## Article 9

### **Consideration of specific grid users needs**

1. System Defence Plans shall be designed and implemented to meet the requirements defined by the competent National Authorities concerning the power supply of specific grid users for reasons of public safety or other aspect.
2. Each DSO shall ensure that the requirements of paragraph (1) are met for specific grid users connected to its Distribution Network.

## Article 10

### **TSO coordination in Emergency situations**

1. Each TSO shall provide any possible assistance through the Interconnectors in case a neighbouring TSO is in Emergency State. This assistance includes but is not limited to a coordinated curtailment of Cross Zonal Allocated Capacities in Emergency, according to Article 80 [NC CACM].
2. Any manual opening of an Interconnector should be announced and duly prepared in coordination with neighbouring TSOs, ensuring that this action will not endanger the remaining interconnected system. Nevertheless, Interconnector opening may be manually or automatically performed, without prior coordination, in specific conditions including but not limited to threshold violation endangering personnel safety or damaging equipment, assuming that these conditions have been described in the multi-party agreement.
3. Each TSO shall provide through HVDC Systems, any possible assistance that does not endanger its own system, in case a neighbouring TSO is in an Emergency State. Such assistance can be provided through different mechanisms and under different conditions, taking into account the technical characteristics and capability of HVDC:
  - a) manual regulation actions of the transmitted active power to help the TSO in Emergency State to bring power flows or power balance to an acceptable operating level;
  - b) automatic control functions of the transmitted active power Article 9 [NC HVDC] based on the signals and criteria agreed upon between the TSOs, to help the TSO in Emergency State to bring power flows or power balance to the safe area;
  - c) automatic frequency control according to Articles 11 to 14 [NC HVDC] in case of islanded operation;
  - d) voltage and reactive power control according to Article 20 [NC HVDC] for the need of the TSO in Emergency State; and
  - e) black start capability according to Article 35 [NC HVDC].

The available assistance mechanisms and agreed conditions as well as the processes of activation for each HVDC System shall be defined in the multi-party agreement and shall be agreed upon with the HVDC System Owner.

4. TSOs having concluded a multi-party agreement in accordance with Article 20 [NC OPS] shall establish with the same counterparts an amendment or a new multi-party agreement concerning Emergency and Restoration, by [date – 15 month after entry into force].
5. The Multi-party agreements for Emergency and Restoration shall cover at least the preparation and activation processes of the following measures:
  - a) specific Interconnector opening rules;
  - b) HVDC Systems assistance, when relevant; and
  - c) Assistance for Active Power according to Article 15.
6. Multi-party agreements shall be reviewed and updated when needed, to take into account changes in the network, evolutions of the System Defence Plan and adapt organisation when needed.

## **SECTION 2**

### **MEASURES OF THE SYSTEM DEFENCE PLAN**

#### Article 11

#### **Frequency management Procedure**

1. Each TSO shall include in its System Defence Plan a set of measures to manage System Frequency deviation outside System Frequency limits for Normal and Alert State defined in Article 42 [NC LFCR].
2. When the absolute value of the Steady State System Frequency Deviation is larger than the Maximum Steady State Frequency Deviation, as defined in [NC LFC&R], each TSO shall ensure that the behaviour of its Load Frequency Control Structure will not endanger the Transmission System of the Synchronous Area.
3. When the absolute value of the Steady State System Frequency Deviation is larger than the Maximum Steady State Frequency Deviation, as defined in [NC LFC&R] and before activation of the Automatic Low Frequency Demand Disconnection Scheme according to Article 12, each TSO shall ensure in its LFC Area that the behaviour of Significant Grid Users and of existing and new type A Power Generating Modules, combined with effect of manual and automatic measures of the System Defence Plan, will result in:
  - a) a decrease of generation smaller than the decrease of demand during low frequency events; and
  - b) a decrease of generation greater than the decrease of demand during high frequency events.
4. In the design of its System Defence Plan, each TSO shall ensure the Demand Side Response and Limited Frequency Sensitive Mode offered by the Significant Grid Users within its Responsibility Area are invoked before the Automatic Low Frequency Demand Disconnection Scheme assuming the rate of change of Frequency allows the TSO to do so.

## Article 12

### Automatic Low Frequency Demand Disconnection Scheme

1. The Automatic Low Frequency Demand Disconnection Scheme characteristics are the following:
  - a) frequency range in which Low Frequency Demand Disconnection is allowed (Low Frequency Allowed Range, LFAR);
  - b) frequency range in which Low Frequency Demand Disconnection is mandatory (Low Frequency Mandatory Range, LFMR);
  - c) total amount of Netted Disconnection as a percentage of Reference Load to be shed (Total Netted Disconnection, TND);
  - d) minimum and maximum amount of Demand to be disconnected at each step of the Low Frequency Demand Disconnection plan (Minimum/Maximum Netted Disconnection per Step, MNDS);
  - e) maximum value of frequency between each step (Frequency Step, FS);
  - f) maximum disconnection delay, which shall include time for accurate frequency measurements and breakers operation time (Maximum Delay, MD);
  - g) maximum inaccuracy of frequency measurements (Maximum Inaccuracy, MI);
  - h) frequency range in which pumps shall be automatically disconnected with a time delay (Pump Delay Frequency Range, PDFR);
  - i) frequency range in which pumps shall be automatically disconnected without a time delay (Pump Frequency Range, PFR); and
  - j) the frequency range in which the derivative of the frequency can be utilized (Derivative Frequency Range, DFR).

For each Synchronous Area, the above mentioned characteristics shall respect the figures listed in the following table.

Parameter	Values SA A	Values SA B	Measuring Unit
Low Frequency Allowed Range, LFAR	x-y		Hz
Low Frequency Mandatory Range, LFMR	w - z		Hz
Total Netted Disconnection, TND	t		% of Reference Load
Maximum Netted Disconnection per Step, MNDS	m		% of Reference Load
Frequency Step, FS	f		mHz
Maximum Delay, MD	d		Ms

Maximum Inaccuracy, MI	i		mHz
Pump Delay Frequency Range, PDFR	a - b		Hz
Pump Frequency Range, PFR	c - d		Hz
Derivative Frequency Range, DFR	e - f		Hz

Table 1: Automatic Low Frequency Demand Disconnection Scheme parameters

2. Each DSO shall:
  - a) implement the Automatic Low Frequency Demand Disconnection Scheme with the objective to minimize the total disconnected installed capacity of Power Generating Modules in its Distribution Network.
  - b) ensure that the Automatic Low Frequency Demand Disconnection Scheme leads to a geographically evenly spread disconnection of Demand, unless required otherwise by the System Defence Plan.

#### Article 13

##### **Voltage management Procedure**

1. Each TSO shall include in its System Defence Plan a set of measures to manage voltage deviation outside Operational Security Limits defined in Article 10(1) [NC OS].
2. Coordination with DSOs and Significant Grid Users for Reactive Power management  
*under development*
3. Automatic Low Voltage Demand Disconnection Scheme, when relevant
4. On-Load Tap Changer Blocking Scheme, when relevant
5. Special Protection Schemes, when relevant  
*under development*

#### Article 14

##### **Power flow management Procedure**

1. Each TSO shall include in its System Defence Plan a set of measures to manage power flow deviation outside Operational Security Limits defined in accordance with Article 8(5) [NC OS]. These measures shall be used in addition to actions developed according to Article 12 (4) [NC OS].

*under development*

## Article 15

### Assistance for Active Power Procedure

1. Each TSO shall be entitled to request Assistance for a change in Active Power, only after having activated all available Balancing Energy or taken into account all available Balancing Energy at the moment of absence of Adequacy, within its Coordinated Balancing Area, according to Article 39 [NC EB].
2. Each TSO shall be entitled to request Assistance for a change in Active Power output to its Balancing Service Providers as defined in [NC EB] and to any Power Generating Modules connected in its Responsibility Area that is not under agreement with a Balancing Service Provider.

In such a case, each Balancing Service Provider and Power Generating Module shall put at disposal of the TSO all its technically available Active Power if not already activated through any Balancing mechanism.

3. Each TSO shall be entitled to request Assistance for a change in Active Power transfer from all TSOs with whom it has established a multi-party agreement for Emergency and Restoration as defined in Article 10, without considering their membership into its Coordinated Balancing Area as defined in [NC EB].

Unless facing the same conditions as the requesting TSO, each TSO receiving a request for Assistance for Active Power shall:

- a) Make available all its Unshared Bids as defined in [NC EB], unless non compliant with TSOs safety margins defined in the multi-party agreement for Emergency and Restoration;
- b) Be entitled to activate the available Balancing Energy from the Coordinated Balancing Area(s) it belongs to and that do not include the requesting TSO, in order to provide the corresponding power to the requesting TSO. Such inter Coordinated Balancing Area assistance is submitted to the existence of dedicated procedures within the multi-party agreement for Emergency and Restoration; and
- c) Be entitled to request Assistance for Active Power to its Balancing Service Providers (acting as Connection TSO [NC EB]) and to any the Power Generating Modules connected in its Responsibility Area that is not under agreement with a Balancing Service Provider, in order to provide the corresponding power to the requesting TSO.

Once the TSO requesting and the TSO offering Assistance for a change in Active Power transfer have agreed on an exchange of a given amount of power at a given time, both TSOs shall ensure they will respect the terms of this agreement for the agreed duration.

The detailed process for request, activation, firmness and settlement of the Assistance for Active Power shall be defined in the multi-party agreement for Emergency and Restoration in accordance with Article 10.



## Article 16

### Manual Demand Disconnection Procedure

1. Each TSO shall be entitled to manually disconnect Demand directly or indirectly in collaboration with DSOs, when necessary to prevent any propagation or worsening of an Emergency state
  - a) to solve overloads or under voltage situations; or
  - b) in case the Assistance for Active Power according to Article 15 has been requested but is not sufficient to ensure Adequacy on its Responsibility Area in D-1 and intraday as defined in Article 49 [NC OPS], leading to a risk of frequency deterioration in the Synchronous Area.
2. In such situation, each TSO shall determine the amount of Demand to be disconnected. The required amount of Demand shall be disconnected directly or indirectly in collaboration with DSOs.
3. Each DSO shall implement the Demand Disconnection, without undue delay, respecting the amount and area specified by the TSO while minimising impact on grid users.

## **CHAPTER 3**

### **RESTORATION PLAN**

#### **SECTION 1**

#### **GENERAL PRINCIPLES**

##### Article 17

#### **Design of the Restoration Plan**

1. Each TSO shall design a Restoration Plan, in coordination with relevant TSOs, DSOs and Significant Grid Users, in accordance with Article 8 [NC OS], covering technical and organisational measures for at least:
  - a) system restoration; and
  - b) system re-synchronization.
2. Each TSO shall consider in the design of its Restoration Plan at least the technical requirements and characteristics of the existing and new Significant Grid Users and of existing and new type A Power Generating Modules.
3. In the design of its Restoration Plan, each TSO shall ensure that:
  - a) the impact for grid users is minimal;
  - b) the Restoration Plan measures are economically efficient;
  - c) the minimum Restoration Plan measures necessary are activated; and
  - d) the requirements set in relation with specific grid users needs according to Article 20 are fulfilled.
4. In the design of its Restoration Plan, each TSO shall use the capabilities of Significant Grid Users which are Power Generating Modules in [NC RfG], of Significant Grid Users which are Demand Facilities and Closed Distribution Networks in [NC DC] and the capabilities required in the national grid codes for those Significant Grid Users who are not subject or are derogated from [NC RfG] and [NC DC]. If it is necessary for the design of Restoration Plan, each TSO shall require modifications of the capability of Significant Grid Users according to the Article 33 of [NC RfG] and Article 36 of [NC DC].
5. In the design of its Restoration Plan, each TSO shall define a number of Power Generating Modules with Black start capability and capability to take part in Islanded Operation, directly or indirectly connected to the Transmission Grid, to restore the TSO's system. The TSO shall take into account at least:
  - a) Geographical distribution of Power Generating Modules with Black start capability and capability to take part in Islanded Operation to minimize impact of natural disasters; and
  - b) Technical capability, availability and reliability of Power Generating Modules with Black start capability and capability to take part in Islanded Operation.
6. In the design of its Restoration Plan, each TSO shall define the conditions under which the top-down and bottom-up approaches have to be activated.

7. The Restoration Plan shall be consisted at least of:
  - a) The Restoration Plan Pre-requisites;
  - b) Restoration Plan Procedures, consisting at least of:
    - i. System Restoration Procedure;
    - ii. Inter-TSO Re-synchronisation Procedure; and
    - iii. Coordination with neighbouring TSOs and DSOs restoration plans.
8. Each TSO shall define at least in its Restoration Plan Procedures:
  - a) the conditions under which the Procedure is activated;
  - b) the relevant set of measures; and
  - c) Restoration Plan Instructions to be issued by the TSO.
9. Each TSO shall submit the concept of the Restoration Plan to the National Regulatory Authorities or, when explicitly foreseen in national law, other relevant national authorities, for notification after entry into force of this Network Code and after major changes to the Restoration Plan.

#### Article 18

##### **Implementation of the Restoration Plan**

1. Each TSO shall ensure the Implementation and availability of measures of its Restoration Plan, according to the principles developed in this chapter, as long as these measures are to be implemented on the Transmission System.
2. Each TSO shall communicate to DSO and Significant Grid User the measures of the Restoration Plan to be implemented on their installations. This communication shall include:
  - a) the measures to be implemented; and
  - b) the periods of time in which the Implementation shall be started and completed.
3. Each DSO and Significant Grid User shall ensure the Implementation of these measures within the period of time requested by TSO and shall confirm to the relevant TSO the Implementation of these measures. Each DSO and Significant Grid User shall ensure the availability of these measures.

#### Article 19

##### **Activation of the Restoration Plan**

1. Each TSO shall activate its Restoration Plan in coordination with DSOs and Significant Grid Users when:
  - a) in Emergency state, after measures from the System Defence Plan have stabilized the system; or
  - b) in Blackout State.

2. Each DSO and Significant Grid User shall execute the Restoration Plan Instructions issued by the TSO, according to Restoration Plan Procedures.

#### Article 20

##### **Consideration of specific grid users needs**

1. Restoration Plans shall be designed and implemented to meet the requirements defined by the competent National Authorities concerning the power supply of specific grid users for reasons of public safety or any other aspect.
2. Each DSO shall ensure that the requirements of paragraph (1) are met for specific grid users connected to its Distribution Network.

#### Article 21

##### **TSO coordination in Restoration**

*under development*

### **SECTION 2**

#### **PROCEDURES OF THE RESTORATION PLAN**

#### Article 22

##### **System Restoration Procedure**

1. The System Restoration Pre-requisites for System Restoration shall contain at least the following items:
  - a) Definition of Power Generating Modules with Black start capability and capability to take part in Islanded Operation and other options to reenergize the system;
  - b) Maximal possible load to reenergise at every stage of the Restoration plan according to the technical possibilities of the primary control units;
  - c) Preliminary defined grid sections and restoration paths for top down or bottom up strategies according to initial switching state;
  - d) Detailed roles and responsibilities of all involved partners including the coordination between TSO Restoration plan and possible Restoration plans on a DSO level;
  - e) Dispositions for specific grid users needs, according to Article 20; and
  - f) Definition of procedures for resynchronisation between TSOs and possibly between TSOs and DSOs.
2. All TSOs of an area in synchronous operation shall decide on a Frequency Leader in the following situation

*Under development*
3. The Frequency Leader shall be designated according to the following criteria:

*Under development*
4. During Frequency Restoration, each Frequency Leader shall ...

*Under development*

5. During Frequency Restoration, other TSOs of the area in synchronous operation shall ...

*Under development*

#### Article 23

##### **Inter-TSO Re-synchronisation Procedure**

1. Frequency Leaders shall decide on a Re-synchronisation Leader in the following situation

*Under development*

2. The Re-synchronisation Leader shall be designated according to the following criteria:

*Under development*

3. During Re-synchronisation, the Re-synchronisation Leader shall:

- a) coordinate the Re-synchronisation process (Switching stations, making sure that every party is informed and ready);
- b) assess the conditions prior to re-synchronisation in collaboration with the Frequency Leaders and the TSOs operating the Re-synchronisation substations;
- c) Close the circuit breaker to resynchronise...

*Under development*

4. During Re-synchronisation, each Frequency Leader of areas capable to synchronise shall define conditions for re-synchronisation as follows:

- a) set frequencies of each area before synchronisation,
- b) set frequency of the area after synchronisation,
- c) the Frequency Leader after re-synchronisation,
- d) strategy for further expansion of the grid including maximum additional load to be added,
- e) maximum active and reactive power exchange between reconnected areas. For DC lines, only maximum power exchange is necessary.

5. Frequency Leaders shall inform all TSOs within their area of the planned re-synchronisation. TSOs shall inform the DSO and Significant Grid Users.

6. Each TSO shall define requirements needed for re-synchronisation of split or islanded systems. Requirements shall at least be defined for maximum phase angle, frequency difference and voltage difference for closing lines. Automatic synchronisation relays shall be installed at least in strategic sub stations according to the Restoration plans. Frequency measurement devices for island operation shall be installed at least in substations where island will be started.

#### Article 24

##### **Coordination with neighbouring TSOs and DSOs restoration plans**

*Under development*

## CHAPTER 4

### INFORMATION EXCHANGE AND COMMUNICATION, TOOLS AND FACILITIES

#### Article 25

##### Information exchange

1. Each TSO shall establish information exchange in Emergency, Blackout and Restoration states, according to Articles 16 to 29 [NC OS].
2. Each TSO shall be entitled to request further agreed information from DSOs and Significant Grid Users according to Articles 16 to 29 [NC OS] if this is necessary for operation and restoration in Emergency, Blackout or Restoration State.
  - a) DSOs shall provide the TSO with information about at least:
    - i. islanded Power Generating Modules;
    - ii. ability to build up islands;
    - iii. ability to synchronize Power Generating Modules;
    - iv. ability to synchronize islands; and
    - v. ability of frequency regulation.
  - b) Significant Grid Users involved in Restoration Procedures shall provide the relevant TSO with information about at least:
    - i. their technical conditions

*Under development*

3. Each TSO shall determine priority information to exchange between Synchronous Area members if essential for operation and restoration in Emergency, Blackout or Restoration State, in coordination with other TSOs of its SA.
  - a) Each TSO shall inform its neighbouring TSOs about at least:
    - i. successful islanding and the size of the islands including consumption and generation;
    - ii. the switching of additional generation and consumption and the expected amount;
    - iii. the time to restore electricity supply for grid users;
    - iv. the preferred reliable communication channel to use; and
    - v. problems with the main control centre.
  - b) Each TSO shall inform the Frequency Leader of its SA about at least:
    - i. islanding and the size of the islands including consumption and generation;
    - ii. the switching of additional generation and consumption and the expected amount;
    - iii. the time to restore electricity supply for grid users;
    - iv. the ability of frequency regulation; and
    - v. problems with relevant Significant Grid Users.

4. All TSO shall exchange between each other information in Emergency, Blackout or Restoration state and define additional information if necessary, according to Article 8(11) [NC OS] including at least:
  - a) active and reactive power limits at Interconnectors; and
  - b) potential problems which cause the need for Assistance for Active Power according to Article 15.
  
5. Each TSO shall establish a procedure to inform, in case of Emergency, Blackout or Restoration state, at least the following parties:
  - a) concerned Nominated Electricity Market Operators or other Market Participants [NC CACM];
  - b) concerned DSOs and Significant Grid Users; and
  - c) its National Authorities.

#### Article 26

##### **Communication channels**

1. Each TSO shall establish in cooperation with all relevant TSOs, DSOs, Significant Grid Users and Substations at least two independent communication channels A and B which fulfil the following requirements:
  - a) Communication channel A shall be at least:
    - i. direct/no public communication channel;
    - ii. prioritized;
    - iii. redundant; and
    - iv. blackout proofed and with backup power supply for at least 48 hours.
  - b) Communication channel B shall be at least blackout proofed and have backup power supply for at least 48 hours.

#### Article 27

##### **Facilities**

1. Each TSO shall ensure backup power supply for the main auxiliaries of its main control room for at least 48 hours, including at least:
  - a) SCADA/EMS system;
  - b) Communication channels as stated in Article 26;
  - c) Load Frequency Control equipment;
  - d) Grid visualization equipment; and
  - e) Electrical safety measures.
  
2. Each TSO shall have at least one geographically separate backup control room. The backup control room shall include at least:
  - a) necessary functionalities to operate all System States;
  - b) similar security functionalities like the main control room;
  - c) premises for backup office people; and
  - d) backup power supply for at least 48 hours.

3. Each TSO shall prepare an evacuation procedure for moving from the main control room to the backup control room, in a maximum time of three hours. This procedure shall also include the organisation to operate the System during the evacuation.
4. Each TSO shall ensure backup power supply for at least the most important substations, for at least XX hours.

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## **CHAPTER 5**

### **COMPLIANCE AND REVIEW**

#### **SECTION 1**

#### **COMPLIANCE TESTING OF TSO, SIGNIFICANT GRID USER AND DSO CAPABILITIES**

##### Article 28

##### **General principles**

1. Each TSO shall be able to periodically assess the proper functioning of equipment contributing to System Defence Plan and to Restoration Plan. In particular, each TSO shall be entitled to periodically verify compliance of the DSO's and Significant Grid User's capabilities that are used in System Defence Plan or during Restoration. This compliance verification shall be based:
  - a) either on successful use of this capability during the last twelve months after last compliance evaluation; or
  - b) on tests and simulation carried out by the DSO or the Significant Grid User as detailed below.
2. Each TSO, DSO and Significant Grid User shall organise testing of the capabilities and services that are used in Emergency and Restoration states, in accordance with Article 33 [NC OS], Articles 34 and 35 [NC RfG], Article 38 [NC DC], Article 65 [NC HVDC] and with minimum requirements set forth in this section.
3. Each TSO, DSO and Significant Grid User shall ensure that the System Security is not endangered during the test.
4. The test is deemed passed provided that the criteria defined by the Relevant Network Operator are fulfilled. As long as a test fails to fulfil these criteria, the TSO, DSO and Significant Grid User have to repeat the test.

##### Article 29

##### **Compliance testing of PGM capabilities**

*Under development*

##### Article 30

##### **Compliance testing of Demand Facilities providing DSR**

*Under development*

##### Article 31

##### **Compliance testing of HVDC capabilities**

*Under development*

Article 32  
**Compliance testing of DSO activities**

*Under development*

Article 33  
**Testing of communication channels and tools**

1. Each TSO, DSO and Significant Grid User involved in System Defence Plan or Restoration shall test their backup communication channels, defined in Article 26, at least every year.
2. Each TSO shall test critical tools and facilities that are developed pursuant to Article 8(15) [NC OS], at least every two years. These tests shall be performed according to a test scheme covering both main and backup tools and facilities. Where these tools and facilities involve DSO or Significant Grid Users, these parties shall participate to this testing.

Article 34  
**Testing of facilities**

1. Each TSO shall test the capability of main and backup power sources to supply its main and backup Network Operator's Control Rooms, in accordance with Article 27, at least every year.
2. Each TSO shall test the capability of main and backup power sources to supply essential services of the substations, in accordance with Article 27, at least every four years.

**SECTION 2**  
**COMPLIANCE TESTING OF SYSTEM DEFENCE PLANS AND RESTORATION PLANS**

Article 35  
**Compliance and review of System Defence Plan**

1. Each TSO shall use the details of the yearly written notification on Low Frequency Demand Disconnection provided by the DSO pursuant to Article 20(1) [NC DC] and by the Demand Facility owner pursuant to Article 22(1)(o) [NC DC], to check that the designed Low Frequency Demand Disconnection is properly implemented.
2. Each TSO shall perform a complete review of its System Defence Plan to assess its efficiency, at least every 5 years. This review shall take into account at least:
  - a) recent development and evolutions on its Network;
  - b) capabilities of new equipment installed on the Transmission and Distribution Systems;
  - c) new Significant Grid Users, their capabilities and relevant offered services;

- d) tests carried out and analysis of system incidents pursuant to Article 33 (5) [NC OS]; and
  - e) operational data collected during normal operation and after incident.
3. In case adaptations of the System Defence Plan appear necessary they shall be implemented in accordance with Article 7.

#### Article 36

##### **Compliance and review of Restoration Plan**

1. Each TSO shall perform testing based on computer simulation of parts of Restoration Plan, in collaboration with DSO and Significant Grid Users involved in the part of the Restoration plan that is tested, at least every five years. These simulation tests shall be defined by the TSO in a dedicated testing procedure and shall at least cover:
  - a) Energizing restoration path from Black Start units or Islanded operation capable Power Generating Modules;
  - b) Supplying main auxiliaries of Power Generating Modules being supplied;
  - c) Demand reconnection; and
  - d) Resynchronization of island operating power system parts.
2. In addition, each TSO shall retain the right to perform operational testing of parts of Restoration Plan, in collaboration with DSO and Significant Grid Users involved in the part of the Restoration plan that is tested. These operational tests shall be defined by the TSO in a dedicated testing procedure.
3. Each TSO shall perform a complete review of its Restoration Plan to assess its efficiency, at least every 5 years.

#### Article 37

##### **Compliance testing of communication processes used during Emergency and Restoration**

1. Each TSO shall perform compliance testing of the communication processes foreseen in the Restoration Procedures pursuant to Article 17. These compliance testing shall be organised with all involved parties, during training organised according to Article 30 [NC OS].

#### Article 38

##### **Testing of specific grid users needs**

1. Each TSO and DSO shall organise testing of processes that have been defined in Article 9 and Article 20, in collaboration with the concerned grid users, according to a periodicity to be defined by the Relevant Network Operator in coordination with the concerned grid users.

## CHAPTER 6

### FINAL PROVISIONS

#### Article 39

##### **Amendments of contracts and general terms and conditions**

By [date – the same as the date in Article 40], each relevant TSO, DSO and each relevant Significant Grid User shall amend all relevant clauses in contracts and relevant clauses in general terms and conditions, regardless of whether the relevant contracts or general terms and conditions contain an amendment process, in order to achieve compliance with the requirements of this Network Code.

#### Article 40

##### **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.

It shall apply as [from the day of expiration of a XX years period following its publication] [OR] [from DATE].

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels, [DD] [Month] [20YY]

*For the Commission*  
*The President*  
[Name President of European Commission]