Supporting Document for the Network Code on Emergency and Restoration

25 March 2015

ENTSO-E AISBL • Avenue Cortenbergh 100 • 1000 Brussels • Belgium • Tel +32 2 741 09 50 • Fax +32 2 741 09 51 • info@entsoe.eu • www.entsoe.eu

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1 PURPOSE AND OBJECTIVES OF THIS DOCUMENT

1.1 PURPOSE OF THE DOCUMENT

This document has been developed by the European Network of Transmission System Operators for Electricity (ENTSO-E) to accompany the consultation of the Network Code on Emergency and Restoration (NC ER) and should be read in conjunction with that document.

The document has been developed in recognition of the fact that the NC ER, which will become a legally binding document after Comitology, inevitably cannot provide the level of explanation, which some parties may desire. Therefore, this document aims to provide interested parties with the background information and explanation for the requirements specified in the NC ER, as well as the document outlines the following steps of the work.

1.2 STRUCTURE OF THE DOCUMENT

The Supporting Document is structured as all other supporting documents for the NCs developed in line with the Framework Guidelines on Electricity System Operation (FG ESO). This Supporting Document is therefore presented as follows:

Background

- Chapter 2 introduces the legal framework within which the System Operation Network Codes have been developed.
- Chapter 3 explains the approach, which ENTSO-E has taken to develop the Network Code, outlines some of the challenges and opportunities ahead for System Operation and benefits of the NC ER.

Explanatory notes

- Chapter 4 deals with the requirements of the FG ESO developed by the Agency for the Cooperation of Energy Regulators (ACER) and their implications regarding the NC ER.
- Chapter 5 deals with the explanation of requirements of the NC ER.
- Chapter 6 introduces the next steps in the process.

Appendices

- Appendix 1: Definitions used in NC ER.
- Appendix 2: Current practices in Europe on Emergency and Restoration.
- Appendix 3: Technical background for the LFDD requirements
- Appendix 4: Response to the public consultations
- Appendix 5: Assessment of the NC ER against Framework Guidelines

1.3 LEGAL STATUS OF THE DOCUMENT

This document accompanies the Network Code on Emergency and Restoration, but is provided for information only.

Therefore it has no legally binding status.

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2 PROCEDURAL ASPECTS

2.1 INTRODUCTION

This chapter provides an overview of the procedural aspects of the Network Codes' development. It explains the legal framework within which Network Codes are developed and focuses on ENTSO-E's legally defined roles and responsibilities. It also explains the next steps in the process of developing the NC ER.

2.2 THE FRAMEWORK FOR DEVELOPING NETWORK CODES

The NC ER has been developed in accordance with the process established within the Third Energy Package, in particular in Regulation (EC) N° 714/2009. The Third Energy Package legislation establishes ENTSO-E and ACER and gives them clear obligations in developing Network Codes. This is shown in Figure 1 below:

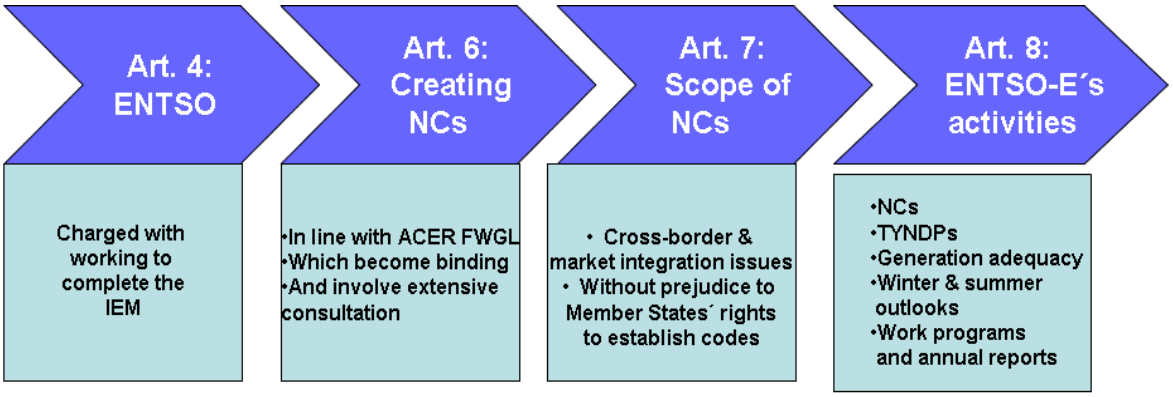

Figure 1: ENTSO-E's legal role in Network Code development according to Regulation (EC) N° 714/2009.

Moreover, this framework creates a process for developing Network Codes involving ACER, ENTSO-E and the European Commission, as shown in Figure 2 below.

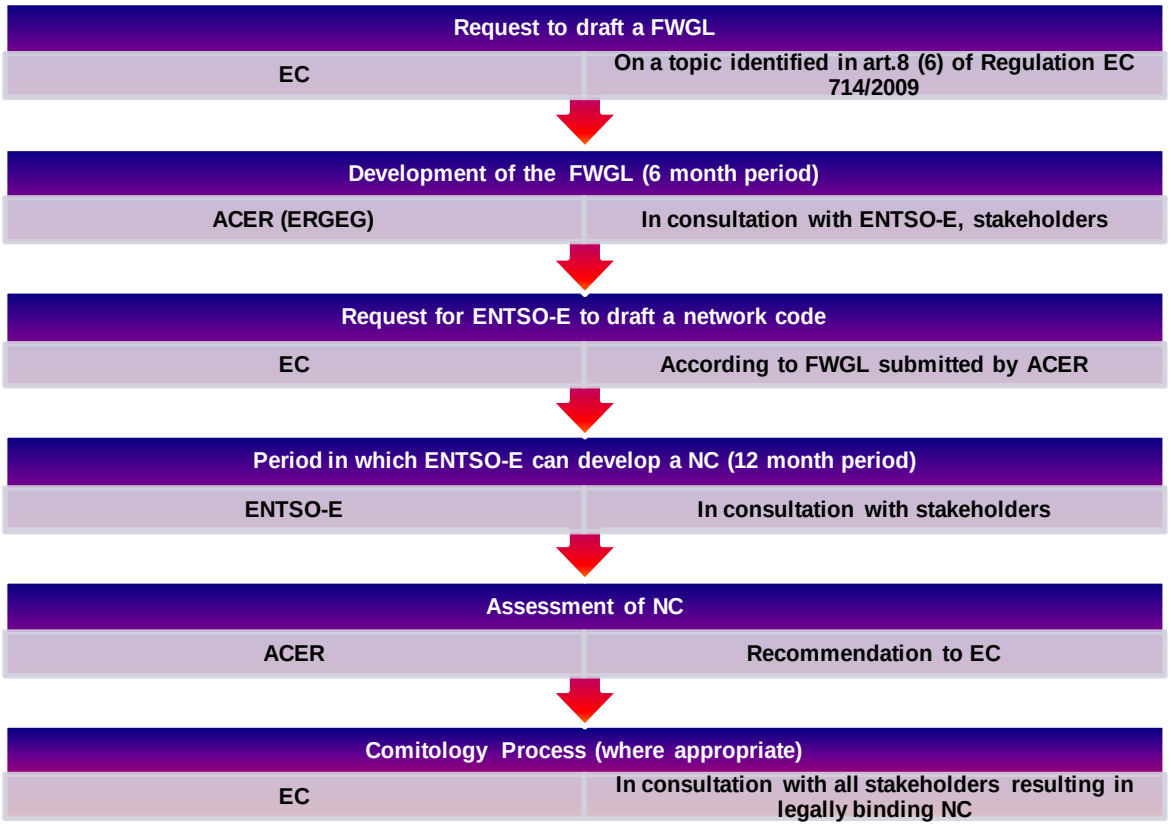

Figure 2: Network Codes' development process [Source: ENTSO-E]

The NC ER has been developed by ENTSO-E to meet the requirements of the FG ESO [1] published by ACER in December 2011. ACER has also conducted an Initial Impact Assessment associated with its consultation on its draft FG ESO in June 2011 [2].

ENTSO-E was formally requested by the European Commission to begin the development of the NC ER on the 1 April 2014. The deadline for the delivery of the code to ACER is the 1 April 2015.

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3 SCOPE, STRUCTURE & APPROACH TO DRAFTING THE NC ER

3.1 INTRODUCTION

This chapter provides the overview of the background and place of the NC ER, covering the guiding principles for the Drafting Team in developing the NC ER, general structure and level of details of the code, challenges and opportunities ahead of system operation, interaction with other Network Codes, interaction with stakeholders during the network Code development process, describing how NRAs are involved and benefits of the NC ER.

ENTSO-E has drafted the NC ER to set out clear and objective minimum requirements for Emergency, Blackout or Restoration States. The aim is to achieve, maintain and restore a satisfactory level of Operational Security of the interconnected Transmission Systems in real time, to support the efficient functioning of the European Internal Electricity Market (IEM), and to allow the integration of electrical Renewable Energy Sources.

Based on the FG ESO and on the Initial Impact Assessment (IIA) provided by ACER, the NC ER states the emergency and restoration principles in terms of technical means, considering compatible market solutions and as such provides support to maintain and restore the security of supply.

3.2 GUIDING PRINCIPLES

The guiding principles of the NC ER are to determine common Interconnected System operation framework, to provide the conditions for maintaining and restoring Operational Security levels throughout the EU, as well as to determine common requirements for Distribution System Operators (DSOs), Significant Grid Users connected to Transmission and Distribution Systems as well as Market Participants, which are relevant for the operation in emergency and restoration situations of the Interconnected System. These principles are essential for the TSOs to manage their responsibilities of secured operation of the interconnected Transmission Systems with a high level of coordination, reliability, quality and stability.

Key objectives of the NC ER are:

- to prevent the propagation or deterioration of an incident, in order to avoid a widespread disturbance and Blackout State; and
- to allow efficient and rapid restoration from Emergency or Blackout System States.

The requirements set out in the NC ER are building on a long history of existing common and best practices, lessons learned and operational needs throughout the European Transmission Systems. This, together with the fact that the European experience of interconnected Transmission Systems operation dates back to the 1950s (ENTSO-E Regional Group Central Europe (RGCE), former Union for Coordination of (Production) and Transmission of Electricity (UC(P)TE)), 1960s (ENTSO-E North, former Nordel), and 1970s (TSO Associations of Great Britain and Republic of Ireland, UKTSOA and ITSOA), distinguishes the NC ER and all other System Operation NCs from other Network Codes in following terms:

- The work on the System Operation NCs does not start from “scratch” but builds upon a wide and deep range of requirements, policies and standards already existing in the different European Synchronous Areas, adapting and developing further these requirements in order to satisfy the requirements from the FG ESO, to meet the challenges of permanent evolution of the energy sector as well as to support the effective and efficient completion of the IEM;
- The subject matter – system operation of the interconnected Transmission Systems of Europe – is vital, not just for the continuous and secure supply of European citizens with electricity, but

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also for the electricity market to function properly, efficiently and for the benefit of all Market Participants. Therefore, any changes, adjustments and developments based on the new (legally binding after Comitology) System Operation NCs framework must acknowledge and respect the fact that system operation cannot be interrupted and "restarted" – TSOs are working on a "living grid"; and

- By their nature and because of the level of technical detail involving all aspects of Transmission System operations, the System Operation NCs are mainly addressing the System Operators; nevertheless, firm links and cross-references, as well as practical dependencies and explanations are established in relation to other NCs, most notably those addressing grid connection, market and regulating power/balancing.

3.3 Background and Structure of the NC ER

Secure and efficient Transmission and Distribution Systems operation can be made possible, only if there is an obligation for the Transmission System Operators (TSOs), DSOs, Significant Grid Users and Market Participants to cooperate and to meet the relevant minimum technical requirements for the operation of the interconnected Transmission Systems as one entity. Even though each TSO has one Responsibility Area, they are responsible for secure and efficient system operation as a common task:

- All systems are to some extent interconnected, and a fault in one area will possibly affect another area. Hence, secure system operation requires close coordination and cooperation between the TSOs.
- Efficient system operation requires close collaboration between all stakeholders; the main purpose of the liberalisation, and therefore of the harmonisation, of the electricity sector was efficiency, more specifically utilizing efficiently the resources for balancing the system. This requires close collaboration and coordination with all stakeholders.

Secure and efficient Transmission and Distribution Systems operation can be made possible only if there is a well-organized preparation of real time operation.

The NC ER provides a basis for this preparation as it defines minimum requirements aiming at efficient System Defence Plan and Restoration Plan. These minimum requirements will be applicable to all TSOs, DSOs, Grid Users of significance to the Transmission System as well as Market Participants.

The NC ER resides under the umbrella of the Network Code on Operational Security, and therefore shares the principles of supporting the coordination of system operation across Europe.

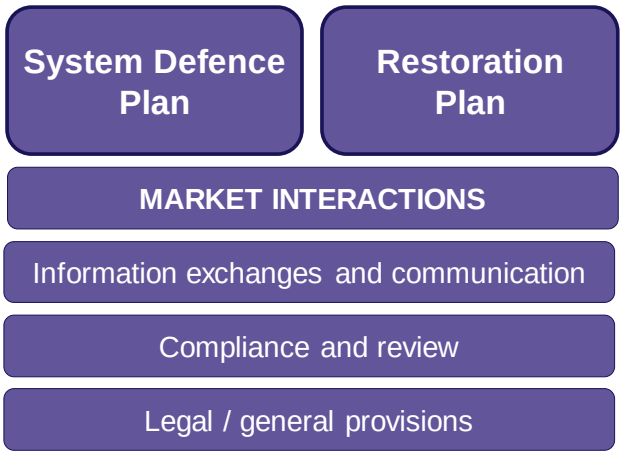

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Figure 3: The NC ER structure

For each Plan, three phases are identified:

Figure 4: Three phases of the plans

1. Design: study phase consisting of defining the detailed content of System Defence Plan and Restoration Plan, according to structure detailed below
2. Implementation: preparatory phase consisting in 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
3. Activation: operational phase consisting of system operational state leading to the use of one (or more) measure(s) from the System Defence Plan or Restoration Plan

3.4 LEVEL OF DETAIL

The System Operation NCs provide minimum standards and requirements related to system operation. The level of detail matches the purpose of the Network Codes:

- harmonising security principles;
- clarifying and harmonising methods, roles and responsibilities of operators and grid users as well as to enable and ensure adequate data exchange in order to future proof the system for integrating innovative technologies and sustainable energy sources, operate the system in a safe, secure, effective and efficient manner; and
- applying the same principles and procedures for different systems to establish a wider level playing field for Market Participants.

In order to achieve the necessary level of European harmonisation, ENTSO-E developed the System Operation NCs by taking a pan-European approach that focused on the most widely applicable requirements. This approach allowed at the same time more detailed provisions at the regional/national level where necessary, with the view of drafting Network Codes for electricity system operation that are open for future developments and new applications.

The FG ESO provided further clarification concerning the issue of European-wide applicability, while pointing out that *"… ENTSO-E shall, where possible, ensure that the rules are sufficiently generic to facilitate incremental innovation in technologies and approaches to system operation being covered without requiring code amendments"*.

Thus, the requirements have been drafted taking into consideration a view of future industry trends, building up a coherent legal mechanism with the appropriate balance between level of detail and flexibility, which focuses on what-to-do, not so much on how-to-do.

Regarding NC ER, harmonisation principles are handled through a global framework, consisting of three coherently addressed levels:

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- **The European wide level** deals with ensuring efficiency of the plans, with common principles for interaction with market mechanism, and with data exchanges;
- **The Synchronous Area level** refers mainly to Frequency management, to System resynchronisation; and
- **The Regional level** groups specific measures of the System Defence Plan such as Assistance for Active Power, Power Flows management, voltage collapse management.

With its strong coordination requirements, this three level framework will ensure a pragmatic and efficient harmonisation of emergency and restoration practices as promoted by the FG ESO.

3.5 CHALLENGES AND OPPORTUNITIES AHEAD OF SYSTEM OPERATION

Today, in line with the challenging objectives addressed in the FG ESO, system operation goes beyond just operating the electric power system in a safe, secure, effective and efficient manner. Aspects such as enabling the integration of innovative technologies and making use of information and communication technologies must be fully integrated, while applying the same principles for the different Transmission Systems of Europe.

In this context, the future challenges for System Operation, which are addressed in particular in the NC ER, include:

- effects resulting from fast growth of embedded generation from Renewable Energy Sources (RES);
- new capabilities of facilities: development of Demand Side Response, High Voltage DC (HVDC) capabilities thanks to new technology... ; and
- needs resulting from the evolution (and completion) of the Internal Electricity Market (IEM).

3.6 INTERACTION WITH OTHER NETWORK CODES

The NC ER is being drafted as a 10th Network Code. Several processes and requirements provided in NC ER are influenced by previous related Network Codes. ENTSO-E sees the coordination of these interactions as an important objective. The most important interactions with other Network Codes have been dealt within the following way:

- The Network Codes on System Operation – these codes consist of the Operational Security NC (NC OS), the Load-Frequency Control and Reserves NC (NC LFCR), the Operational Planning and Scheduling NC (NC OPS) and this Network Code (NC ER). The NC OS is the 'umbrella' code of the System Operation Network Codes. It therefore sets the overall principles for system operation, describes data exchanges and reflects on the common issues with the NC LFCR, NC OPS and the NC ER while these latter three describe their specific processes in greater detail.
- The connection codes (NC Requirement for Generators (NC RFG), NC for Demand Connection (NC DC) and NC HVDC) establish the technical capabilities of the generation and Demand Units connected to the grid. The NC ER references to them in those provisions in which information related to technical characteristics is required. The translation of technical capabilities described in connection codes to operational criteria is done in the NC OS.
- The market guidelines and codes (Capacity Calculation and Congestion Management (GL CACM), Electricity Balancing (NC EB) and Forward Capacity Allocation (NC FCA) define market processes and principles that shall apply as long as possible, unless NC ER situations making it impossible to perform these activities any longer.

3.7 WORKING WITH STAKEHOLDERS & INVOLVED PARTIES

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The legally binding nature of Network Codes, which is achieved through the Comitology process, means that they can have a fundamental bearing on stakeholders' businesses. As such, ENTSO-E recognises the importance of engaging with stakeholders at an early stage, involving all interested parties in the development of the code, in an open and transparent manner.

ENTSO-E's stakeholder involvement comprised of workshops with the DSO Technical Expert Group and public stakeholder workshops, as well as ad-hoc meetings and exchange of views with all interested parties as necessary.

Due to the many questions concerning the functioning of the Transmission System from an operational point of view that arose during the public consultation of the NC RfG, the first ENTSO-E stakeholder workshop on system operation was held on 19th March 2012 in Brussels. The aim of the workshop was to present information focusing on the operation of an interconnected Transmission System, and the physical basis for scoping and drafting the system operation Network Codes. Stakeholders had the opportunity to express feedback and expectations.

In line with suggestions by stakeholders' organizations and following requests by the EC and ACER, ENTSO-E organised three workshops for NC ER with the DSOs Technical Expert Group and four Public Workshops with all stakeholders, both prior to, during and after the public consultations:

- The aim of the first NC ER Workshop, held on 9 July 2014 was to present and discuss the scope of the draft NC ER, which reflected the work completed by TSO experts. The workshop addressed the scope of the Network Code, updated stakeholders on its present state and allowed for discussion and a Q&A session. Stakeholders in attendance included DSOs, industrial electricity consumers, generators, energy traders and turbine suppliers.
- The aim of the second NC ER Workshop (12 November 2014) during the public consultation is presenting the draft NC ER for the formal public consultation after updates have been made to the Network Code based on stakeholder feedback received in the first workshop. The workshop provided stakeholders with the opportunity to discuss their views on the Network Code and for a Q&A session.
- The third NC ER Workshop, held on 8 January 2015, was dedicate to specific topics: Low Frequency Demand Disconnection (LFDD) and Market interaction. Stakeholders expressed feedback on the topics and exchanged views with ENTSO-E.
- The fourth and final NC ER workshop was held on 12 February 2015. Drafting team presented all the changes made after the two public consultations and stakeholders had the opportunity to give their feedback on the Network Code before submitting it to ACER for opinion.

In particular, the following items have been discussed with the DSO Technical Expert Group (with the participation of the 4 European associations of DSOs: CEDEC, EDSO for smart grids, Eurelectric DSO and GEODE) and with Market and Generation units' representatives (through Eurelectric coordination), through exchanges and meetings (17 April 2014, 9-10 July 2014, 10 September 2014, 12 November 2014, 8 January 2015, 12 February 2015):

- Smartgrids;
- Interaction between NC ER and market mechanisms;
- Design and implementation of Low Frequency Demand Disconnection plans, and impact of embedded generation of these plans; and
- Periodic compliance testing of capabilities used in System Defence and Restoration Plan.

3.8 INVOLVEMENT OF NATIONAL REGULATORY AUTHORITIES

The security of the Transmission System is the core business of the TSOs and often requires operational actions to be taken within a very short timeline. In that sense, the responsibility of adopting

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these measures cannot be shifted to the NRAs as it would otherwise lead to delays in the adoption of the necessary operational measures.

On the other hand, the involvement of the NRAs is foreseen for the approval of certain procedures and plans, listed in the Network Code. NRAs will thus have the opportunity to control a priori that these methodologies are compliant with the principles of transparency, proportionality and non-discrimination which the TSOs should respect.

NRAs will also always remain competent for any complaint that a party could raise against a TSO or DSO in relation to the TSO's or DSO's obligations under this Network Code.

Finally, the Network Code is without prejudice to a stronger involvement of NRA or other competent authority which could be established in national legislation, as long as these are not in contradiction with the provisions of this Network Code.

3.8.1 Derogations

The Network Code is in line with the framework guideline and builds on the capabilities required in NC RfG, DCC and HVDC, thus taking into account possible derogations under these NCs. In addition, the Network Code applies the requirements to "Service Providers" which voluntarily opted to provide the services. A derogation process would thus be redundant.

3.9 BENEFITS OF THE NC ER

During the process of scoping the objectives and topics to be included in the NC ER, the objectives and topics defined by the FG ESO have been kept under careful consideration. The NC ER addresses all activities dealing with the preparation of operation and as expressed in the previous paragraph, opportunity has been taken to strongly improve the coordination between the TSOs on a Pan-European, synchronous area and regional level, from which the following significant benefits are to be expected:

- Developing the same principles in which the best practices are incorporated will result in improving the efficiency of system operation when in emergency and during system restoration.
- Introducing basis principles for the management of market mechanisms during emergency, blackout and restoration situations will result in more clarity and efficiency.

The efficiency objective is reached the following way:

- Economic efficiency is taken into account by TSOs in Defence and Restoration Plan design.
- The plans shall be designed with the objective to minimize the overall impact for the grid users using the minimum possible resources.
    - Defence Plans, and in particular load shedding (as a last resort), shall be designed with the objective to minimize the impact for the grid users (for example: using rotational load shedding or applying load shedding to non-preferable load) and also to minimize the total load that needs to be shed taking into account the constraints.
    - Demand Side Response services should be developed (including interruptible load processes). Grid users with interruptible load contracts are to be shed first (before any other load is shed).
    - Restoration Plans shall be designed with the objective to minimize the time to restore the whole system back to Normal State with the minimum resources available taking into account the constraints.

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- These plans need also to consider civil security and nuclear safety issues identified typically by the responsible national authorities when defining “high priority Grid Users” (economic efficiency versus security obligations). These constraints increase significantly the complexity of the problem; TSOs shall analyse different scenarios in order to select the optimum solution.

Globally, the benefits mentioned above cover the ability to maintain the high system security standard as it is nowadays and as it is appreciated by European citizens. With these benefits the TSOs lay a robust basis for facing the new energy transition challenges.

3.10 CONCLUSIONS

A key goal of the NC ER is to achieve as much as possible harmonised and solid technical framework for Emergency, Blackout or Restoration State. Consequently, the requirements have been designed in order to allow fast and efficient organisation that meets the objectives of a secure Interconnected System operation and the effective development of the IEM.

The requirements set out in the NC ER are building on a long history of existing common and best practices, lessons learned and operational needs throughout the European Transmission Systems.

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4 NC ER & FRAMEWORK GUIDELINES COMPLIANCE

This chapter aims to provide a short overview of the requirements of the Framework Guidelines on Electricity System Operation [1] issued by ACER on 2 December 2011.

The Framework Guidelines on Electricity System Operation (FG ESO) focuses on three key challenges, which shall be addressed by four objectives as Figure 5 shows.

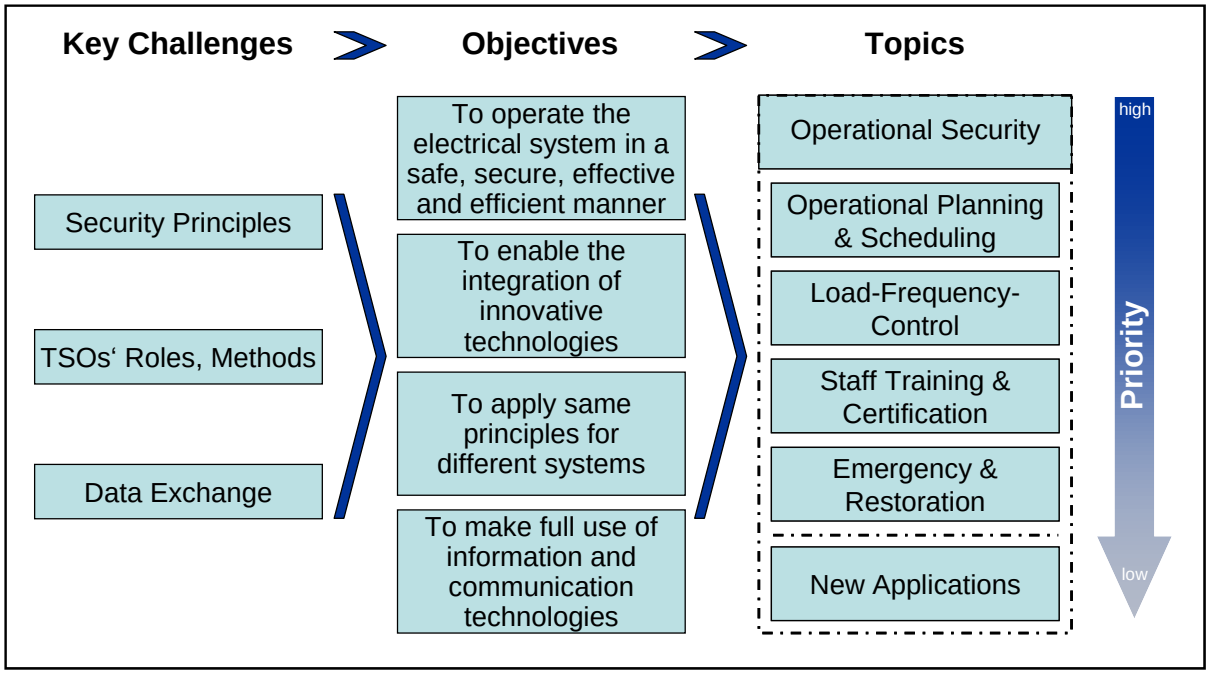

Figure 5: Structure and development flow of the Framework Guidelines on Electricity System Operation

The overall scope and objectives of the FG ESO is *"Achieving and maintaining normal functioning of the power system with a satisfactory level of security and quality of supply, as well as efficient utilisation of infrastructure and resources".* The FG ESO focuses on defining common principles, requirements, standards and procedures within Synchronous Areas throughout EU, especially regarding the roles of and the coordination/information exchange between the TSOs, DSOs and Significant Grid Users.

The requirements described in the NC ER have been formulated in line with the FG ESO and the new developments on system operation, with the aim to ensure a satisfactory level of Operational Security and an efficient utilisation of the power system and resources by providing a coherent and coordinated operation.

According to the FG ESO, NC ER shall define the following criteria, unless when they are already defined in NC OS (items 1 and 4 below):

1. *The criteria for assessing when the power system is in the normal operating state and when it diverges from the normal state. This shall be defined for each synchronous area and shall be communicated between the synchronous areas and EU-wide, respectively within ENTSO-E.*
2. The process, principles and main characteristics for the elaboration of predetermined emergency and restoration plans and related activities on synchronous area level. The principles should be agreed at EU-level. Specific needs of grid users based on national

regulation should be taken into account with a high priority level in the elaboration of restoration plans (e.g. fast power restoration on nuclear plants).

3. Application of the Restoration Plans and procedures for remedial actions;
4. *Principles and characteristics which cause the operating state to differ from the normal operating state, e.g. out-of-range disturbances, flows in the transmission network and on interconnections; active power reserves (automatically and manually activated reserves); reactive power reserves; status of network control system and stability of the system (voltage, frequency and angle);*
5. Load shedding procedures, involving DSOs where necessary, including criteria and taking into account local islanding provisions, responsibilities and efficiency evaluation, but also the design of automatic load shedding systems. A non-discriminatory, transparent and efficient manner of the load shedding shall be ensured;
6. Common principles in system protection settings to ensure system security, efficient usage and reliability (also during critical operating state and restoration state); the related procedures shall be co-ordinated among TSOs to ensure interoperability within and between synchronous areas. System protection shall limit the consequences of operational disturbances to a minimum;
7. Minimum requirements to inform Significant Grid Users in case of alert and critical operating states. Duties of Significant Grid Users in such situations shall be clearly stated.
8. Procedure for restoration of regular market operations after technical restoration.

The NC ER was developed according to the principles defined in the ACER Framework Guidelines on Electricity System Operation of 2 December 2011.

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5 NC ER: EXPLANATION OF REQUIREMENTS

5.0 INTRODUCTION

This chapter aims at providing the reader a basis for understanding the requirements in the NC ER and is based on the questions and concerns raised by the stakeholders at the workshops held during the NC ER development process.

It has the same structure as the NC ER to ease the reading.

5.1 GENERAL PROVISIONS

5.1.1 Subject matter and scope

Explains the boundaries of this Network Code, summarizes its key objectives and clarifies those affected by it. Defines precisely the concept of Significant Grid User for this Network Code and introduce the necessary cross-references with all other affected Network Codes in order to have a fully consistent approach to this key concept.

As in all other Network Codes, the subject matter and scope of this System Operation Code are defined in terms target audience and Significant Grid Users, dependencies with other Network Codes and goals are defined in this Article.

The list of Significant Grid Users is derived from the one in NC OS, with the addition of HVDC Systems and DC-connected Power Park Modules, and without the Demand Facilities providing Demand Side Response, that are addressed in NC ER as “Service Provider”. (see also the General Answer on Service Provider in Appendix 4, on page 65)

The application of the Network Code to Type A Power Generation Modules is also considered, provided they act either as Defence Providers or Restoration Provider. The objective is to be able to integrate them in the processes defined in the Network Code. At the moment it is not current practice and it is not planned to use Type A Power Generation Modules in Restoration Plans, but NC ER should let this possibility open for the future.

In addition, this article provides that Types A and B Power Generating Modules could fulfil the requirements they are subject to directly or indirectly, via e.g. an aggregator, so as to ease the compliance with this Network Code by these Power Generating Modules. This provision applies also to Demand Side Response.

Finally, this article also includes a paragraph about possible delegation of tasks to Regional Security Coordination Initiatives (RSCI) in the Emergency and Restoration context. It must be noted that such a delegation is included in NC OS and applies to any System States. One could ask if there could be a specific role for RSCIs in Emergency, Blackout and/or Restoration States:

During Emergency, the RSCI may perform the same activities than in Normal and Alert states. For instance, in case of preparation of a measure of the System Defence Plan (Manual Demand Disconnection, Assistance for Power Supply, power flows management ...), requiring coordination between several TSOs due to the area concerned, the RSCI may support this coordination, through Security Analysis studies etc...

During Restoration, an RSCI could provide coordination services, especially during resynchronisation phase and/or top-down re-energisation strategy.

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But RSCI are not granted today any role and responsibility in real-time operation, neither in activities related to emergency and restoration, even in “off-line”. ENTSO-E position paper on TSOs coordination for system operation does not cover real-time activities and addresses activities performed on another timeframe. Enlarging the scope of mandatory activities for RSCI raises new questions that need to be considered:

- Responsibility for the final act on the system
- Data and tools
- Skills and knowledge
- Added-value for “rare” situations versus critical size of trained and skilled people

These questions are not neutral and cannot be answered and agreed easily.

Thus, even if RSCI may support TSOs in some situations, assign to them a role directly in the Network Code does not seem to be the appropriate answer to the development of coordination among the TSOs.

Who are the neighbouring TSOs in the context of the NC ER?

When referring to “neighbouring TSOs”, the Network Code addresses TSOs directly connected (via at least one AC or DC link), or TSOs connected through a TSO which have no relevant asset on its grid (i.e. no relevant demand facility and no relevant Power Generating Module).

For instance: National Grid and Tennet NL are neighbouring TSOs, even if connected via Britned TSO.

Using the approach of NC OPS, “neighbouring TSOs” are “neighbouring Outage Coordinating TSOs”.

5.1.2 Definitions

Explains the terms used in this Network Code, while ensuring the same terms are used in existing EU law and other ENTSO-E Network Codes. The definitions have been introduced according to the following principle (i) first use definitions from the EU Directives and Regulations if existing; (ii) second use existing definitions from the other ENTSO-E Network Codes the development of which is in a more advanced phase than this Network Code; (iii) only if no definitions from (i) and (ii) can be applied introduce a new definition in this Network Code.

Cross-references with other ENTSO-E Network Codes: none (but using the definitions from all other ENTSO-E Network Codes)

The definitions applicable specifically in this Network Code are introduced in this article; the definitions from the Directive, Regulation and those which are already introduced in other Network Codes are used as they are, and the first paragraph of this article expressly provides for the application of these definitions to this Network Code.

The definitions are listed by order of appearance in the Network Code.

The Appendix 1 of this document lists all the definitions used in the NC ER. In addition, the on-line tool “ENTSO-E Metadata Repository” gives access to already defined terms.
https://emr.entsoe.eu/glossary/bin/view/GlossaryCode/GlossaryIndex

5.1.3 Regulatory aspects

Addresses the regulatory aspects of relevance for this Network Code.

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Cross-references with other ENTSO-E Network Codes: referring to the capabilities required in the NC RfG and NC DCC for the Power Generating Facilities, Demand Facilities an HVDC links and the conditions for those which are not a subject of relevant provisions – binding them to those technical requirements applying to them pursuant to the Member State national legislation. For sake of clarity, requirements related to communication systems used for Restoration purposes, defined under Article 39, shall be applicable to both existing and new installations, since they are not considered as "technical capabilities" described in the connection codes.

The principles to be respected in the whole Network Code and by fulfilling the requirements of this Network Code need to be appointed in one place. Benefits have been taken from the discussions on these other System Operation Network Codes for system operation by clarifying the elements to be taken into account by the TSOs when defining terms and conditions pursuant to this Network Code.

5.1.4 Regulatory approval

The article establishes all regulatory approvals required in application of this Network Code. It has been developed in a similar way than other System Operation Network Codes.

The paragraph 2 lists the elements that shall be submitted for NRA (or any other relevant competent authority) approval (mainly the terms and conditions to be developed pursuant to this Network Code).

The paragraph 3 lists the elements that shall be notified to the NRA (or any other relevant competent authority). These notifications are without prejudice to each national organisation and legislation relatively to approval or not of the notified elements.

5.1.5 Recovery of costs

Defines provisions for recovery of costs related to the obligations from this Network Code, including assessment by NRA, recovery via Network tariffs, providing any necessary additional information by the TSOs.

Required NRA approval: general NRA involvement and key role in costs assessment, recognition and recovery through the regulated Network tariffs

The issues related to the recovery of costs in relation with this Network Code are introduced in line with the equivalent provisions in the draft CACM Guideline, as approved in comitology on 5 December 2014.

5.1.6 Consultation and coordination

This article gives general principles to define how "consultation" and "coordination" shall be organised, from a general point of view, each time such a process is required in the Network Code. It aims at providing clarity on these two processes that are essential to operate a system, interconnected between several countries, and with strong interactions between the TSO, the DSOs and the significant grid users.

- Consultation is used each time a decision has to be made before real time or in real time, taken into account possibilities and constraints from different parties.
- Coordination is used each time, in addition to a decision, actions have to be executed in real time by several parties.

The article identifies measures of the System Defence Plan and Restoration Plan that require a consistency check, to assess they are not contradicting each other, or among them. For efficiency

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reasons, this consistency assessment shall be jointly performed, among the TSO of the widest coherent area. One could foresee dedicated task forces to perform this activities, most probably at Synchronous Area level, with experts skilled in the phenomena to be managed by the assessed measure.

For instance, the consistency assessment of frequency management procedures could be performed by expert group on frequency, established at SA level.

5.1.7 Confidentiality obligations

Ensuring that obligations for confidentiality are specified in a clear and unique way, applicable to all TSOs and respective other entities, most notable RSCIs.

The provisions for confidentiality are important for TSOs and any other entities.

The wording of this article has been aligned on the draft CACM Guideline, as approved in comitology on 5 December 2014.

5.1.8 Agreement with TSOs not bound by the Network Code

Clauses introducing the obligation for Agreement with TSOs not bound by this Network Code shall be implemented to guarantee that they also cooperate to fulfil the requirements under this Network Code.

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5.2 SYSTEM DEFENCE PLAN

5.2.1 Remedial Actions & System Defence Plan measures

The CACM Guideline defines a Remedial Action as any measure applied by a TSO or several TSOs, manually or automatically, in order to maintain Operational Security. Remedial Actions serve, in particular, to fulfil the (N-1)-Criterion and to maintain Operational Security Limits. It must be understood as Remedial Actions being mainly dedicated to Normal and Alert States whereas System Defence Plan measures are to be used specifically in Emergency State when (N-1)-Criterion and Operational Security Limits are already violated.

Additionally, it has to be considered that System Defence Plan measures are complementary to Remedial Actions and can be activated while Remedial Actions are ongoing. We can, for example, imagine the following situations:

- An Emergency State declared a few minutes after an Alert State with Remedial Actions still ongoing.
- Only one Operational Security Limit being violated at the same time (e.g. frequency limit is violated while power flows are secured). In that case the TSO is in Emergency State and activates System Defence Plan measures to manage the frequency deviation but this TSO may also need to activate at the same time Remedial Actions to manage power flows.

Remedial Actions may include, but are not limited to the following:

- re-dispatching or counter trade actions (including Demand Side Response and increase/decrease energy storage);
- topology changes in the network;
- adjusting flows by phase shifters and other flow controlling devices;
- use of reactive power devices (tap-changers, reactors, capacitor banks, SVC, etc.);
- request (or control if available) additional voltage/reactive support from power plants;
- HVDC Systems active and reactive power control; and
- System Protection Schemes actions.

System Defence Plan measures may include, but are not limited to the following:

- start or stop/disconnection of Power Generating Modules;
- Demand disconnection or Energy Storage disconnection;
- instruction to Significant Grid Users to change their Active and Reactive power outputs;
- instruction to DSOs to change voltage regulator set-points on transformers on their grid;
- behaviour change of the Load Frequency Control Structure (e.g. freezing the automatic activation of FRR);
- Low Frequency Sensitive Mode activation;
- HVDC Systems active and reactive power control;
- System Protection Schemes actions (including Automatic Low Frequency Demand Disconnection and On-Load Tap Changer Blocking Schemes);
- Requesting maximum or minimum values of Reactive Power to Significant Grid Users in coordination with DSOs;
- Assistance for Active Power; and
- Cross-Zonal Allocated Capacity curtailment.

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5.2.2 General Principles

5.2.2.1 Design of the System Defence Plan

The System Defence Plan is essentially a document describing **automatic measures** (referred to "Schemes" in the Network Code) and **manual measures** (so called "Procedures" in the Network Code) that aim at limiting the extension of disturbances and at stabilizing the system when in Emergency, in order to return to Normal State as soon as possible with minimal impact on grid users (incl. end customers) using the Restoration Plan. It is elaborated by each TSO, taking into account the prescriptions of this and other NCs, superior legislation (public health and safety, nuclear safety etc.) as well as possible local specificities.

At the moment System Defence Plans across Europe are based on:

- Inter-TSO agreements in Synchronous Areas (e.g. Operation Handbook Policy 5 in Continental Europe);
- Bilateral contracts between TSOs; and
- National law provisions.

As previous system disturbances[1] have shown, large-scale system failures do not respect national or TSO responsibility area borders. With the growing integration of European electricity market and stronger interconnection between TSOs, the risk for large scale incidents remains high. Therefore NC ER introduces a new pan-European layer harmonizing all System Defence Plans and ensuring their interoperability. Still, there is the possibility for local specificities to be covered by national laws and synchronous area agreements respecting different historical development, different characteristics of synchronous areas or even different characteristics of TSOs and DSOs networks such as existence of electrical corridors, specificities of equipment and materials, structural load/generation imbalances in some areas...

Since the System Defence Plan affects almost every grid user (DSOs, Power Generating Modules, HVDC operators, ...) it has to be made by the TSO, which is an entity with oversight over all grid users, in consultation with all impacted entities. When designing the System Defence Plan, TSOs have to make sure that:

- measures of the Plan, implemented mostly by individual grid users, complement each other instead of countering;
- the measures are adequate to cope with expected problems; and
- only the necessary amount of measures to cope with the problem is activated to and thus minimizing impact on grid users and duration of disturbance and therefore maximizing economic efficiency.

[1] See for example incident report https://www.entsoe.eu/fileadmin/user_upload/_library/publications/ce/otherreports/Final-Report-20070130.pdf

To ensure the System Defence Plan is non-discriminatory, efficient and effective[2] each TSO has to notify at least elements listed in the Network Code to the NRA or other authority if specified by national law, after entry of the NC into force and every time significant changes are made.

The economic efficiency of the System Defence Plan cannot be assessed by looking at the Plan alone. Instead the impact on the whole society has to be considered. This is a very complex task for a TSO, operator of a power system, to do. The Network Code therefore considers the System Defence Plan as economic efficient when the three previous bullets are met. After entering into force of relevant Network Codes (most notably NC RfG and NC DCC) the TSO also has to respect that some grid users are already subject to requirements of these Codes while others are still subject to previous rules. As the number of users compliant with new Codes will grow, TSOs will have to use their new capabilities, taking into account grid configuration and overall efficiency.

5.2.2.2 IMPLEMENTATION OF THE SYSTEM DEFENCE PLAN

The implementation of the measures of the System Defence Plan is the phase consisting in the development and installation of all necessary means and in the procurement of services necessary to allow the activation of the plan; the implementation is carried out by TSOs and notified DSOs and Significant Grid Users which have a major role in implementing the System Defence Plan as well as by Defence Service Providers. Concerning Significant Grid Users and new type A Power Generating Modules connected on the Distribution System, DSOs will have most of the time a role in the implementation (e.g. roof-mounted PV modules), through the notification process described in the NC.

For a Significant Grid User and new type A Power Generating Modules implementing a System Defence Plan may mean for example:

- Changing settings of existing protections or frequency regulation;
- Altering procedures during Emergency States; and
- Installing or setting relays for automatic schemes.

5.2.2.3 ACTIVATION OF THE SYSTEM DEFENCE PLAN

Automatic schemes are part of the System Defence Plan measures. Activation of these measures is a matter of design of the scheme and real-time operational conditions. There is no human action required to activate such measures.

Manual activation of the System Defence Plan procedures can be necessary for example in the following situations:

- The system is in Emergency State and no Remedial Action is available (as described in chapter 5.2.1).
- Intraday and close to real-time studies (i.e. Operational Security Analysis) show an Emergency State is imminent and no Remedial Action is available. A given example is the manual Demand Disconnection to avoid a drop of frequency. In this case, the TSO may need to activate this measure before the actual drop of frequency to mitigate the risk of a drop too quick for the TSO to react before activation of Automatic Low Frequency Demand Disconnection in its Synchronous Area.

[2] In line with Regulation (EC) No. 714/2009.

5.2.2.4 INTER-TSO ASSISTANCE AND COORDINATION IN EMERGENCY STATE

The basic principle in Emergency State is that all TSOs will provide to the TSO in that state all the possible assistance without putting their own system at risk.

A TSO is not allowed to knowingly put the rest of the interconnected system at risk. Therefore, a manual or automatic opening of a cross border interconnector shall be among the last measures to be considered. It should always be coordinated together with the neighbouring TSOs, unless an immediate risk for personal safety or equipment damage exists.

The assistance to a neighbouring TSO can be provided through both AC and HVDC interconnections and through both manual and automatic actions. The principles of the HVDC automatic actions are specified in the NC HVDC. (See in paragraph 5.1.1 “Who are the neighbouring TSOs”)

5.2.3 Measures of the System Defence Plan

5.2.3.1 FREQUENCY DEVIATION MANAGEMENT PROCEDURE

Frequency deviation management is among the most important topics of the System Defence Plan since frequency is the same in all parts of the Synchronous Area. Therefore coordination of actions in this field is of the utmost importance.

NC OS Article 9(3) foresees a procedure for frequency management, drafted by TSOs of each synchronous area. NC ER requires each TSO to describe specific frequency management measures that respect the common procedure. These measures:

- include manual and automatic actions;
- cover under- and over-frequency deviations; and
- must activate before activation of the Low Frequency Demand Disconnection, if the nature of the frequency deviation permits.

The criterion to enter Emergency State due to frequency deviation is defined in NC LFC&R. This criterion is used by NC ER to define the activation condition of the Frequency management Procedure.

When this criterion is reached, it is important to avoid the LFC operating mode will endanger the system security through activation in the opposite direction. For instance, in Continental Europe, this would be achieved by freezing the automatic activation of Frequency Restoration Reserve. Indeed in such a situation, the first priority of TSOs shall be to support frequency, while limiting the amount of cross-border exchanges that are activated without manual control and therefore potentially endanger the interconnected transmission system.

During the frequency deviation, different phenomena can have an impact on frequency:

- The activation of Demand Side Response and Limited Frequency Sensitive Mode will result in additional active power generation in addition to the FCR and FRR provided by Power Generating Modules; and
- Some Power Generating Modules (especially embedded generation) can disconnect from the grid, thus further increasing frequency deviation.

Each TSO shall take into account above-mentioned behaviour and aim that their combination in addition to complementary actions in its Responsibility Area, will result in:

- overall netted power increase in case of under-frequency; and

- overall netted power decrease in case of over-frequency.

In case of under-frequency one way of restoring frequency is through demand disconnection. However, since the TSOs have to minimize the impact on system users (including end customers), the demand disconnection has to be seen as a last-resort measure for avoiding blackout. Therefore, each TSO has to design its frequency deviation management in a way that Limited Frequency Sensitive Mode – Underfrequency, Demand Side Response and any other usable measures are activated first. If these are not sufficient[3] to restore frequency, only then Manual Demand Disconnection (manual - for cases of low frequency gradient) or Low Frequency Demand Disconnection (automatic – for cases of high frequency gradient) may be activated.

For example: If type A Power Generating Modules disconnect due to under-frequency deviation, the concerned TSO has to compensate for this loss of generation. This may be done through activation of additional generation and/or demand disconnection. Since type A generating modules are most likely connected to the DSO and additional power generation will come from Power Generating Modules who are Significant Grid Users, the design of this measure has to be done in collaboration with DSOs and SGUs.

Among the measures that TSOs can activate individually to support frequency restoration before nomination of the Frequency Leader are for instance changing an active power set-point of Power Generating Modules, remote cease of active power of new type A Power Generating Module (as defined in NC RFG, through the Defence Service Provider mechanism) or, as a last resort measure, manual demand disconnection.

5.2.3.2 AUTOMATIC UNDER-FREQUENCY CONTROL SCHEME

5.2.3.2.1 General structure of the Article

This article provides a European framework for the design of the automatic low Frequency control scheme, which includes the automatic Low Frequency Demand Disconnection (LFDD) scheme.

In a highly meshed power system, like a Synchronous Area, frequency instability phenomena can arise as consequence of various events, like large power outages or cascading faults driving to system splitting. Especially when the system is separated along highly loaded transmission corridors, the remaining isolated areas suffer a high amount of sudden surplus or deficit of power which results in frequency deviation.

The under-frequency transients can be additionally worsened, as operation experience shows, by the loss of conventional generation and dispersed generation.

In such a case it is of utmost importance to stabilize the frequency above the disconnection threshold for generating units (47.5 Hz). This is achieved by adequate automatic Low Frequency Demand Disconnection Scheme, which creates a certain margin before definitive trip of units.

Such automatic Low Frequency Demand Disconnection Scheme is a mandatory plan that the TSO shall implement according to given parameters. Below the frequency of last mandatory load shedding

[3] Their volume compared to power deficit, rate of activation compared to frequency gradient as well as geographical placement of the power deficit and PGMs activation, may cause their insufficiency.

level, other measures and defence strategies can be designed and implemented at TSO level in order to allow faster restoration process, ensuring of course to not endanger transmission system stability.

Additionally, demand disconnection based on frequency gradient is allowed in special cases. The basic concept of frequency gradient is to anticipate demand disconnection and avoid further frequency drop, especially in areas facing regular high import power balance and where a network splitting may lead to severe under-frequency transients. The use of frequency gradient is limited to a specific range of frequency and with gradient above a defined threshold which allows activation in case of very huge incident or network splitting, at the condition that the characteristics of general Demand Disconnection Scheme are respected. In this conditions, in fact, the frequency deviation is due to an event bigger than the Reference Incident (the threshold of 0.3 Hz/s, currently used in some areas of Central Europe, correspond to a power imbalance above 3.6% of total load, by far bigger than the Reference Incident, assuming an extremely low inertia constant in the whole synchronous area as 6 s).

5.2.3.2.2 LFDD study (for Synchronous Area Continental Europe only)

The harmonisation of Automatic Low Frequency Demand Disconnection Scheme among TSO of a same SA is motivated by:

- the principle of solidarity;
- the technical development of load shedding relays; and
- the necessity to prevent over and under-compensation as a result of Demand Disconnection Scheme, leading to frequency deviation not compliant with frequency connection range of distributed generation.

An efficient Demand Disconnection Scheme shall be designed on the basis of the following general principles:

- Evenly geographically distributed and effective shed load between TSOs as well as within a TSO area,
- Same reference for frequency and shedding load steps across the interconnected system,
- Ability to compensate the maximum credible active power deficit of the system,
- System implementation allows the effectiveness of Demand Disconnection Scheme: it means a minimal necessary shedding of load,
- Compensate disconnection of dispersed generation disconnection at unfavourable frequencies
- Avoid over frequency (overcompensation), overvoltage and power transients that can lead to an additional loss of generation.
- Compensate statistical failed trip by load shedding relays and conventional generation lost during the under frequency transient,
- Avoid splitting of network by intervention of line protection and, if necessary control network splitting scenarios.

Against the background that the concept must be robust in a wide range of scenarios and taking into account the existing load shedding schemes, a study has been performed by ENSTO-E experts in order to establish exact parameters to be included for Continental Europe. Main results and recommendations of this study are presented hereunder. The full study is annexed to the Supporting Document (Appendix 3).

The approach of the study is normative; this means that model used by ENTSO-E experts is the same adopted to study performance and requirements of regulation and effects of the Dispersed Generation over the system.

5.2.3.2.3 LFDD scheme design recommendations (for Synchronous Area Continental Europe only)

A general finding from the simulations which all parties should bear in mind is the fact that a load shedding plan is the last resort in a system that is in crisis due a sequence of severe perturbations. This means that ENTSO-E Demand Disconnection Scheme in some situations leads from a less than optimum state of the system to not optimal final state, and in few cases, cannot avoid a system black out.

This conclusion is in line with the state-of-the-art experience and it is a consequence of the behaviour under extreme circumstances. Many local problems such as voltage stability, loss of units due to false tripping by protection, grid splitting, can produce unexpected situations within the system. These particular effects can be studied with more detailed models, but experience shows that uncertain information about parameters and real grid configuration at moment of the transient studied can lead to results which are even more inconsistent.

So starting from these considerations, the study was based on a normative model that guarantees an adequate degree of conservative approach without deviating to far from the real system behaviour.

According to the recommendation from the study (see Appendix 3), the maximum value of demand that shall be shed per single TSO is 50% of the total load in this TSO area; the minimum value that shall be shed per single TSO is 40% of the total load.

The number of steps and the value of the total disconnected demand is chosen in order to avoid overcompensation or frequency stagnation at low values. The appropriate ideal frequency to the system after load shedding intervention could be in the band of ± 200 mHz around 50 Hz; but this is not possible or feasible in all studied cases.

The amplitude of each step shall be in the range of 5-10%. The minimum mandatory number of steps for single TSO is 6; this value is a compromise between the equal linear theoretical setting and the optimal practical solution. If the maximum permitted amplitude of single step is exceeded, the TSO must increase the number of steps in order to comply with it.

Selected operating frequency range of the automatic Demand Disconnection Scheme is 49.0 - 48.0 Hz. The highest value is determined by the minimal frequency value of the automatic disconnection of pump-storage generating units from pumping mode (e.g. 49.3 Hz) taking into consideration a necessary security margin. The lowest value is determined by the minimal required operating frequency value (47.5 Hz) of the generating units taking into consideration a small frequency band also with necessary security margin for an individual additional load shedding of TSOs if it is needed. This additional load shedding can be important after a network split in case of island operation.

5.2.3.2.4 LFDD requirements in the NC ER

Based on the study, the NC ER develops requirements for Automatic Low Frequency Demand Disconnection Schemes in all European TSOs, with dedicated parameters for each Synchronous Area.

Objectives of the LFDD

The objective of an LFDD scheme is to shed load to manage a Frequency deviation, using the load in the system at the moment of the incident. The load shedding is a stepwise mechanism; each step of the plan shall shed a given % of the load (with a given tolerance).

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The table 1 of NC ER describes the expected behaviour of the scheme, and gives the percentage of load to be shed in real time, to manage a frequency deviation, expressed in percentage of Total Load at national level. When the frequency deviates between the thresholds in rows 1 and 3, the LFDD scheme shall disconnect an amount of load inside the range defined by rows 2 and 4, with tolerance margin corresponding to the implementation range (row 5) (see also Figure 6 below). Each TSO shall thus design its LFDD scheme with the objective to shed load in real-time according to this table.

Shedding Load in real-time

The amount of Demand to be disconnected is expressed in percentage of the load, to reflect the real time behaviour of the system (real load at the moment of the incident). For instance, when the frequency reaches 49.0 Hz, at least 5% of the load has to be disconnected:

- in high load situation (100 GW for instance), 5 GW shall be shed to manage the frequency deviation
- in low load situation (50 GW for instance), 2,5 GW shall be shed to manage the frequency deviation
- applying a fix amount of load (or a percentage on a fix value) would lead to an over or under compensation of the frequency deviation

Total Load

It is important to note that article 9(2)b of NC ER and the definition of Demand in NC ER ensure that for each specified frequency step, disconnected Demand will correspond to a specific netted value (load – generation) covering both following situations:

- Generation (mainly embedded generation) connected behind DSOs disconnection relays that will be disconnected by LFDD scheme; and
- Generation that would disconnect due to the frequency deviation before the frequency reach admissible disconnection thresholds defined in NC RFG.

The percentage of Demand to be disconnected applies to Total Load, which is defined in the regulation 543/2013:

- *Total Load, including losses without power used for energy storage, means a load equal to generation and any imports deducting any exports and power used for energy storage.*
- *Notes: Generation should include all types of generation connected, including auto-generation (e.g. solar panels for own use) whether estimated or measured.*

In other words, the Total Load means the total power consumed in real-time in a given area at all voltage levels, including losses, but without the power used for Energy Storage. It means the real-time total power equal to the sum of generations and imports in an area deducting exports and the power used for Energy Storage.

Since the Total Load is used to define the amount of Demand to be disconnected, it shall be expressed in MW (or kW, or GW). (i.e. Total Load in “Power”, not in “Energy”)

The amount of load is estimated at **national level**: due to characteristics of each system, and implementation choice, some local areas (DSOs) may shed more or less load. From Synchronous Area perspective, the global amount of load that is shed in each country is important, to reach proportionality among all the Member States. But if locally, the amount of load shed differs, it is not a cross-border issue.

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Implementation range

The implementation range (in table 1) around the "ideal LFDD target" provides some implementation flexibility which is necessary for different reasons including the following:

- Demand disconnection relays are installed on the network (mainly at distribution level) so that their activation corresponds to the disconnection of a given percentage of the Total Load at a given time of the year. Depending on the type of generation/consumption behind the relays (industry, domestic with more or less thermo sensitivity, renewable energy sources infeed…), the demand disconnected by a relay changes.
- After an incident (loss of an important amount of generation, grid split…) the frequency drops in the whole synchronous region but it will not be exactly the same in every substations of the region at the same precise moment. It will lead to the activation of some relays before others even if supposed to work at the same frequency thresholds.
- The disconnection of demand by some relays will lead to a disruption of the frequency signal and could lead to a start over of the frequency measurement by relays around, meaning an additional delay to their activation.

The implementation range corresponds to the tunnel in dotted line in the Figure 6.

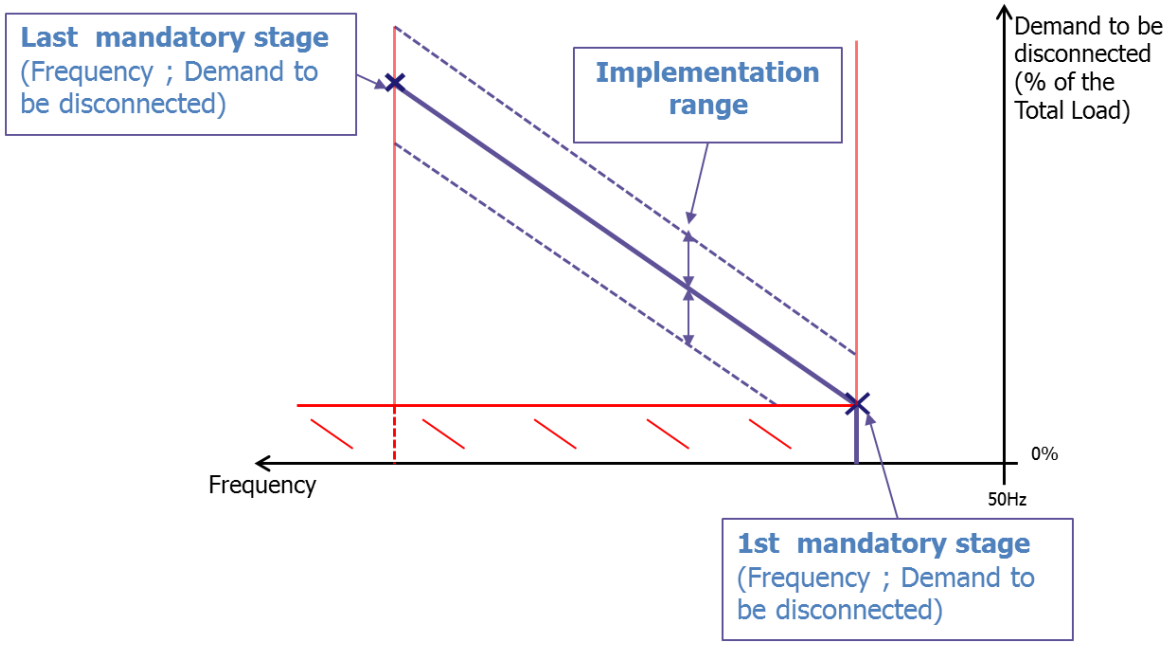

Figure 6: The implementation range for LFDD plan

Localisation of LFDD relays

Each TSO and/or DSO shall locate its Low Frequency Demand Disconnection relays taking into account at least load behaviour and dispersed generation. In particular, TSO and DSO shall consider the dispersed Renewable Energy Sources on the networks. They shall also consider the load behaviour: type of load, characteristics of the load, average/minimum/maximum amount, load pattern, etc.

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The TSO and DSOs will then decide where to implement the LFDD relays (geographical area, concerned substation and voltage level) and which settings to be set (number and size of the steps).

Operating time of the LFDD relays

The expected **total tripping time** of load shedding relays (=”operating time” in NC ER) is the sum of the time needed for the measurement of frequency, trip action of auxiliary circuits and circuit breaker opening time. NC ER requests to avoid intentional delay, considering that the operating time is set in [NC DC] to 150 ms for new devices: **it is assumed that the operating time includes the suitable time for sufficiently accurate frequency measurement and allows to avoid the activation of relays produced by frequency spikes.**

Number of steps

The code requires a minimum number of steps (6): it should be underlined that it doesn’t mean to implement 6 steps in each relay.

Nowadays several types of relays are used for LFDD; the change of settings is possible in most of them.

It is a matter of design strategy to define an appropriate scheme of LFDD, combining 2-4 steps for each substation/relay to reach a global target of 6 steps (or more) in a wider area, till national level. Even if this is not current practice in all European countries today, one should notice it is in place in several Member States, and properly working.

With such approach, by a proper design of the overall plan in each TSO area, for almost all the substations the complete replacement is not necessary and retuning of settings in existing relays is enough: the related costs in this case are covered by usual maintenance costs.

5.2.3.3 AUTOMATIC OVER-FREQUENCY CONTROL SCHEME

This article provides a framework for the design and the coordination at European level of the high Frequency control scheme.

The motivations for having an automatic over-frequency control scheme are the same as for under-frequency. Besides, a lack of automatic control in severe high frequency transients could lead to a massive disconnection of Power Generating Modules resulting in an extreme under-frequency, with a concrete risk of system collapse.

This over-frequency control scheme not being covered by any current practice in Europe today, providing accurate and harmonized requirements in the Network Code is not feasible. Therefore NC ER requires TSOs of each Synchronous Areas to perform a study and implement the scheme according to the results of this study.

The key element for implementation of the scheme will be the Limited Frequency Sensitive Mode - Overfrequency, provided by generators as required in [NC RfG], as the primary method to control over-frequency. In the case it would not be sufficient, the scheme should be complemented by a step-wise linear disconnection of Power Generating Modules respecting the conditions that will be defined by the Synchronous Area study.

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5.2.3.4 VOLTAGE DEVIATION MANAGEMENT PROCEDURE AND AUTOMATIC SCHEME AGAINST VOLTAGE COLLAPSE

Keeping Voltage at the optimal value (e.g. to minimize losses) in Normal System State is mostly not a cross-border issue. The exception is keeping voltage at bordering substations where a reactive power flow on interconnectors caused by voltage difference on each side of the border increases interconnector loading. In addition, the voltage collapse phenomena can impact a wide area if not solved properly by automatic schemes.

Generally, the biggest impact on voltage has the source closest to the problem. Therefore each TSO has to prepare its Voltage management Procedure using measures as follows:

- Excitation of synchronous machines;
- Reactive Power sources (such as reactors, capacitors, STATCOM, VSC…);
- Changing Reactive Power flow at Connection Point of Transmission Connected Distribution Networks and Transmission Connected Demand Facilities (thus using embedded reactive power sources);
- Help from neighbouring TSO; and
- Manually disconnecting load (only in under-voltage).

The procedure described above applies to problems which develop slowly (minutes) and operators have time to activate appropriate measures. In case voltage problems appear too quick for operator to react (seconds, e.g. after cascade tripping) TSOs have to prepare Automatic Schemes against Voltage Collapse. Since these measures are automatic they have to be tailored to local grid configuration. The Network Code only gives high-level requirement and specifies basic Schemes that may be needed at national level to manage operational security:

- Automatic On-Load Tap Changer Blocking Scheme to prevent tap changers from trying to keep voltage at the secondary side of the transformer during over/under-voltage on the primary (TSO) side. This may further deteriorate voltage in the transmission system and ultimately cause voltage collapse. Therefore conditions for tap changer blocking have to be set case by case respecting local grid configuration.
- Automatic Low Voltage Demand Disconnection Scheme to lower transmission elements loading and thus raise voltage.
- Special Protection Schemes are another measure which can be applied to counter voltage problems. These Schemes may have multiple functionalities (even grid splitting) and have to be tailored to suit local grid conditions and overall grid topology[4]. If a TSO decides to use a Special Protection Scheme it has to at least inform affected parties (Significant Grid Users, neighbouring TSOs) about expected effect on their equipment or grid.

5.2.3.5 POWER FLOW MANAGEMENT PROCEDURE

The Operational Security Limits for power flow in the grid are specified in the NC OS.

[4] Whether the grid is an island (such as GB, IR), a meshed grid with many AC connections to neighbouring TSOs (CH, CZ) or elongated grid with a few AC connections to neighbouring TSOs (IT, SE).

In the NC OS, it is also stated that the TSOs have the right to use Redispatching of available Significant Grid Users. In Emergency State, the instruction of an active power set-point as described in NC ER can be decided by the TSO independently from provisions given by NC OS and GL CACM (redispatching procedure) and shall be executed by the instructed Significant Grid Users.

Additionally, the TSOs have the right to disconnect Significant Grid Users and to instruct new type A Power Generating Modules to cease to produce Active Power in line with NC RFG, through the Defence Service Provider mechanism. This can be done directly by the TSOs or indirectly though the DSOs.

5.2.3.6 Assistance for Active Power and Manual Demand disconnection procedures

This section aims at explaining the interaction and complementarity between some measures described in the Network Codes Electricity Balancing, Capacity Allocation and Congestion Management and Emergency and Restoration.

NC EB introduces the Common Merit Order List

In Normal and Alert States, in order to balance their Responsibility Area, TSOs can activate offers from the Common Merit Order List (CMOL) within their Coordinated Balancing Area (NC EB). This CMOL offer activation is limited as TSOs can only activate outside their Responsibility Area an offer volume:

- that can transit on the interconnected system; and
- smaller or equivalent to the available offer volume from their LFC area, in the CMOL.

When in Emergency State, TSOs can activate offers from the CMOL, without being restricted to available offer volume from their LFC area. Nevertheless in case of absence of Adequacy (NC OPS), the offers available in the CMOL could not be sufficient to keep system balance. In such a case, Network Codes foresee some exceptional mechanisms.

NC ER introduces the Assistance for Active Power

The Assistance for Active Power is a measure of the System Defence Plan that aims at providing a TSO facing absence of Adequacy with exceptional power sources:

- Within the LFC area of the requesting TSO, all technically available power from Balancing Service Providers and Significant Grid Users shall be put at disposal of the TSO, even if not offered on the market.
- Within the Coordinated Balancing Area of the requesting TSO, all technically available power from Balancing Service Providers and Significant Grid Users (including Unshared bids as defined in NC Balancing) shall be put at disposal, even if not offered on the market.
- The requesting TSO shall have an access to the CMOL offers from Coordinated Balancing Areas it does not belong to, through neighbouring TSOs. The standard products exchanged in different Coordinated Balancing Areas can be different (duration, activation time...), therefore specific dispositions shall be described in dedicated procedures in order to ease the activation of such a measure.

It is important to note that D-1 and intraday absence of Adequacy is defined in NC OPS that stipulates TSOs shall inform NRAs in such a situation (Article 49 NC OPS). ENTSO-E underlines it is not in the mission of a TSO to suggest solutions to solve the inadequacy (most of the time, the causes for inadequacy will be firmly outside of the control and outside of the responsibility of the TSO; solutions may be politically sensitive or costly…). Nevertheless, if the inadequacy persists in real time, TSO mission is to guaranty the security of the system by applying all available actions. NC ER defines

assistance for Active power as an action to be triggered by TSOs in case the inadequacy has not been solved at a point in time critical for system security management (mainly from intraday to close to real-time). Additionally, in close to real-time situations, TSOs will probably have the possibility to re-assess and sometimes to decrease reliability margins on the borders (better knowledge of the operational conditions meaning a better knowledge of the flows on the grid, use of the Dynamic Line Rating, different risk policies in close to real-time compared to D-2 or D-1…). Therefore TSOs could be able to exchange more power than assumed during the capacity calculation, while respecting the basis criteria of capacity calculation (i.e. consultation among the concerned TSO to allow not to endanger the Operational Security of the Interconnected Transmission Systems).

As mentioned above, the assistance for Active Power can be requested in case of absence of Responsibility Area Adequacy in day-ahead and intraday as defined in NC OPS. The following aims at justifying the applicability of this term in NC ER context.

- One of the main objectives of the request of Assistance for Active Power is to encourage / force Power Generating Modules and Demand Facilities to change their Availability Status and therefore to put at disposal of the TSO all technically available power, even if not offered on the market.
- Such request shall be based on a TSO analysis proving that such request is needed to maintain system security. The analysis is performed using Responsibility Area Adequacy analysis methodology, as described in NC OPS (NC OPS defines Adequacy as the ability of in-feeds into an area to meet the demand in this area).
- The principles of this methodology are defined in Articles 46 and 49 (for D-1 and ID) of NC OPS, which stipulate that each TSO shall perform Adequacy analyses **using**, among other inputs, cross-border capacities.
- When performing an Adequacy analysis, cross-border capacities are to be used as an upper limit for import and export but not as a “probable” import or export amount of power (especially for short-term timeframes when technical and market probable hypotheses become quite precise). For instance when performing an intraday Adequacy analysis, the TSO takes into account the scheduled exchanges on its borders and the shared offers in its COBA, making sure not to exceed the cross-border capacities when summing both. At such a timeframe, it is not realistic to consider a TSO import capability is equal to its cross-border import capacity without considering market trends.

GL CACM introduces the Cross-Zonal Allocated Capacity curtailment

The Cross-Zonal Allocated Capacity curtailment can be used by TSOs facing an “emergency situation” (see 5.4.1), to be understood as a specific situation leading to Emergency State, mostly in case of:

- absence of Adequacy; or
- cross-border power flow issue.

In these cases TSOs can, **in coordination with neighbouring TSOs**, curtail cross-zonal capacities already allocated. For implicit auction mechanisms, this action corresponds to a reduction of nominated exchanges on a border and will thus impact the imbalance of one or more Balancing Responsible Party(s).

In case of absence of Adequacy, this measure shall be activated after Assistance for Active Power has been requested, and is not sufficient.

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NC ER introduces the Manual Demand Disconnection

This measure of the System Defence Plan, as the Cross-Zonal Allocated Capacity Curtailment, shall be activated by TSOs in case of absence of Adequacy, after Assistance for Active Power has been requested but is not sufficient. It is a complementary measure to Cross-Zonal Allocated Capacity Curtailment.

Manual Demand Disconnection can also be a System Defence Plan measure for power flow or voltage management and risk or actual low frequency deterioration due to lack of adequacy.

5.3 RESTORATION PLAN

5.3.1 General principles

The restoration of the system is based on general principles that apply everywhere in Europe and are based on the coordination between TSOs. The TSOs will assist each other in circumstances in which restoration becomes a necessity. System restoration is done whenever there has been an Emergency or Blackout State and the system has stabilised.

Aside from harmonised procedures that are described within this chapter, each TSO will develop its own Restoration Plan. This Restoration Plan is a national plan for restoration of national grids, taking into account all the specificities that vary across Europe, such as the specific layout of the grid, the TSOs, DSOs and Significant Grid Users involved and the possible locations of black start units. The section of the Network Code on General Principles describes the requirements for the design, implementation and activation of the restoration plan.

5.3.1.1 DESIGN OF THE RESTORATION PLAN

The aim of the Restoration Plan is to restore the system to Normal State as fast as possible. Each TSO will design a Restoration in consultation with relevant DSOs, Significant Grid Users, neighbouring TSOs and Synchronous Area TSOs. This plan shall include procedures for re-energisation, for frequency management, for re-synchronisation and for communication.

It shall be submitted to NRA, while respecting national law regarding national scrutiny principles.

In the design of the Restoration Plan, each TSO shall take into account the specifics of its own system. This includes the characteristics of its Network and underlying DSOs Networks and the expected behaviour of load and generation in its Control Area, specifically that of Significant Grid Users and of aggregated type A Power Generating Modules that could have an impact on restoration. The TSO will also need to take into account specific needs of high priority Significant Grid Users, which are appointed in accordance with Article 32(10) of NC OS.

The TSO will also take into account capabilities of connected parties, in order to make optimal use of the resources available within the system in its Restoration Plan.

An important part of the Restoration Plan is the choice of the power sources capable of re-energisation located within the Control Area. Each TSO needs to be able to re-energise its system using a Bottom-up Re-energisation Strategy if necessary. For this the TSO shall identify the power sources with the required capability in its Control Area, and appoint the ones necessary to be able to complete the Bottom-up Re-energisation Strategy.

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5.3.1.2 IMPLEMENTATION OF THE RESTORATION PLAN

The implementation of the restoration plan consists of the preparation of necessary measures, such as the installation of measurement equipment and the application of specific settings such as for instance settings for automatic reconnection of generation. Involved DSOs, Significant Grid Users and Restoration Service Provider shall implement and make available the required measures.

5.3.1.3 ACTIVATION OF THE RESTORATION PLAN

The activation of the Restoration Plan is done in Emergency State, once the system is stabilised following activation of the measures of the System Defence Plan, or when there has been a blackout. The measures defined in the restoration plan will then be activated in accordance with the necessary strategy.

5.3.2 RE-ENERGISATION

When there has been a blackout or a partial blackout, part of the network of one or more TSOs will need re-energisation. In this situation, TSOs can apply either a top-down or a bottom-up re-energisation strategy, or a combination of the two. In case of a top-down re-energisation strategy, assistance of another TSO is required. In case of a bottom-up re-energisation strategy, there is a need for resources to be available in the network of the TSO, including power sources such as black-start units that are capable of re-energising (part of) the network.

5.3.2.1 RE-ENERGISATION PROCEDURE

Within the Restoration Plan, each TSO shall include at least local measures based on these two re-energisation strategies, that will enable the TSO to carry out these strategies in practice. Scenarios will be developed in order to make the choice between top-down and bottom-up re-energisation strategies and combinations thereof.

In order to apply a top-down re-energisation strategy, assistance is required from a neighbouring TSO. For this reason the TSO will exchange information with those neighbouring TSOs who may provide this assistance, in order to coordinate the application of the Top-down re-energisation strategy.

5.3.2.2 RE-ENERGISATION STRATEGY

When re-energisation is necessary in real-time, the TSO will decide on a strategy to apply, considering the conditions of directly connected systems, the power sources capable of re-energisation in its Responsibility Area, the high priority Significant Grid Users and the expected duration of possible re-energisation strategies. The strategy the TSO decides upon may include a Top-down strategy. In that case the TSO will ask the support of neighbouring TSOs, who are then obliged to provide assistance unless it will lead their systems to Emergency or Blackout States. If no TSO is able to provide assistance under these terms, the TSO needing re-energisation shall use a bottom-up re-energisation strategy.

During the re-energisation process, each TSO shall manage the connection of load and generation within its Responsibility Area, with the aim to restore the frequency towards the Nominal Frequency with a maximum tolerance of the Maximum Steady-State Frequency Deviation. Each TSO shall respect conditions for connection of load and generation defined by the Frequency Leader, when appointed. When applying a Bottom-up Re-energisation Strategy, each TSO shall manage the

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connection of load and generation with the aim to regulate the Frequency towards the target Frequency defined.

During Re-energisation, DSOs shall, after being consulted by the TSO, connect the amount of generation and load requested by the TSO, taking into account the automatic re-connection of load and generation in their grids.

5.3.3 FREQUENCY MANAGEMENT

In case a Synchronous Area has been split into several Synchronised Regions, blackout, or after a large scale frequency incident, the usual balance between generation and load has suffered a disturbance that warrants coordinated frequency management. In those cases the Synchronous Area is split into several Synchronised Regions, this means that these regions need to be resynchronised. The frequency management of the Restoration Plan deals with the restoration of frequency in both the Synchronised Area and in the Synchronised Regions. The aim is to coordinate the restoration of the System Frequency of a Synchronous Area back to the Nominal System Frequency.

Frequency management includes a description of the coordination of frequency management procedures in Synchronous Area in these situations, as well as the appointment of frequency leaders, and the resynchronisation.

In details the frequency management procedures describes the determination of the amount of load and generation to be reconnected, taking into account the available Active Power Reserves within the Synchronised Region in order to avoid major Frequency Deviations.

Remarks:

- The Nordic Synchronous System uses coordinated frequency management (among which the appointment of frequency leaders) also in the Normal State.
- The Baltic Area coordinates their frequency with Russia, so for the Baltic Area this would not apply either.

5.3.3.1 FREQUENCY MANAGEMENT PROCEDURE

The Frequency management procedure of the Restoration Plan shall contain a set of measures aiming at restoring System Frequency back to Nominal Frequency.

The Frequency management procedure shall include at least appointment of Frequency Leaders, definition of target Frequency in case of Bottom-up Re-energisation Strategy, Frequency management after Frequency Deviation and Frequency management after Synchronous Area split.

In details the frequency management procedures describes the determination of the amount of load and generation to be reconnected, taking into account the available Active Power Reserves within the Synchronised Region in order to avoid major Frequency Deviations.

5.3.3.2 APPOINTMENT OF FREQUENCY LEADERS

Whenever the Synchronous Area is split into multiple Synchronised Regions, a Frequency Leader shall be appointed for each of those Synchronised Regions. A Frequency Leader shall also be appointed for the entire Synchronous Area in case there is no split of the system, but a large frequency incident has occurred that takes the system outside of the frequency limits for Alert State as defined in NC LFCR.

The choice for a Frequency Leader is in principle a mutual decision by all the TSOs of the Synchronised Region. When making a selection, the TSOs will take into account the amount of available Active Power Reserves, the available interconnection capacity, and the availability of measurements of frequency (in their SCADA for instance) and on Critical Grid Elements.

However, in order for this selection process to have a certain outcome, the Network Code provides a default value, appointing the TSO with the largest real-time K-factor (K-factor is defined in NC OS) as the Frequency Leader in case the TSOs do not otherwise agree.

The K-factor is figuring the ability of a TSO to manage the frequency using Active Power regulation capacities. The K-factor depends of the installed capacity of Power Generating Modules with Inertia in a given Area. The K-factor varies in real-time. Some simple methods exist to estimate the K-factor in real-time. For instance: K = Pn/2, with Pn = sum of Nominal Active Power of the power plants available in the area (taken into account the connected ones); using the ½ coefficient would give a rough estimation of the K-factor assuming a typical droop value (4%). For efficiency reason, a single formula should be defined (during implementation period) and applied at Synchronous Area level. Article 6 (5) requires TSO of the same SA to assess consistency of, among other, Frequency procedures under Article 26; appointment of Frequency Leader is part of these procedures. Thus, the real-time estimated K-factor used to assign a Frequency Leader will be harmonised at SA level.

Once a Frequency Leader has been appointed, this TSO shall inform all other TSOs of the Synchronous Area of its appointment. The TSO will remain Frequency Leader until:

- another TSO is appointed as Frequency Leader for the particular Synchronised Region,
- until its region is resynchronised with another Synchronised Region, and a new Frequency Leader is appointed for the resultant Synchronised Region, or
- until the Synchronous Area is fully resynchronised and the System Frequency is back within the limits for Normal State as defined in NC LFCR and LFC Area uses its own load frequency controller again.

In order to support frequency management in general and the process of selecting Frequency Leaders, each TSO is required to monitor which Synchronised Regions its system belongs to, who the other TSOs in those Synchronised Regions are and what Active Power Reserves are available in its own Responsibility Area.

Remarks:

- The Nordic Synchronous System uses coordinated frequency management (among which the appointment of frequency leaders) also in the Normal State.
- The Baltic Area coordinates their frequency with Russia, so for the Baltic Area this would not apply either.

5.3.3.3 FREQUENCY MANAGEMENT AFTER FREQUENCY DEVIATION

After a large frequency deviation that takes the system frequency outside of the limits for Alert State but does not cause a system split, a Frequency Leader is appointed for the Synchronous Area. This TSO will then become responsible for frequency management in the Synchronous Area. To this end, all other TSOs shall suspend the manual activation of Frequency Restoration Reserves and Replacement Reserves, and shall follow the instructions of the Frequency Leader in regards to the settings for automatic activation of reserves.

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The Frequency Leader shall define, after consultation of the other TSOs of the Synchronous Area, on operating mode[5] to be applied on the load frequency control operated by each TSO of the Synchronous Area.

The change of operating mode of the load frequency control operated by each TSO is performed at TSO level (usually in the SCADA function computing the load frequency control signal sent to the PGM).

The Frequency Leader shall manage the manual activation of Frequency Restoration Reserves and Replacement Reserves within the Synchronous Area aiming at regulating the frequency of the Synchronous Area towards the target Frequency, taking into account Operational Security Limits. The other TSOs shall support the Frequency Leader by activating Reserves in their Responsibility Area when necessary.

5.3.3.4 FREQUENCY MANAGEMENT AFTER SYNCHRONOUS AREA SPLIT

When the Synchronous Area is split into several Synchronised Regions, each of these regions will appoint a Frequency Leader in the manner described above. The Frequency Leader for each of the Synchronised Regions will carry out the responsibilities for its Synchronised Region as described above, and shall be supported by the other TSOs of the Synchronised Region.

5.3.4 RESYNCHRONISATION

5.3.4.1 RESYNCHRONISATION PROCEDURE

When the Synchronous Area is split into multiple Synchronised Regions, these will need to be resynchronised once their frequency permits. This will be a stepwise process, in which the Resynchronisation takes place between pairs of Synchronised Regions until the whole Synchronous Area has been resynchronised. The Resynchronisation procedure deals with this process of resynchronisation, and includes the appointment of Resynchronisation Leaders and the strategy for Resynchronisation. It shall also include principles, based on national considerations of local grid situations, for the maximum phase angle, frequency difference and voltage difference for closing lines.

5.3.4.2 RESYNCHRONISATION LEADER

When the Synchronous Area is split into multiple Synchronised Regions, Resynchronisation Leaders shall be appointed to pairs of regions in order to manage the resynchronisation between those pairs of regions.

The appointment of a Resynchronisation Leader is generally done by a mutual decision of the TSOs of the two Synchronised Regions that will be reconnected to form one Synchronised Region. There are some minimum requirements for the Resynchronisation Leader. The Resynchronisation Leader must have control over a substation in operation equipped with a parallel switching device on the border

[5] The operating mode of load frequency control operated by a TSO can be for instance:

- Normal mode (considering Frequency and Control Program to activate reserves)
- Frequency mode (considering only Frequency to activate reserves)
- Control Program mode (considering only Control Program to activate reserves)
- Frozen mode (no activation of reserves)

between the two Synchronised Regions. He must have access to frequency measurements from both Synchronised Regions, and access to voltage measurements on the substations between which the Resynchronisation Points could be located, which means that there needs to be a location on which to resynchronise within its Responsibility Area. He must also be able to control the voltage at this potential Resynchronisation Point.

Once a Resynchronisation Leader is appointed, he shall inform all other TSOs of the Synchronous Area of its appointment, so that other TSOs are aware of the progress toward resynchronisation of the entire Synchronous Area. The TSO shall remain Resynchronisation Leader until another Resynchronisation Leader is appointed for one of the two Synchronised Regions, or the Resynchronisation strategy as described below has been completed. A Resynchronisation Leader shall be chosen for each new resynchronisation.

5.3.4.3 RESYNCHRONISATION STRATEGY

There are three basic steps in the resynchronisation strategy:

1. the preparation;
2. the actual Resynchronisation, which is done by physically linking the two Synchronised Regions at the Resynchronisation Point, and
3. the creation of additional links between the Synchronised Regions to strengthen the connection.

The preparation consists of two parts. Part 1: The Resynchronisation Leader shall define the allowable limits for the frequency difference between the two Synchronised Regions, for the active and reactive power exchange, and he shall define the settings for the automatic activation of reserves within the Synchronised Regions,. Before defining these things, the Resynchronisation Leader shall agree upon these topics with the Frequency Leaders of the involved Synchronised Regions.

Aside from defining these limits and settings, during part 2 the Resynchronisation Leader shall also select the Resynchronisation Point, taking into account the Operational Security Limits in the Synchronised Regions. He shall define and prepare all necessary actions for the Resynchronisation of the two Synchronised Regions at this Resynchronisation Point. Such actions could include for instance local switching operations to provide an optimal grid topology, or ensuring the manning of a crucial substation. Similarly, he shall define and prepare in coordination with the relevant TSOs subsequent actions for the creation of additional connections between the Synchronised Regions. Finally, he will assess the readiness of the Synchronised Regions for Resynchronisation, taking into account the limits and settings defined. These steps will be done after consultation with both the Frequency Leaders of the Synchronised Regions, and the TSOs operating the involved substations.

When all these steps have been prepared to satisfaction, the Resynchronisation Leader shall perform the Resynchronisation. Once the connection has been made at the Resynchronisation Point, further connections will be created to strengthen the system. Afterwards, a new Frequency Leader will be appointed for the newly created Synchronised Region.

5.4 MARKET INTERACTIONS

5.4.1 General

This chapter provides a general scope related to market activities and TSO in the unlikely event of an Emergency State or an even more unlikely event of a Black-out State. As ENTSO-E values the liberalisation of the Energy market very high, market activities and its accompanying processes will be suspended with the utmost care and always as a last resort: indeed the action of conduction business is free, also during an Emergency State or a Black-Out State.

Whilst writing this chapter on Market Interactions, the following fundamental principles has been used as a guidance:

This Chapter of the NC ER has been written with the notion that the notion 'market activities' is entirely dependent on the notion 'system operations'. In other words, the section deals with how and if System Operation of the network influences market activities, and not the other way around: how market inefficiencies effects or could have an effect upon system operations.

The other principle is that this chapter of the Network Codes deals with the relation between monopolists (TSOs, DSOs) and users (connected parties, BRPs, BSPs, NEMOs, traders and third parties that has been granted a role in the wholesale market electricity). The commercial domain deals with all interactions between connected parties and their BRPs, BSPs, NEMOs, traders, metering parties and third parties with a wholesale market role. When a supplier of last resort issue occurs (a BRP, BSP or trader is about to go bankrupt or is not supposed to be liquid anymore), there is a very serious problem. That a TSO can contribute to a solution as a facilitator is known. This, however, would in general not lead to suspension of market activities. A regulation prescribing how to deal with these kind of problems does not belong in this Network Code. Administrative problems in the market needs to be solved, but especially by these parties themselves.

It must be pointed out that this operational Network Code uses the term Emergency State as defined in NC OS; in the context of markets, the Guideline CACM uses the term emergency situation. The latter is defined in the Article 16(2) of Regulation 714/2009. The criteria to qualify as Emergency Situation are:

- that the TSO has to act in an expeditious manner; and
- that re-dispatching and countertrading are not possible.

5.4.2 Procedure for suspension of market activities

Article 33 clarifies which market activities can be suspended by a TSO (paragraph 2). Because of the fact that each TSO is fully responsible for the functioning of its LFC Area and Transmission System, each TSO must be able to decide whether or not to suspend market activities, also when this affects market coupling processes where many more parties are involved. If any market activity is suspended, communication with BRPs and all other relevant market parties is foreseen in paragraph 5 with reference to article 36 Communication Procedure. During an Emergency or Blackout situation, it might be necessary to ensure that TSOs can request Significant Grid Users to keep their last Active Power set point, until further instruction of this TSO (paragraph 3). Paragraph 4 allows the TSO to fully or partially suspend the operation of any of its own processes (e.g. providing Cross Zonal Capacities, receiving and executing schedules according to Chapter 7 of NC OPS, submitting activation requests for Balancing Energy bids to the Activation Optimisation Function according to Article 42 of NC EB …). Paragraph 6 prescribes the parties with which the TSO have to coordinate when suspending market activities.

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5.4.3 Rules and conditions for suspension and restoration of market activities

Paragraph 1 of the article 34 described the rules and conditions for suspension and restoration of market activities that have to be established by the TSO. The TSO must consult the parties listed in paragraph 33(5). The NRA shall approve these rules and conditions; the TSO shall publish them. These rules and conditions may be included within the terms and conditions to be developed pursuant to Article 37(6b) of the Directive 72/2009. The objective is to have in a single place all the rules to be defined, in particular together to the ones defined pursuant to Article 27 [NC EB].

Paragraph 2 and 3 states that market activities can be suspended when continuation of these activities would worsen the conditions of the transmission system that is already in Emergency State; restoration can be done when these market activities would not or no longer worsen the transmission system. Other more market related conditions, like the percentage of Demand or Generation Disconnection in the LFC area of a TSO that might be a reason for suspension are listed in paragraph 4. The last sentence of paragraph 4 respects a waiting period before the suspension conditions are actually activated: this prevents suspension of market activities for problems that can be or has been solved in a short period of time. Such waiting period would not be necessary when restoring market activities.

Paragraph 5 lists the rules and conditions under which market activities can be restored; the actual values (percentages) can be equal to the suspension rules and conditions, but that does not necessarily have to be so. TSOs shall make sure that it can practically assess in real time the suspension and restoration triggers (paragraph 6). For the percentage of BRPs and or BSPs not being able to perform their duties anymore for reasons out of their control the TSO needs to be informed by its NRA: a TSO can't decide to suspend or restore markets based upon a phone call by an individual BRP or BSP. These parties need to escalate to the NRA that something out of their control is happening, something so extraordinary that indeed they wish market activities to be suspended. It is up to the discretion of the NRA that such situation is the case, upon which the NRA informs the TSO. If a cross border market activity, such as day ahead or intraday market coupling, has to be stopped it must be all NRAs related to this process to inform its TSO(s) and NEMO(s) about the suspension.

5.4.4 Procedure for restoration of market activities

Article 35 gives a procedure to be used during restoration of market activities. Paragraph 1 describes that a TSO restores a market activity in consultation with its NEMO(s) and neighbouring TSOs. Paragraph 2 describes TSO-coordination in case a TSO would like to restore TSO-processes. TSOs do have a bit more flexibility when restoring TSO processes because sometimes the processes are a precondition for a market activity to run.

Paragraph 3 states that each NEMO shall launch the restoration of the relevant Intraday and/or Day Ahead Market Coupling Process after being informed by the TSO that the TSO processes are restored again. GL CACM and NC FCA gives TSOs the right to curtail cross zonal allocated capacities in case of an emergency or force majeure situation. In addition to these options TSOs can use three strategies to find the correct amount of Cross Zonal Capacities: use the already existing calculated Cross Zonal Capacities, launch a regional capacity calculation process applicable in Normal and Alert States in accordance with GL CACM and use values TSO defines based on the actual physical network conditions (paragraph 4). The latter possibility means using the Cross Zonal values that have been used by TSOs during the restoration process to help re-energise each other systems. It is quite common for Market activities to be performed crossing borders of Member States as is reflected in, for example, the day ahead and intraday market coupling mechanisms. Paragraph 5 states that NEMOs also have the possibility to start a partial day ahead and/or intraday market coupling

5.4.5 Communication procedure

Paragraph 1 of article 36 requires TSOs to set up a communication procedure, to be used during the suspension and restoration of market and TSO activities. This procedure can only be set up after consultation of the parties listed in Article 33(5). The procedure must be based on the aforementioned roles that are in place to run a liberalised energy market and must focus strongly on interactions between these roles. The ultimate aim of this communication procedure is ensuring that all parties in its role know exactly which activities it can still perform and which not during a suspension and restoration process. This procedure can only be done on a national level because the roles and tasks of TSOs differ from one Member States to another. Paragraph 2 lists the steps, not exhaustively, that must find a place in the communication procedure.

5.4.6 Settlement principles

Paragraph 1 of article 37 gives each TSO the right to develop specific rules and conditions for the purpose of the settlement of imbalance energy. If it does not do so, the Settlement Chapter of NC EB shall be applicable. When a TSO wishes to do so it shall consult all the parties mentioned in Article 33(5). Given the specific nature of these rules, the NRA shall approve them, upon which the TSO shall publish the rules and conditions. These rules and conditions may be included within the terms and conditions to be developed pursuant to Article 37(6b) of the Directive 72/2009. The objective is to have in a single place all the rules to be defined, in particular together to the ones defined pursuant to Article 27 [NC EB].

Paragraph 2 stipulates that when a TSO wishes to write these specific rules and condition it shall make sure that all settlement actions between a TSO and Balance Responsible Parties and Balance Service Providers and other TSOs are covered. The latter one, the TSO-TSO settlement, deals with the settlement of energy that has been used during the Top-Down Strategy.

For example, it can be reasonable in some cases during the restoration phase that the generators receive a compensation for costs they have reasonably incurred: e.g. start costs, fuel costs and operational costs. Also the financial neutrality of TSOs with regard to the financial outcome as a result of the settlement is ensured.

5.5 Information Exchange And Communication, Tools And Facilities

This chapter serves to explain the requirements set in NC ER on Information Exchange and Communication, Tools and Facilities necessary to guarantee the Operational Security of the Transmission System at any time.

5.5.1 Information exchange

Information Exchange is an essential topic for the work of the TSO and for guaranteeing the Operational Security of the Transmission System. Therefore the general provisions of Articles 16 to 29 [NC OS] are detailed in this NC especially for Emergency, Blackout and Restoration State.

To be able to gather all the necessary information from DSOs and Significant Grid Users identified in the Restoration Plan and Restoration Service Providers, and to make sure that there is a common understanding of the most important information between all involved parties the following information are specified in the NC ER.

During an Emergency, Blackout or Restoration State each TSO shall be entitled to gather information from DSOs identified in the Restoration Plan about at least the:

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- existing part of their Network in Island Operation: DSO shall inform the TSO about existing islands in the responsibility area of the DSO and the Power Generating Modules (conventional and hydro but so far no other RES) of Type C or D connected to the island. This is essential for the TSO to take this into consideration while deciding about the best strategy to restore the grid.
- ability to synchronize parts of their Network in Island Operation: DSO shall inform the TSO about the ability to synchronize existing inlands in the DSO grid or synchronize existing inlands to the TSO grid along with the possible Resynchronisation Points of the islands. Additionally DSO shall provide TSO with the information about their possible Resynchronisation Points from DSO to TSO grid.
- capability to start Island Operation: DSO shall inform the TSO about the possibility to build up islands in the DSO grid. This also includes information about Power Generating Modules (conventional and hydro but so far no other RES) of Type C or D which are in House Load Operation or Black Start Capable, able to build up an island.

Also during Emergency, Blackout or Restoration State TSO shall be entitled to gather information from Significant Grid Users identified in the Restoration Plan and Restoration Service Providers about at least the following conditions:

- current status of the installation: Significant Grid User and Restoration Service Providers shall inform the TSO about the current status of operation of each power plant, e.g. out of operation, Island Operation, House Load Operation, etc.
- operational limits: Besides the current status of the installation also the operational limits are necessary for the TSO. This means the minimal and maximal Operating Point (in the current situation).
- Full Activation Time and time to increase generation: The time period between the activation request by TSO and the corresponding full activation of the concerned product is of interest for the TSO (time for starting processes till synchronization to the grid). Besides this timeframes for the increasing of generation, also other timeframes are essential for the TSO to be able to organize the further process of the restoration.
- time critical processes: Furthermore, Significant Grid User and Restoration Service Providers shall inform the TSO about time critical processes related to a power plant, e.g. how long can a power plant stay in House Load Operation, maximum time of station blackout e.g. before damaging the equipment.

Besides the information to be gathered by TSOs, the common understanding of information to be provided by the TSO in due time and for the purposes of System Defence Plan Procedures and Restoration Plan Procedures to DSO and Significant Grid Users identified in the Restoration Plan and Restoration Service Providers is also very important, provided the information is available to the TSO.

Therefore TSO shall in coordination with its neighbouring TSOs determine information to exchange, if essential for operation and restoration in Emergency, Blackout or Restoration State. To guarantee an efficient communication between these TSOs, TSOs shall establish a “checklist” with the most important information to be exchanged in case of Emergency, Blackout or Restoration State. Besides this “checklist” each TSO shall inform its neighbouring TSOs about at least:

- the extent and borders of the Synchronised Region or Synchronised Regions to which his Responsibility Area belongs: TSOs need to know about possible Resynchronisation Points to other TSO and therefore the information about the extent and borders of the Synchronised Regions.
- restrictions to operate Synchronised Regions: The TSOs need to know about limitations of a Synchronised Region. A Synchronised Region might have limited power supply (e.g. hydro

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pump storage or limitation of fuel) and therefore needs assistance from another Synchronised Region.

- Active and Reactive Power time limits at Interconnectors: Time limits on Interconnectors mean e.g. that the amount and duration of assistance of a TSO is limited to certain duration of time.
- other technical or organizational restrictions: The TSO shall inform the directly connected TSOs about any problem with their communication channels. In case of existing problems with one specific communication channel the other TSOs need to know to use the alternative communication channel. Also if a TSO prefers to use one specific communication channel this information shall be given to the other TSOs so they know which channel to use.
  If a TSO has problems with the main control room, the other TSOs need to know about it (for instance evacuation to the backup control room). This can be for several reasons e.g. if there is a problem in the main control room with the backup power supply of the SCADA system or the ability of switching.

In addition, each TSO shall inform the Frequency Leader of its Synchronised Regions about at least:

- restrictions to maintain Island Operation: Since the Frequency Leader defines the amount of power (upwards and downwards) to be requested from each TSO of the concerned area he needs information about the overall generation and the connected load of the island. The Frequency Leader needs to know about the amount of generation reserve that can be mobilized (upwards in case of under-frequency situations, downwards in case of over-frequency situations), and the free secondary reserve capability. Also the capacity margin of interconnectors (import in case of under-frequency situations, export in case of over-frequency situation) is important to know.
- the available additional generation and load: The Frequency Leader needs information about possible limits of additional generation and load to be connected to the island and especially information about the frequency limits which should not be exceeded (e.g. 50.2 Hz in Germany due to the automatically disconnection and reconnection of PV generation).
- the availability of Operational Reserves: The Frequency Leader needs to know if the TSO in its Synchronized Region have any problems/limitations with their frequency controller which might cause problems during and after the re-synchronisation. In addition the Frequency Leader needs to know about limitations of frequency regulation of certain TSO (e.g. Estonia can use a HVDC with Finland to regulate the Frequency but only within limited time and capacity range).

Concerning Transmission Connected DSOs, TSOs shall inform these DSOs about at least:

- the System State of its Transmission System: Transmission Connected DSOs need to know in which System State the TSO they are connected to is in currently. This is also important for the communication to the Distribution Connected DSOs.
- limits of active and reactive power, Blocking Load, tap and breaker position at the connection points: All the listed information is necessary to be able to coordinate an efficient resynchronisation.
- information on the current and planned status of Power Generating Modules connected to the DSO, if not available to the DSO directly: In case the DSOs is not able to directly access information of Power Generating Modules connected to his grid (for different reasons) this information, if available to the TSO, should be given to the DSO.
- all necessary information leading to further coordination with distribution connected parties: In case the TSO plans to activate measures which might lead to further coordination of the Transmission Connected DSOs with Distribution Connected DSOs the TSO has to provide this information to the Transmission Connected DSOs

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Besides this, TSOs shall also provide Defence Service Providers, DSOs and Significant Grid Users identified pursuant to in the Restoration Plan and Restoration Service Providers with information about at least the System State of its Transmission System and scheduled measures which require their participation. The actual System State can be communicate by phone call or trough other communication. The scheduled measures can be any independent activities coordinated earlier with TSO also.

In addition TSOs shall provide to DSOs and Significant Grid Users identified in the Restoration Plan and to Restoration Service Providers with information about ability and plans to re-energize couplings. The ability can be communicate by phone call or trough other communication. Very important are coordinated independent activities for instance preparing schemes, energizing power plants etc…

Very important is also the establishment of a common understanding of information all TSOs of a SA need to exchange between each other. Therefore all TSOs shall exchange between each other information in Emergency, Blackout or Restoration State and define additional information if necessary including at least:

- known circumstances that led to the current System State of its Transmission System: known or presumed origins leading to a certain situation shall be notified between the TSOs.
- potential problems making assistance for Active Power necessary: this can be the case if there is a need for additional power supply to fire up e.g. a coal power plant when a TSO does not have any generation to do that in his own grid. This is not related to assistance for nuclear power plants or surface mines; it is “just” assistance and not immediate.

Also NC ER aims to achieve a common understanding/procedure between TSOs of when and how Nominated Electricity Market Operators (who shall make this information available to Market Participants) and National Regulatory Authorities, or when explicitly foreseen in national law, other relevant national authorities should be informed about the System State of its Transmission System and, if available, additional information. It is afterwards the responsibility of the Nominated Electricity Market Operators to make this information available to their Market Participants.

5.5.2 Communication systems

This article aims that in Emergency, Blackout or Restoration State, a proper communication between the parties identified in Restoration Plan can take place, to exchange the necessary information for operating or restoring the system. Therefore each TSO, DSO and Significant Grid Users identified in the Restoration Plan and Restoration Service Providers shall establish in cooperation with the other parties at least one redundant voice communication system.

This means that two independent communication channels need to be established (e.g. direct phone lines and satellite communication).

Concerning the establishment of communication systems to Significant Grid Users identified in the Restoration Plan and Restoration Service Providers, this involves e.g. in case of Significant Grid Users, either a communication directly with the power plant or with a dispatch centre. Communication to both parties is essential for TSOs to securely operate and restore the system.

Voice communication of TSO and DSO includes communication between themselves (company internal) and each other and additionally also to other premises necessary for restoration e.g. substations, backup control rooms, regional (control) centres, headquarters, crisis centres etc.

To allow communication in any case, at least for one voice communication channel, backup power supply for at least 24 hours needs to be established. This means that the communication channel needs to be backed up e.g. with batteries or a diesel generator for guaranteeing functionality for at

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least 24 hours in case of the loss of primary power source. Guaranteeing a minimum requirement of e.g. 24 hours for backup power supply for voice communication channels provides TSOs with the certainty that each relevant party for restoration can be contacted during that time.

Additionally the backed up voice communication channels shall be prioritized. This means the respective party always has a free line for the other connected party and a Calling-Line-Identification-Presentation (CLIP) so that a direct identification of the calling party is possible to decide if it is 1st priority to take the incoming call or not. Another important aspect is that the same communication channel which is prioritized does not use public communication channels. This means a private connection between respectively two of the mentioned parties without using the lines of a public network.

Concerning the backup power supply of communication systems a detailed assessment on which system elements are affected by the requirement of backup power supply needs to be carried out. This analysis should take into account which elements are needed for the proper performance of the communication channels and the reception by the Control Centre.

Notwithstanding the provisions describes before previous paragraph, Significant Grid User identified pursuant to Article 21(8) which are type B Power Generating Modules and Restoration Service Provider which are type A or B Power Generating Modules, shall have the possibility to only have a redundant data communication system instead of voice communication system if agreed upon with the TSO. This reflects the circumstances that small Power Generating Modules of type A and B usually do not have a control room or personnel available 24/7. Therefore it has to be guaranteed that instead of exchanging information and instructions via voice communication these information and instructions are communicated via data communication systems.

5.5.3 Tools and Facilities

For each TSO, DSO and Significant Grid Users identified in the Restoration Plan and Restoration Service Providers critical tools and facilities necessary to operate and restore the system, as defined in Article 8(15) [NC OS], have to be available in any system state. Therefore in case of loss of primary power supply at least backup power supply for 24 hours has to be established e.g. with batteries or diesel generators.

Concerning the backup power supply of the critical tools and facilities in NC ER in case of loss of primary power supply the mentioned time of 24 hours is a minimum requirement that in the unlikely event of a complete blackout might not be sufficient for communication and auxiliary power supply to re-install and re-cover system operations. However, as the necessary time to re-build a stable system operation might take longer than 24 hours in highly meshed and interlinked systems, the threshold for guaranteed communication to the stakeholders might be extended. Also the existing different power generation structures of the SAs and the single TSOs itself, e.g. large share of renewables or shut down of nuclear power plants, may lead to the necessity to extend the backup power supply to more than 24 hours by certain TSOs. Critical tools mentioned here also include the IT tool for real-time data exchange at pan-European level mentioned in NC OS.

To guarantee that TSOs can operate their system in case of any problem concerning the main control room, e.g. fire, each TSO has to establish a second control room, a so called backup control room. It is not a necessity that this backup control room is manned at all time since TSO are not obliged to operate from the backup control room as long as the main control room is available. To be able to operate the system also from the backup control room it shall be equipped at least with the same systems and tools like the main control room. Back up control room tools and systems shall be regularly tested. Additionally the backup power supply for the backup control room shall be arranged for at least 24 hours, for the same reasons the main control room needs to have backup power supply.

Another important topic concerning the backup control room is the requirement that the backup control room has to be geographically separate from the main control room. The backup control room needs to be at least in a separate building and not right next to the main control room. This limits the risk that impacts on the main control room directly influence the backup control room as well.

Related to the backup control room is also the preparation of an evacuation procedure for moving from the main control room to the backup control room. The maximum time for this evacuation shall not exceed three hours. In case there is a need to move to the backup control room each TSO has to be prepared how to proceed. This means it needs to be clear, which things and which equipment from the main control rooms need to be taken to the backup control room. Also it needs to be clear for the staff how to reach the backup control room on the fastest way. Through preparing such a procedure TSOs have to be able to fully operate their system again from the backup control room within a maximum time of three hours. This evacuation procedure shall also include the organisation how to operate the system during the evacuation. During the time of moving to the backup control room the TSO has to make sure that his system is observed and operated e.g. via its regional control centres. The procedure also needs to include measures that guarantee that the backup control room is available and accessible at any time (e.g. streets and entrance need to be free of snow or trees).

Ensuring the operability of substations identified as necessary for the Restoration Plan Procedures is essential for operating the system. Therefore backup power supply of equipment in these substations is necessary. The equipment includes e.g. switching devices. Usually all substations are remote controlled and therefore power supply needs to be guaranteed to be able to operate the grid and handle the restoration process. In case of loss of primary power supply it has to be guaranteed that e.g. switching can be performed in the identified substations. Backup power supply in case of substations shall be implemented for at least. 24h, taking into account a certain amount of switching actions. For substations in Ireland, the duration on operation in case of loss of primary power supply shall be approved by regulatory authority or other competent authority of the Member State, on proposal of the TSO.

5.6 COMPLIANCE & REVIEW

5.6.1 General principles

Defence and Restoration Plans are prepared on the basis of the best TSO/DSO knowledge, supported by technical analyses and experience. Nevertheless, Defence and Restoration Plans normally are not verifiable in practice during normal operation of the system. There is a chance that some plans may never be realised and some equipment (i.e. under frequency relays) may never be triggered. For this reason it is difficult to ensure that prepared Plans are reliable without on-site tests. Some of the equipment tests can be done during maintenance (i.e. relays, protections), but most functions or capabilities need special dedicated approaches (i.e. Black Start Capability). In addition it is important to check the procedures for necessary cooperation and coordination during an Emergency and/or Blackout System State.

Testing of Significant Grid User capabilities/services, identified as Defence Service Providers or Restoration Service Providers (PGM + Demand Facility providing DSR + HVDC System Owner) that are used for ER purposes is already required by Articles 39 (5) and 39 (6) [NC RfG], Articles 43 (1) and 44 (1) [NC DC] and Article 66 [NC HVDC] and the methodology to be applied is established in the those articles. For Significant Grid Users which are not subject to [NC RfG], [NC DC] and [NC HVDC], they shall follow the provisions of national law with regard to the methodology to be applied in the test.

The only really missing requirement regarding testing Defence and Restoration Providers capabilities is the periodicity of these tests.

Thus the NC ER refers to existing NC for the methodology to perform the tests, while adding a requirement for the definition of periodicity for these tests. The periodicity shall be decided at national level, while respecting minimum requirements for those of the capacities that are seen as most important in the System Defence and Restoration Plans.

In addition, according to Article 33 [NC OS], TSO, DSO and Significant Grid User with Connection Point directly to the Transmission System can test standard procedures for Emergency State and Restoration State, which is seen as necessary. Thus the NC ER will set some general principles regarding global testing of System Defence Plans and Restoration processes.

5.6.2 COMPLIANCE TESTING OF TSO, DSO and SIGNIFICANT GRID USER CAPABILITIES

5.6.2.1 COMPLIANCE TESTING OF PGM CAPABILITIES

Black Start Capabilities are to be tested on a minimum basis of once every 3 years. This corresponds to current practice in most of the TSOs. Black Start Capability is essential in Bottom-up strategy for restoration.

Houseload capability is an important mean for bottom-up strategy in a restoration and therefore the availability has to be assessed after any changes of equipment having an impact on its Houseload Operation capability or in case two unsuccessful consecutive tripping in real operation.

5.6.2.2 COMPLIANCE TESTING OF DSR

According to NC DC, DSR means demand offered for the purposes of, but not restricted to, providing Active or Reactive Power management, Voltage and Frequency regulation and System Reserve.

The DSR capability to modify their demand consumption after receiving an order, entail a useful tool for TSO and DSO to provide a quick and efficient response in emergency states. Given the critical nature of the situations in which this capability is going to be used, TSO and DSO shall be completely sure about their proper performance in the contracted time frame. Therefore, a periodic test of the availability and capability is needed.

Regarding of test periodicity, and taking into account this service is mainly provided by industrial consumers which are not very familiar with Electricity System Operation, real experience shows that one test/per year should be enough to ensure a proper functioning. This test would not be required if this capability has had a successful real activation in the period between test.

The test to be performed should consist of following a real activation order from TSO or DSO for time, load reduction and duration specified. According to Article 44 [NC DC], an Equipment Certificate may be used instead of part of the tests required.

For households, the tests could be performed in aggregated way.

For each Defence Service Provider delivering DSR LFDD, common minimum requirements for testing these relays have to be defined. According to [NC DC], the methodology described in Article 43(1)(d) [NC DC] has to be used for Transmission Connected Demand Facilities or agreed with the Relevant Network Operator for other Demand Facilities. The periodicity of these tests shall be defined at national level.

5.6.2.3 COMPLIANCE TESTING OF HVDC CAPABILITIES

Using HVDC black start capability is quite new for several TSOs. The requirement on periodicity test shall be the same as for PMG with this capability since this capability is essential in Bottom-up strategy for restoration.

5.6.2.4 COMPLIANCE TESTING OF LFDD RELAYS

Since LFDD scheme is addressing EU-wide phenomena (major frequency deviation), it is fundamental to check that the relays works properly all over Europe. For this reason, common minimum requirements for testing these relays have to be defined.

The test shall assess that the requirements defined in testing methodology described in the NC DC are fulfilled. The frequency shall be defined at national level in order to use the regular maintenance of the devices to perform these tests.

5.6.2.5 TESTING OF COMMUNICATION CHANNELS AND TOOLS

It is essential that communication is functioning properly in all states, especially in Emergency, Blackout and Restoration States. In order to assess all needed systems for the communication channels work in the different states especially in Blackout State, two types of tests shall be performed:

- Test of the communication systems.
- Test of the backup power supply of their communication systems.

In case of the communication systems use the public network, the performance of the mentioned tests shall be included in the agreement with the communications provider.

5.6.2.6 TESTING OF TOOLS AND FACILITIES

Main testing activity related to TSO's facilities relies on testing the backup power supply sources. Only periodic testing allows to assess the proper functioning of diesel generators and other energy storage devices, to be used in case of absence of the main power source. Where these tools and facilities involve DSOs or Significant Grid Users, these parties shall participate in this test.

5.6.3 COMPLIANCE TESTING OF SYSTEM DEFENCE PLANS AND RESTORATION PLANS

5.6.3.1 COMPLIANCE TESTING AND PERIODIC REVIEW OF SYSTEM DEFENCE PLAN

The NC DC requires yearly notification on LFDD implementation. Thus, TSO has to consider these notifications, and propose modifications to DSO in order to solve situations in which the LFDD implementation does not fulfil the LFDD design. This assessment shall also include details of implementation when LFDD are installed at transmission level. Based on this assessment, the TSO may have to update internal tools used to prepare and manage the Demand Disconnection plans.

When designing the System Defence Plan, the current situation is taken into account. Due to on-going evolutions of the network and all other elements of the system, **TSO regularly updates some**

measures of the System Defence Plan. This is a continuous action of the TSO, part of the usual daily business of the TSO.

In order to assess consistency of these modifications, it is necessary to add milestones to check the whole Defence Plan. Thus a periodic review of the whole system defence plan is needed, to assess its effectiveness. This is the aim of the 5 years full review of the complete system defence plan.

5.6.3.2 COMPLIANCE TESTING AND PERIODIC REVIEW OF RESTORATION PLAN

Responsible national authorities can identify specific grid users' needs to be taken into consideration while designing System Defence Plan and Restoration Plan. For some of these specific grid users, periodic testing may be needed. For instance, power supply of auxiliaries of nuclear power plant from an external source has to be regularly tested. The TSO and the power plant define one or more re-energisation paths. These paths have to be tested, according to a frequency and methodology to be defined between the TSO and the concerned plants taking into account the requirements of responsible national authorities.

These tests shall be organised with all involved parties.

In addition, similar to the System Defence Plan, the Restoration Plan has to be reviewed regularly, in order to assess its effectiveness, while considering all recent developments in the system. **TSO regularly updates some measures of the System Restoration Plan**. This is a continuous action of the TSO, part of the usual daily business of the TSO. Criteria of efficiency will be defined at National Level.

5.7 IMPLEMENTATION

5.7.1 Monitoring

The article is similar to the other network codes.

5.7.2 Stakeholder involvement

The article introduces the cooperation around the NC ER after its entry into force, for the implementation and the further improvements of its requirements.

5.8 FINAL PROVISIONS

5.8.1 Amendments of contracts and general terms and conditions

This article is similar to other System Operation Network Codes and refers to existing agreement that need to be updated to align on the Network Code.

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5.8.2 Entry into force

The article detail the different deadlines for entry into force. The figure below summarises them.

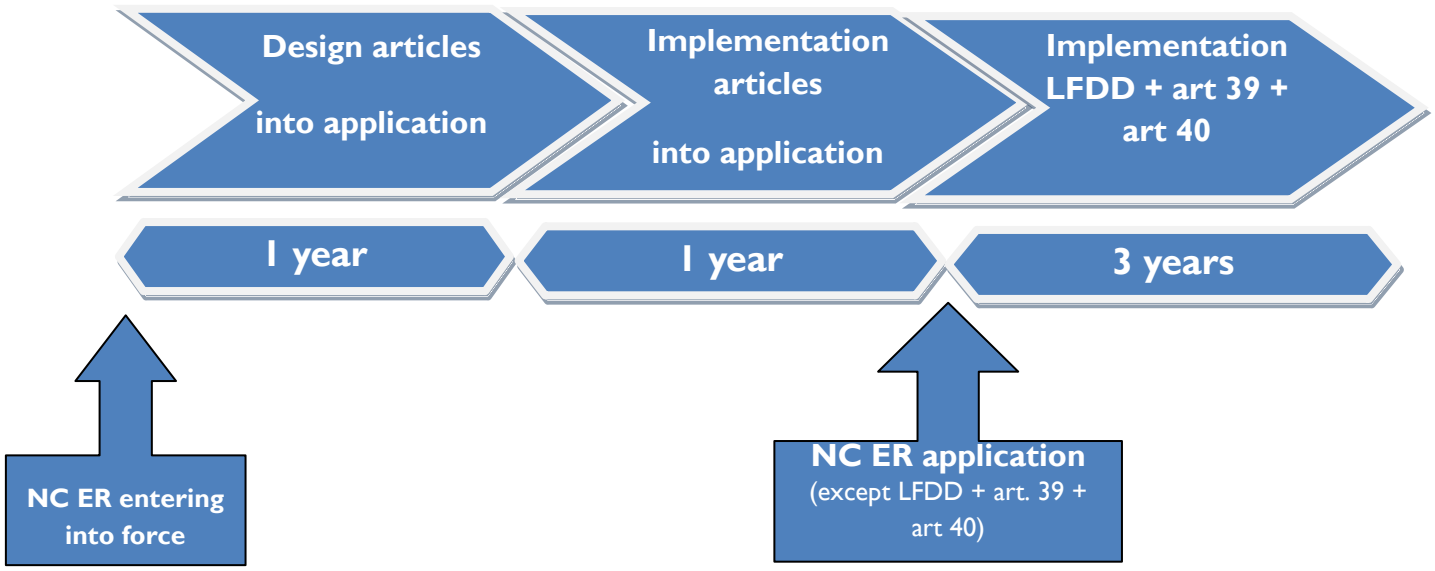

Figure 7: Dates of entry into force

6 NEXT STEPS

In this chapter, ENTSO-E briefly summarises the main steps of the Network Code development process with a special focus on those that will occur between the submission of the Network Code to ACER and its application.

6.1 SUBMISSION TO ACER

Regulation (EC) N° 714/2009, and in particular its Article 6, defines a clear Network Code development process.

The process begins with the set up by the Commission of an annual list of priorities amongst the 12 areas where Article 8(2) of Regulation (EC) N° 714/2009 foresees the need for a NC. The annual priority list must be adopted after consultation with the relevant stakeholders.

Once a priority list is established, the Commission shall request ACER to develop and submit to it a non-binding framework guideline. The framework guideline is intended to set clear and objective principles with which the Network Code should be in line.

The development of a framework guideline is followed by a request from the Commission for ENTSO-E to develop a Network Code within a twelve month period. The Network Code to be developed by ENTSO-E within that period shall be subject to an extensive consultation, taking place at an early stage in an open and transparent manner.

At the end of these 12 months ENTSO-E delivers a Network Code and set of explanatory documents to ACER for its assessment.

6.2 THE ACER OPINION

ACER has three months to assess the draft prepared by ENTSO-E and deliver a reasoned opinion. In doing so, ACER may decide to seek the views of the relevant stakeholders.

ACER can decide to recommend to the Commission that it adopts the Network Code if it's satisfied that it meets the requirements of the framework guideline or can provide a negative opinion; effectively meaning the Network Code is returned to ENTSO-E.

6.3 THE COMITOLOGY PROCEDURE

The NC prepared by ENTSO-E shall only become binding if, after being recommended to the Commission by ACER, it is adopted via the Comitology procedure.

The Comitology process will be led by the Commission who will present the draft text to representatives of Member States organized in so-called "committee". The Comitology procedure used for the Network Codes (called regulatory procedure with scrutiny) grants the European Parliament and the Council important powers of control and oversight over the measure adopted by the committee.

For that reason, it is unclear how much time the process can take in practice. Our working assumption is that it will take about 12 months from the issuing of the ACER opinion (if positive) to the conclusion of the Comitology process.

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6.4 ENTSO-E STEPS DURING THIS PERIOD

Meeting the requirements of the NC ER as soon as practicable is a significant challenge for ENTSO-E. During the period in which the Network Code is being considered by ACER and the Commission, ENTSO-E will continue work to prepare for the delivery of the requirements of the Network Code.

6.5 ENTRY INTO FORCE

The Network Code will enter into force 20 days after its publication. However, due to the various consultations and approvals the application of different parts of the Network Code will be triggered by the timing of regulatory decisions. Because of uncertainties about the ACER opinion, the timings of the Comitology process, the time needed to deliver parts of the Network Code and the time needed to approve parts of the Network Code it is not possible to say exactly when each part will apply. A close working relationship between ENTSO-E, ACER, national regulators and the Commission is, in our view, necessary to ensuring the ER Network Code can be implemented as quickly as possible.

See also paragraph 5.8.2 of this document.

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[9] FNN/VDE, Technische Anforderungen an die automatische Frequenzentlastung, June, 2012

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[11] Final Report, System Disturbance on 4 November 2006, UCTE https://www.entsoe.eu/fileadmin/user_upload/_library/publications/ce/otherreports/Final-Report-20070130.pdf

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8 APPENDICES

8.1 APPENDIX 1 DEFINITIONS USED IN NC ER

The reference tool for all definitions used in the Network Codes is the ENTSO-E Metadata Repository (Search for Definitions): https://emr.entsoe.eu/glossary/bin/view/GlossaryCode/GlossaryIndex.

In order to ease the reading, definitions used in the draft NC ER are listed below. They are produced only for indicative purpose.

(N-1)-Criterion [NC OS] - The rule according to which elements remaining in operation within TSO's Responsibility Area after a Contingency from the Contingency List must be capable of accommodating the new operational situation without violating Operational Security Limits.

Active Power [NC RfG] – The real component of the Apparent Power at fundamental Frequency, expressed in watts or multiples thereof (e.g. kilowatts (kW) or megawatts (MW)).

Active Power Reserve [NC OS] – The Active Power which is available for maintaining the frequency.

Adequacy [NC OPS] – The ability of in-feeds into an area to meet the demand in this area.

Alert State [NC OS] – The System State where the system is within Operational Security Limits, but a Contingency from the Contingency List has been detected, for which in case of occurrence, the available Remedial Actions are not sufficient to keep the Normal State.

Balancing Service Provider [NC EB] – A Market Participant providing Balancing Services to its Connecting TSO, or in case of the TSO-BSP model, to its Contracting TSO.

Blackout State [NC OS] – The System State where the operation of part or all of the Transmission System is terminated.

Black Start Capability [NC RfG] –The capability of recovery of a Power Generating Module from a total shutdown through a dedicated auxiliary power source without any energy supply which is external to the Power Generating Facility.

Bottom-up Re-energisation Strategy [NC ER] – A strategy where (part of) the system of a TSO can be re-energised without the assistance from other TSOs.

Closed Distribution Network [NC DC] – A Network classified as Closed Distribution Network pursuant to Article 28(1) of Directive 2009/72/EC at national level. Article 28 of Directive 2009/72/EC defines such a Network as a system which distributes electricity within a geographically confined, industrial, commercial or shared services site and does not (without prejudice to a small number of households located within the area served by the system and with employment or similar associations with the owner of the system) supply households customers. This Closed Distribution Network will either have its operations or the production process of the users of the system integrated for specific or technical reasons or distribute electricity primarily to the owner or operator of the Closed Distribution Network or their related undertakings.

Common Merit Order List [NC EB] – A list of Balancing Energy bids sorted in order of their bid prices, used for the activation of Balancing Energy bids within a Coordinated Balancing Area.

Connection Point [NC RfG] – The interface point at which the Power Generating Module, Demand Facility, Distribution Network or HVDC System is connected to a Transmission Network, offshore Network, Distribution Network, or HVDC System, as identified in the Connection Agreement.

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Coordinated Balancing Area [NC EB] – A cooperation with respect to the Exchange of Balancing Services, Sharing of Reserves or operating the Imbalance Netting Process between two or more TSOs.

Cross-Zonal Allocated Capacity [GL CACM] – The capability of the Interconnected System to accommodate energy transfer between Bidding Zones. It can be expressed either as a Coordinated Net Transmission Capacity value or Flow Based Parameters, and takes into account Operational Security Constraints.

Defence Service Provider [NC ER] - A legal entity with a legal or contractual obligation to provide a service contributing to one or several measures of the System Defence Plan;

Demand [NC ER] - The netted value of Active Power seen from a given point of the system, computed as (load – generation), generally expressed in kilowatts (kW) or megawatts (MW), at a given instant or averaged over any designated interval of time.

Demand Facility [NC DC] – A facility which consumes electrical energy and is connected at one or more Connection Points to the Network. For the avoidance of doubt a Distribution Network and/or auxiliary supplies of a Power Generating Module are not to be considered a Demand Facility.

Demand Side Response [NC DC] – Demand offered for the purposes of, but not restricted to, providing Active or Reactive Power management, Voltage and Frequency regulation and System Reserve.

Distribution System [swiss electricity market glossary] – High, medium or low voltage electricity grid for supplying end consumers or electricity supply companies.

Emergency State [NC OS] – The System State where Operational Security Limits are violated and at least one of the operational parameters is outside of the respective limits.

Energy Storage [NC ER] – A device being used for storage of energy and that can be used to balance the system, e.g. water pumped-storage or batteries. **Frequency Containment Reserves [NC OS] –** Frequency Containment Reserves (FCR) means the Operational Reserves activated to contain System Frequency after the occurrence of an imbalance.

Frequency Leader [NC ER] – The TSO managing Frequency within a Synchronised Region or a Synchronous Area in order to restore System Frequency back to Nominal Frequency.

Frequency Restoration Reserves [NC LFCR] – Frequency Restoration Reserves (FRR) means the Active Power Reserves activated to restore System Frequency to the Nominal Frequency and for Synchronous Area consisting of more than one LFC Area power balance to the scheduled value.

Full Activation Time [NC EB] – The time period between the activation request by TSO and the corresponding full activation of the concerned product.

HVDC System Owner [NC HVDC] – A natural or legal entity owning a HVDC System.

Interconnector [Regulation 714/2009] – Interconnector means a transmission line which crosses or spans a border between Member States and which connects the national transmission systems of the Member States.

Island Operation [NC RfG] – The independent operation of a whole or a part of the Network that is isolated after its disconnection from the interconnected system, having at least one Power Generating Module supplying power to this Network and controlling the Frequency and Voltage.

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K-Factor [NC OS] – A factor used to calculate the frequency bias component of the ACE of a LFC Area or a LFC Block.

Load-Frequency Control Area [NC OS] – A part of a Synchronous Area or an entire Synchronous Area, physically demarcated by points of measurement of Interconnectors to other LFC Areas, operated by one or more TSOs fulfilling the obligations of a LFC Area.

Load Frequency Control Structure [NC LFCR] – The basic structure considering all relevant aspects of Load- Frequency Control in particular concerning respective responsibilities and obligations (Process Responsibility Structure) as well as types and purposes of Active Power Reserves (Process Activation Structure).

Low Frequency Demand Disconnection [NC DC] – An action where demand is disconnected during a low Frequency event in order to recover the balance between demand and generation to restore system Frequency to acceptable limits.

Low Voltage Demand Disconnection [NC DC] – A restoration action where demand is disconnected during a low voltage event in order to recover Voltage to a sustainable level within acceptable limits.

Maximum Steady-State Frequency Deviation [NC OS] – The maximum expected Frequency Deviation after the occurrence of an imbalance equal or less than the Reference Incident at which the System Frequency is designed to be stabilized.

Network [NC RfG] – Plant and apparatus connected together in order to transmit or distribute electrical power.

Normal State [NC OS] – The System State where 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.

On Load Tap Change Blocking [NC DC] – An action that blocks the on load tap changer(s) during a low voltage event in order to stop transformers from tapping and suppressing Voltages in an area further. Often employed in association with LVDD.

Operational Reserves [NC OS] – Operational Reserves means the spinning and non-spinning reserves that are accessible to at least one TSO.

Operational Security [GL CACM] – Keeping the Transmission System within agreed security limits.

Operational Security Limits [NC OS] – The acceptable operating boundaries: thermal limits, voltage limits, short-circuit current limits, frequency and Dynamic Stability limits.

Power Generating Facility [NC RfG] – A facility to convert primary energy to electrical energy which consists of one or more Power Generating Modules connected to a Network at one or more Connection Points.

Power Generating Module [NC RfG] – Either a Synchronous Power Generating Module or a Power Park Module.

Re-energisation [NC ER] – The process of energising (parts of) the system that have been disconnected by reconnecting generation and Demand.

Regional Security Coordination Initiative [NC OS] – A regional unified scheme set up by TSOs in order to coordinate Operational Security Analysis in a determined geographic area.

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Remedial Action [GL CACM] – Any measure applied by a TSO or several TSOs, manually or automatically, in order to maintain Operational Security. In particular, Remedial Actions serve to fulfil the (N-1)-Criterion and to respect Operational Security Limits; they can be used to relieve or contribute to the relief of Physical Congestions. They can be applied pre-fault or post-fault and may involve costs.

Replacement Reserves [NC LFCR] – Replacement Reserves (RR) means the reserves used to restore/support the required level of FRR to be prepared for additional system imbalances. This category includes operating reserves with activation time from Time to Restore Frequency up to hours.

Responsibility Area [NC OS]– A coherent part of the interconnected Transmission System including Interconnectors, operated by a single TSO with connected Demand Facilities, or Power Generating Modules, if any.

Restoration [NC OS] – The System State in which the objective of all activities in Transmission System is to re-establish the system operation and maintain Operational Security after a Blackout State or Emergency State.

Restoration Plan [NC ER] – The sum of all technical and organisational measures to be undertaken to restore the system back to Normal State.

Restoration Service Provider [NC ER] - A legal entity with a legal or contractual obligation to provide a service contributing to one or several measures of the Restoration Plan.

Restoration Plan Instruction [NC ER] – Instruction to be issued by the TSO to a DSO or to a Significant Grid User for the purpose of Restoration Plan activation.

Resynchronisation [NC ER] – Synchronising and connecting again two Synchronised Regions at the Resynchronisation Point. .

Resynchronisation Leader [NC ER] – The TSO in charge of Resynchronisation of two Synchronised Regions.

Resynchronisation Point [NC ER] – The device used to connect two Synchronised Regions, usually a circuit breaker.

Significant Grid User [NC OS] – The existing and new Power Generating Facility and Demand Facility deemed by the TSO as significant because of their impact on the Transmission System in terms of the security of supply including provision of Ancillary Services.

Synchronised Region [NC ER] – A subpart of a Synchronous Area covered by interconnected TSOs with a common System Frequency not synchronised with the rest of the Synchronous Area.

Synchronous Areas [NC OS] – An area covered by interconnected TSOs with a common System Frequency in a steady operational state such as the Synchronous Areas Continental Europe (CE), Great Britain (GB), Ireland (IRE) and Northern Europe (NE);

System Defence Plan Instruction [NC OS] – Instruction to be issued by the TSO to a DSO or to a Significant Grid User for the purpose of System Defence Plan activation.

System Defence Plan [NC OS] – The sum(mary) of all 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.

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System Frequency [NC OS] – 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 time frame of seconds, with only minor differences between different measurement locations.

System Protection Schemes [NC OS] – The set of coordinated and automatic measures designed to ensure fast reaction to Disturbances and to avoid the propagation of Disturbances in the Transmission System.

System State [NC OS] – The operational state of the Transmission System in relation to the Operational Security Limits: Normal, Alert, Emergency, Blackout and Restoration System States. .

Top-down Re-energisation Strategy [NC ER] – means a strategy that requires the assistance of other TSOs to re-energise (part of) the system of a TSO.

Total Load [Regulation 543/2013] - Load, including losses without power used for energy storage, means a load equal to generation and any imports deducting any exports and power used for energy storage.

Transmission Connected Demand Facility [NC DC] – A Demand Facility which has a Connection Point to a Transmission Network.

Transmission Connected Distribution Network [NC DC] – A Distribution Network which has a Connection Point to a Transmission Network.

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8.2 APPENDIX 2 CURRENT PRACTICES IN EUROPE ON EMERGENCY AND RESTORATION

See online document:
https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20ER/140527_NC_ER_Current_practices_on_Emergency_and_Restoration.pdf

8.3 APPENDIX 3 TECHNICAL BACKGROUND FOR THE LFDD REQUIREMENTS

Please note that this study has been produced and is valid for Synchronous Area Continental Europe only.

The technical background for the LFDD requirements can be downloaded on the following link:

https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20ER/141215_Technical_background_for_LFDD.pdf

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8.4 APPENDIX 4 RESPONSE TO THE PUBLIC CONSULTATIONS

The following tables provide the summary of comments received during public consultation and overview over the ENTSO-E response.

General responses

National Scrutiny

Summary	The main received on the topic of national scrutiny are the following : 1. The System Defence Plan, the Restoration Plans, the test plans and in general any items should be approved by NRAs. 2. The plans should not only be notified to NRAs – other authorities may be relevant. 3. NRAs should be competent over the entire plan, and not only the concept. 4. The measures to be implemented by the TSOs and those to be implemented by SGUs/DSOs should be notified to the NRAs within the concept.
Changes made	1. Partially changed to include the possibility at national level to provide for notification of the overall System and Restoration Plans or NRA approval of the System Defence and Restoration Plan. Recitals added to clarify that competence of TSOs has to be in line with competence of NRA at national level (Recitals 7 and 8). 2. Partially changed to refer to NRAs or other relevant national authorities. 3. Change 4. Change
Explanation for change or no change	1. The NC ER requires NRA approval for items deemed essential to ensure minimum harmonized requirements. In addition, in line with the principles of hierarchy of norms, the NC ER has to be read in line with the provisions of Directive 2009/72/EC and Regulation 714/2009 on NRA competences. When a Member State, when applying these acts, grants a competence to NRAs, the NC ER cannot override this competence and the TSO, when applying the NC ER, has to follow the rules applicable at national level for the involvement of the NRA. For clarity, the NC ER has been amended to clearly provide that the notification to NRAs of the System Defence and Restoration Plans are without prejudice to either a notification of the full plans or a possible approval of part or the entire plans by NRAs or other competent national authorities, when Member States granted them such competences. Recitals have also been added to clarify the competences of NRAs, or other competent authorities at national level. These recitals are consistent with the recitals in NCs OS, OPS and LFCR. 2. As for point 1, the NC ER is without prejudice to competence that may have been granted to national authorities distinct from NRAs in application of the Third Energy Package. For clarification, reference has been made in NC ER to other relevant national authorities along the NRAs, when granted such a competence by a Member State. 3. According to each national legislation. 4. The notification includes now “who will implement the measures”

Consultation – Coordination

Summary	The main concerns are the following : 1. The distinction between “consultation” and “coordination” lacks clarity. 2. The design of plans (System Defence Plan, Restoration Plan and test plan) only in consultation with DSOs and SGUs is problematic as there is no need for parties to agree and no involvement of NRAs, contrary to the coordination process. 3. DSOs/SGUs should be consulted in the implementation and the amendment of the System Defence Plan and the Restoration Plan. 4. It should be clarified that consultation and coordination should be public and open to all stakeholders.

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Changes made	1. Change. 2. Partially changed. 3. No change. 4. No change.
Explanation for change or no change	1. "Consultation" is foreseen in the NC ER for decisions to be made by the TSO, taking into account the possible constraints/situations of other parties. Requirements of the NC ER for which consultation is foreseen are to be performed before real-time (ex-ante) or in real time. "Coordination" is foreseen in the NC ER when the TSO needs a set of actions to be executed in real-time by several parties, with strong interactions between each concerned parties. Requirements to be coordinated by the TSOs with several parties require swift responses and implementation for the actions to be executed in real-time. Clarifications have been made in Article 5 of the NC ER to stress the distinction between the two processes. 2. The design of plans pursuant to the NC ER are per definition ex-ante requirements: they aim at the design and identification of the necessary measures to be performed in a later stage when necessary in real-time. As the design takes place in an ex-ante phase, the consultation of DSOs, SGUs and other possible parties is foreseen in the NC ER. A "consultation" process does not require the entity conducting the consultation to agree with the consulted parties. It only requires this entity to duly consider the views it receives and to justify its final decision taking into account these views. Considering comments received from stakeholders, minor changes have however been made to stress how the comments received in the frame of a consultation should be taken into account by TSOs. Article 5(1) has been amended in line of the consultation provision of the draft CACM Guidelines, as approved in comitology on 5 December 2014. In addition, a recital has been added on the possibility for a party having a complaint against a TSO or a DSO pursuant to the NC to bring this complaint to the NRA, in line with the NCs OS, OPS and LFCR(whereas 7). 3. The NC ER requires the TSOs to design/establish their various plans (System Defence Plan, Restoration Plan and test plans) in consultation with DSOs, SGUs and other possible concerned parties if relevant. The TSOs shall then implement the measures of the plans it designed in consultation of the concerned parties. Therefore the concerned parties, if they have concerns with regard to certain aspects of the implementation of a measure, should raise this concern when consulted in the frame of the design of the concerned plans. It is not necessary to add a requirement of consultation or coordination at the level of the implementation as this is already reflected in the designing phase of the plans. The same applies for the amendments of the System Defence and the Restoration Plans. TSOs have to amend these plans in line with the process applicable for their design. They thus have to consult the concerned parties. 4. The consultation and coordination of parties do not have to be per definition public. When framing a consultation or coordination process, it is necessary to determine which parties are relevant and should accordingly be consulted/coordinated. Article 5 of the NC ER provides the general process to be applied for the consultation or coordination of stakeholders. The relevant stakeholders to be consulted or coordinated are then listed in the appropriate requirements for which consultation or coordination is to take place.

Cost recovery

Summary	The main concerns are the following : 1. The NC ER only governs the recovery of regulated Network Operator's costs, but does not address the recovery of costs of other parties such as significant grid users, consumers, etc. 2. The NC ER does not clarify that the measures necessary for the System Defence Plan and the Restoration Plan are to be procured. 3. Additional comments required that costs implied by the NC ER (e.g. tests for compliance and imbalance settlements of SGUs) should be directly borne by the TSO and not by SGUs.

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Changes made	1. No change to the approach but alignment on the final wording of CACM Guidelines. 2. No change. 3. No change
Explanation for change or no change	1. The provisions on costs recovery in the NC ER have been aligned on the similar provisions in preceding network codes, namely RfG, DCC, OS, OPS and LFCR. The provisions in these NCs are limited to the recovery of costs incurred by regulated network operators. It is considered that the issue of stakeholder cost recovery is a matter of national legal framework. The approach has been confirmed in the draft CACM Guidelines, adopted on 5 December 2014 in comitology by the European Commission. The text in the NC ER has been aligned to the wording confirmed in the CACM Guidelines, with minor changes. 2. The procurement of the services is to be handled at the national level. In addition, the changes made with regard to the Service Providers clarify that the TSO has to appoint and select identified Service Providers. The modalities of such appointment, including if relevant procurement, are to be defined at the national level. 3. Such cost recovery rules shall be defined at national level.

Capacity Remuneration Mechanism

Summary	The main concerns on the issue of Capacity Remuneration Mechanism (CRM) are the following : 1. Energy contracted under a CRM should be delivered, even if its delivery may move the system hosting the CRM resource into the alert or emergency state. Otherwise CRMs in foreign system are not reliable, and CRM trading is de facto not feasible. Thus, XB CRM must be granted in emergency conditions.
Changes made	1. No change.
Explanation for change or no change	• NC ER (neither CACM) do not prevent nor obstacle cross-border participation to Capacity Remuneration Mechanisms. There are different methods for cross-border participation to CRMs being studied, designed or implemented across Europe, all of which we believe can effectively complement the current target model as defined by the third package and related guidelines and network codes. • According to Reg, 714/2009, transaction curtailment procedures shall only be used in emergency situations where the transmission system operator must act in an expeditious manner and re-dispatching or countertrading is not possible. Any such procedure shall be applied in a non-discriminatory manner, hence without differentiating between generation installed in their system and generation installed across their borders. A priority access to the grid (or reserved capacity) for CRM resources would thus not be in line with current legislation. • Current formulations of NC ER (and of the draft CACM Guideline) simply give the possibility to TSOs to curtail cross-zonal capacity if really necessary when a transmission system is under force majeure or emergency situations. In such cases, TSOs act taking into account the underlying conditions and the available resources with the objective to stop the deterioration of an incident. The optimum set of actions is selected to minimize impact to system users. As cross-border capacities and interconnectors are important contributors for security of supply, curtailment is considered as one of the last resource measures to be taken. • In the interest of using cross-zonal capacity as effective as possible in critical system security situations, TSOs will duly coordinate with all relevant TSOs under force majeure and emergency situations, as clearly requested by Article 69 of CACM Guideline, referred to in Article 11 of NC ER: "curtailment shall be undertaken in a coordinated manner following liaison with all directly concerned TSOs".

Service Provider

Summary	Comments were received on the issue of Significant Grid Users, Demand Facility, PGM of type A, related to: • Clarification on addressees of the NC • Possibility for Demand Facility to participate to services on a voluntary basis, without

	having to fulfil requirements, in application of the NC ER, leading to huge costs and major efforts to comply • Use of type A Power Generating Modules in the System Defence Plan and/or Restoration Plan • Possibility to derogate from the requirements of the NC ER should be introduced.
Changes made	• Clarification of applicability in Article 1(6), (7) and (8) • New definition of Defence Service Provider and Restoration Service Provider • Articles on design: selection of Service Provider and identification of SGU involved in System Defence Plan and Restoration Plan • For each requirement: review of applicability
Explanation for change or no change	• The list of Significant Grid Users remains identical to the list in NC OS and NC OPS, with the addition of HVDC systems for consistency with the NC HVDC. Demand Facilities, Closed Distribution Networks and aggregators providing DSR were taken out of the list to be included as Service Providers. • Some measures of the Plans are based on capabilities that are mandatory for the Grid Users according to requirements in NC RFG, NC DC and NC HVDC ("minimum operational requirements"). These capabilities can thus be directly used by the TSO in its Plans. For instance: Type C and D PGM shall be able to follow an Active Power set-point instructed by the TSO. In the design of its Plans, the TSO is requested to identify these capacities, and to identify the concerned grid users. • Some measures of the Plans are based on capabilities that are foreseen to be provided on a voluntary basis according to the connection codes. For instance: Demand Facility providing Demand Side Response voluntarily. To use these capabilities, the TSO is requested to procure these services via "Service Provider" mechanism described in the code. This mechanism allows to define the obligations of each party, and conditions for the service delivering. • Some measures of the Plans are based on capabilities that are not mandatory for the Grid Users according to requirements in NC RFG, NC DC and NC HVDC, but that be defined as mandatory in national legislation, pursuant to Article 4(3) of NC RFG, NC DC and NC HVDC. For instance: Black-Start capacity, communication channel between TSO and Type B PGM to remotely access the logic interface. For these capabilities: either the national legislation makes them mandatory, then the TSO will use them as "minimum operational requirements", following the process described above; or they not mandatory at national level, and the TSO will use them using the Service Provider mechanism. • The requirements related to secure/black-out proof communication channels have been restricted to the Restoration Service Provider and to DSO involved in the Restoration procedures. • Finally, with regard to derogations, the NC ER clearly states it builds on the capabilities of NC RfG, NC DCC and NC HVDC. If a Significant Grid User is not subject to these NCs, then it shall remain subject to the applicable framework pursuant to the legislation in force at the national level. The provision of services via "Service Providers" brings an additional level of flexibility that makes any derogation procedure unnecessary and redundant.

Significant Grid User – Service Provider approach: Few examples (non exhaustive list):

Type of User	Capability used	Mandatory status	Way to access the capability
PGM type C and D	Follow an active power setpoint instruction	Mandatory according to NC RFG	Significant Grid User "identified" in the plan
PGM type C and D	Black-Start	NC RFG: Not mandatory Case 1: Mandatory in national legislation Case 2: Not mandatory	 1: SGU "identified" in the plan 2: Restoration Provider on contractual basis
PGM type B	Follow an active power reduction instruction	NC RFG: communication link from Network Operator to PGM not mandatory Case 1: Mandatory in national	 1: SGU "identified" in the plan

		legislation Case 2: Not mandatory	2: Service Provider on contractual basis
PGM type A	Follow an instruction to cease active power	NC RFG: communication link from Network Operator to PGM not mandatory Case 1: Mandatory in national legislation Case 2: Not mandatory	 1: Service Provider on legal basis 2: Service Provider on contractual basis
Demand Facility	Demand Side Response	NC DC: on a voluntary basis	Service Provider on contractual basis

Efficiency

Summary	The main concerns on the issue of efficiency are the following : 1. What is exactly meant by efficiency? 2. "Minimum efficiency": for who?
Changes made	1. No change. 2. No change
Explanation for change or no change	The efficiency objective is reached the following way: · Economic efficiency is taken into account by TSOs in Defence and Restoration Plan design. · The plans shall be designed with the objective to minimize the overall impact for the grid users using the minimum possible resources. o Defence Plans, and in particular load shedding (as a last resort), shall be designed with the objective to minimize the impact for the grid users (for example: using rotational load shedding or applying load shedding to non-preferable load) and also to minimize the total load that needs to be shed taking into account the constraints. o Demand Side Response services should be developed (including interruptible load processes). Grid users with interruptible load contracts are to be shed first (before any other load is shed). o Restoration Plans shall be designed with the objective to minimize the time to restore the whole system back to Normal State with the minimum resources available taking into account the constraints. · These plans need also to consider civil security and nuclear safety issues identified typically by the responsible national authorities when defining "high priority Grid Users" (economic efficiency versus security obligations). These constraints increase significantly the complexity of the problem; TSOs shall analyse different scenarios in order to select the optimum solution. The economic efficiency of the System Defence Plan cannot be assessed by looking at the Plan alone. Instead the impact on the whole society has to be considered. This is a very complex task for a TSO, operator of a power system, to do. The code therefore considers the System Defence Plan as economic efficient when the three previous bullets are met. After entering into force of relevant Network Codes (most notably NC RfG and NC DCC) the TSO also has to respect that some grid users are already subject to requirements of these Codes while others are still subject to previous rules. As the number of users compliant with new Codes will grow, TSOs will have to use their new capabilities, taking into account grid configuration and overall efficiency.

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Responses articles by articles

Whereas

Summary	The main issues are the following : 1. Consultation and coordination; 2. Consistency and derogation possibility;
Changes made	1. No change. 2. Change.
Explanation for change or no change	1. See general response on Consultation – Coordination. 2. Most whereas of the NC ER (e.g. Recitals 3, 6 and 7) have been aligned on the corresponding whereas of the preceding NCs OS, OPS and LFCR. For consistency reasons, the wording of the concerned recitals cannot be altered.

Article 1 – Subject-matter and scope

Summary	The main issues are the following : 1. Consistency of Applicability of the Network Code for Islands or parts of a Transmission System not operating synchronously 2. Consistency of terms (power system) 3. Consistency of the provision for Member States with more than one TSO 4. Consistency of SGU-Definition
Changes made	1. Partially changed 2. No change 3. No change 4. No change
Explanation for change or no change	1. Alignment with wording of the draft CACM guideline as adopted on 5 December 2014 in comitology by the European Commission 2. The term "power system" is already used in the draft CACM guideline as adopted on 5 December 2014 in comitology by the European Commission and Annex 1 of Regulation 714/2009. 3. Consistency with the other operational codes and the draft CACM guideline as adopted on 5 December 2014 in comitology by the European Commission. 4. The addition in NC ER is needed, but the definition in NC OS cannot be changed by the DT ER. NC HVDC was drafted after NC OS.

Article 2 – Definitions

Summary	The main issues are the following : 1. Missing definitions 2. Clarification of definitions 3. How definitions of other Network Codes shall apply and be recalled.
Changes made	1. No change 2. Partially changed 3. No change
Explanation for change or no change	1. The definitions requested to be introduced are already provided in other preceding Network Codes, such as the NCs OS, OPS or RfG, or in NC ER 2. The wording of some definitions has been improved 3. Definitions of previous Network Codes and Guidelines as well as of Regulations and Directives in the Energy sector apply in every case without naming such definition again. Furthermore this is said in the beginning of article 2 of NC ER.

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Article 3 – Regulatory aspects

Summary	The main issues are the following: 1. Clarification of efficiency 2. National scrutiny: one comment considered only general principles were stated and that the structure of the article should be aligned on preceding NCs and Guidelines.
Changes made	1. Change: amendment of paragraph 3(c) to cover "overall efficiency" 2. Change.
Explanation for change or no change	1. Clarification that efficiency regards all participants, 2. Article 3 of the NC ER is aligned on the NCs OS, OPS and LFCR with regard to the general principles applicable. In addition, it clearly provides the principles and requirements TSOs have to take into account when defining terms and conditions pursuant to the NC ER. This ensures the foreseeability and clarity of the requirements under the NC ER and frames TSOs actions under the NC ER. A new article 4 has additionally been adopted to list the terms and conditions or actions developed under the NC ER that are subject to NRA approval or NRA notification, following the same approach as in NCs OS, OPS and LFCR.

Article 4 – Recovery of costs (Article 5 in version submitted to ACER)

Summary	The main issues are the following : 1. Cost recovery: the comments focused on covering the costs of stakeholders, and not only of regulated network operators; 2. Consistency: the use "best endeavour" is seen as too broad.
Changes made	1. No change – see the general response on cost recovery. 2. No change to the approach but alignment on the wording of the draft CACM guideline as adopted on 5 December 2014 in comitology by the European Commission.
Explanation for change or no change	1. See general response for cost recovery. 2. The draft CACM Guideline, as adopted on 5 December in Comitology, deleted the notion of "best endeavours". The text in the NC ER has been accordingly amended.

Article 5 – Consultation and coordination (Article 6 in version submitted to ACER)

Summary	The main concerns are the following: 1. Consultation and coordination; 2. Internal consistency;
Changes made	1. Partially changed. 2. Change.
Explanation for change or no change	1. See general response on Consultation – Coordination. 2. Clarification that the TSO has to explain when consulting both the motivation and the objective, as for a coordination process.

Article 6 – Confidentiality obligations (Article 7 in version submitted to ACER)

Summary	The main issues are the following : 1. Not all involved parties should be included into this article
Changes made	1. Partially changed.
Explanation for change or no change	1. Alignment with the draft CACM Guideline, as adopted on 5 December in Comitology.

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Article 7 – Agreement with TSOs not bound by this Network Code (Article 8 in version submitted to ACER)

Summary	The main issues are the following : 1. Endeavour is not enough, clear requirements for implementing a Synchronous Area Agreement with TSOs not bound to the NC should be implemented. 2. What shall the TSO bound by the NC do if the other TSO doesn't agree?
Changes made	1. No change 2. No change
Explanation for change or no change	1. Same wording as NC LFCR (consistency), TSOs not bound by the NC cannot be enforced to sign an agreement. 2. Consistency with NC LFCR, the consequence is already named (implementing respective processes)

Article 8 – Design of the System Defence Plan (Article 9 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Consistency with other NC 2. Consistency with other part of NC ER 3. Consultation/Coordination processes and National Scrutiny 4. Cost recovery 5. Include a derogation process in NC ER 6. Efficiency 7. External technical considerations 8. Objective/scope of NC ER 9. Significant Grid Users and Service Providers 10. Interactions between TSOs and DSOs 11. Technical precisions expected 12. TSO responsibility 13. Typo
Changes made	1. Change : Grid User replaced by System User 2. No change 3. Change 4. Change 5. Change 6. Change 7. Changes 8. No change 9. Change 10. Change 11. Changes in NC ER and in the Supporting Document 12. No change 13. Changes
Explanation for change or no change	1. Consistency with other NC The term "Grid Users" has been replaced by "System User" defined in Directive 2009/72/EC as follow: *System user means a natural or legal person supplying to, or being supplied by, a transmission or distribution system.* The term "Demand disconnection" is used in NC ER instead of "load disconnection" for consistency reasons with NC DC that introduces the term "Low Frequency Demand Disconnection". DT for NC ER considers it is preferable to keep these current terms. Nevertheless, low and high frequency control schemes have been changed to under and over frequency control schemes. Retrofitting and modifications pursuant to Art. 9(4), 10(3) and 31(8) of NC OS are taken into account in the design of the System Defence Plan: Art.8(2) of NC ER stipulates that "the expected behaviour of SGUs and existing and new type A PGM" shall be taken into account. 2. Consistency with other part of NC ER: The "assistance for Active Power procedure" has to be distinguished from "power flow management procedure" and it consists of requesting assistance internally and abroad to get additional Active power. Therefore, DT for NC ER

	considers the current wording appropriate. 3. Consultation/Coordination processes and National Scrutiny: See general answer. Consultation on System Defence Plan is extended to "neighbouring TSOs and Synchronous Area TSOs". 4. Cost recovery: See general answer. 5. See general answer related to Service Provider. 6. Efficiency: See general answer. 7. External technical considerations: Taking into account that: - System Defence Plan is established in consultation with DSOs and SGUs and their restrictions are taken into account. - The focus of the TSO is on the power system and on stopping the propagation and worsening of the incident. Endangering the DSO network and SGUs will be avoided, but it is impossible to guarantee this for every DSO and SGU in every incident. - System Security in the Responsibility Area is already endangered when System Defence plan measures have to be taken. - Legal clauses about asset damages are included in contracts for connection as well as for network access. DT for NC ER considers it is not necessary to add a requirement in Art. 8(3) about "damages on the assets of Grid Users or System Operators". Art. 8(2) is modified and includes now "characteristics of underlying DSOs' Networks". In addition Art. 8(2) and (4) are merged for more clarity: capabilities of SGUs including PGM are taken into account. 8. Objective/scope of NC ER: As explained in whereas (7), NC ER defines common requirements to be implemented within each national System Defence Plan. These requirements are inspired by current practices in Europe, but they go much further toward harmonization. Thus, NC ER ensures all TSOs in Europe will have in the future an harmonised base for their System Defence Plan which can be considered as the European System Defence Plan. 9. SGU and Service Providers: see general answer. 10. Interactions between TSOs and DSOs: DSOs and SGUs shall be involved in the process to identify Defence Service Providers. It is now covered by Art. 8. 11. Technical precisions expected: • It has been made more explicit that all Operational Security Limits (and not only short-circuit and stability) are taken into account in the design. • NC ER has been modified: "minimum necessary measures are activated" changed in "only necessary measures are activated". • The description of the System Defence Plan" has been changed for more clarity: "context triggering the measures of the System Defence Plan" is now "conditions triggering…". • NC ER Supporting Document has been completed to make clearer what has to be understood by "characteristics of Networks" (Design of the System Defence Plan section). 12. TSO responsibility • It is TSO's (or DSO's when notified by TSO) responsibility to inform Service Providers what measures they have to implement and be prepared for, depending on their identification as described in Art. 8(5). This process is covered by Art. 9. • Even if some measures of the System Defence Plan are automatic, the TSO remains responsible for manual activation of an important part of the System Defence Plan. A complete automatisation of plans is of course unrealistic as it is unrealistic to implement a fully automatized operation of the grid. Nevertheless, automatic low and high frequency control schemes, automatic schemes against voltage collapse… are current practices already in different European countries. They are considered necessary due to dynamic of specific disturbances.

Article 9 – Implementation of the System Defence Plan (Article 10 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Consistency with other NC

	2. Consultation/Coordination processes and National Scrutiny 3. Cost recovery 4. Include a derogation process in NC ER 5. Significant Grid Users and Service Providers 6. Interactions between TSOs and DSOs 7. Technical precisions expected
Changes made	1. No change 2. Changes 3. No change 4. Change 5. New definition of Service Provider 6. Changes 7. Changes
Explanation for change or no change	1. Consistency with other NC DT in charge of NC ER considers that notification of Service Providers concerning the implementation of measures is necessary even if the corresponding capabilities are mostly covered by connection codes. Indeed, in some cases, capabilities described in NC DC or RFG have to be requested explicitly by TSOs based on assessment (e.g. on-load tap changer blocking scheme). In some other cases, implementation does not apply only to new installations (e.g. ALFDD). Finally, the capabilities defined in NC DC or RFG are not always the only thing to be implemented (e.g. communication channel with type A PGM identified as Service Providers to cease active power). 2. Consultation/Coordination processes and National Scrutiny DSOs and Service Providers shall indeed be involved in the definition of the implementation deadlines. Therefore, Art. 8(1) and (8) of NC ER have been completed and the definition of deadlines is now part of the design phase performed in consultation with DSOs and SGUs and notified to NRAs. 3. Cost recovery: See general answer. 4. Include a derogation process in NC ER: See general answer related to Service Providers. 5. SGU and Service Providers: See general answer. 6. Interactions between TSOs and DSOs • As NC OS, NC ER needs to take into consideration cases when a TSO communicates directly to DSOs or Service Providers even if they are not connected to its network and cases when this communication is made indirectly through DSOs. Indeed, existing communication channels shall be used. If already today a direct communication between TSO and SGUs connected to a DSO is in place, this should not be hindered by the code. Furthermore in specific situations like restoration sometimes a communication via DSO isn't possible or too slow. Therefore in this case a contract between the TSO and SGU will be established. This communication principle applies all along NC ER for activation of measures and it is logical to apply the same principle for notification of the measures to be implemented. In any case, DSOs will be informed of the notification (Art. 9(2b)). • The extension of the notification cascading process including Network Operators with no Connection Point to the Transmission Network has been introduced in NC ER. • Taking into account that NC ER explicitly mentioned in Art. 8(2) that “each TSO shall take into account specific needs of Significant Grid Users listed as high priority Significant Grid Users” when designing the System Defence Plan, DT for NC ER considers it is not necessary to add an explicit reference to “safety and environmental measures” to be designed first and then implemented. • Article has been modified to include the notification of the TSO by the Network Operator after this Network Operator has received confirmation of the implementation by the Defence Service Provider. 7. Technical precisions expected • For more clarity the wording “make available” has been replaced by “implement and maintain”. • Of course, as in the rest on NC ER, the “measures” to be implemented and maintained do not refer to “measurements” but more generally to the means allowing the actions of the System Defence Plan. DT in charge of NC ER considers the current wording is sufficiently understandable.

Article 10 – Activation of the System Defence Plan (Article 11 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Cost recovery 2. Cascading communication chain between TSO, directly connected SGUs and indirectly connected SGUs 3. Consistency with NC OS definition of Emergency State 4. Respecting technical constraints of SGUs 5. Respecting health and safety legislation. 6. NRA approval of each SDP measures activation. 7. Notification to NRA on each SDP measures activation. 8. Editorial comments
Changes made	1. No change 2. No change 3. Wording improved and added reference to relevant article of NC OS 4. No change 5. No change 6. No change 7. No change 8. Modification of the structure of the article
Explanation for change or no change	1. The issue of cost recovery is addressed in general. Please see "Recovery of Costs". 2. The issue of communication chain is addressed in general. Please see "Consultation – Coordination". 3. New wording is clearer and more consistent with NC OS 4. Technical constraints are taken into account already in the design phase of the SDP 5. Health and safety legislation prevails over this NC in any case. 6. Activation of SDP measures has to be as fast as possible to avoid blackout therefore waiting for NRA approval is not efficient. 7. Notification of NRA in case of System Defence Plan measure activation is covered by Information chapter. 8. .

Article 11 – TSO coordination in Emergency State (Article 12 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Capacity Remuneration Mechanism 2. Reference to force majeure is confusing 3. Conditions for opening an interconnector are not clear enough 4. Cost recovery
Changes made	1. No change 2. Reference deleted 3. Wording has been refined 4. No change
Explanation for change or no change	1. See general answer on Capacity Remuneration Mechanism 2. Reference to force majeure was not necessary. 3. To provide more clarity to reader. Still, opening an interconnector should be seen as a last-resort measure. 4. The issue of cost recovery is addressed in general. Please see "Recovery of Costs".

Article 12 – Frequency Deviation management procedure (Article 13 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Unification of LFDD steps 2. Referring to demand vs. load 3. Clarity issues

	4. Cost recovery 5. Inclusion of type A PGMs and households 6. Cascading communication chain between TSO, directly connected SGUs and indirectly connected SGUs 7. Respecting technical constraints of SGUs 8. NRA approval of a set point issued by a TSO 9. Determination of a set point in cooperation with SGUs and DSOs 10. Capacity Remuneration Mechanism 11. Respecting health and safety legislation 12. Reconnection of disconnected PGMs 13. Editorial comments
Changes made	1. No change 2. Word "demand" substituted by the word "load" 3. No change 4. No change 5. New definition of Service Provider 6. No change 7. No change 8. No change 9. General clarification on Consultation - Coordination 10. No change 11. No change 12. Paragraph amended 13. No change
Explanation for change or no change	1. Proposed approach to LFDD setting allows for tailoring to specific grid requirements while ensuring different settings do not cause problems for the whole grid. This was proven by a study. 2. The term load is more appropriate in this context 3. Physics behind frequency management is described in the Supporting Document 4. The issue of cost recovery is addressed in general. Please see "Recovery of Costs". 5. . 6. This is consistent with NC OS. 7. Technical constraints are taken into account already in the design phase of the SDP 8. Activation of SDP measures has to be as fast as possible to avoid blackout therefore waiting for NRA approval is not efficient. 9. See general answer on Consultation-Coordination 10. See general answer on Capacity Remuneration Mechanism 11. Health and safety legislation prevails over this NC in any case. 12. PGMs may only connect after command/approval of their relevant network operator and/or TSO. 13. NC DC defines the term Low Frequency Demand Disconnection. This NC has to take into account requirements introduced in other codes as well as the terms.

Article 13 – Automatic under Frequency control scheme (Article 14 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Consistency with NC RfG 2. Activation of LFSM 3. Respecting provisions of NC RfG, DC and HVDC 4. Introduce a definition of "frequency gradient" 5. Activation of LFDD shall not cause breaching Operational Security Limits 6. TSO has to respect the same criteria as DSO if it implements LFDD in its grid 7. NRA approval 8. Wording "Low Frequency control scheme" 9. The proposed article 13 on automatic low frequency control scheme shall not induce any preventive requirement for residential consumers. 10. It is necessary to take preventative action in the 'yellow' 49-49,8 Hz zone, to avoid entering the 'red' 49-47,5 Hz zone. 11. Misleading wording: energy storage "acting as demand"

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	12. Household or “low scale” energy storage use in the scheme 13. Requirements on LFDD parameters and ENTSO-E study 14. Total load or Reference Load 15. Different LFDD parameters for different SA 16. Demand disconnection based on gradient 17. Coordination TSO/DSOs for implementation of the scheme 18. To make the system as reliable as possible it is important to make sure the relays react to a real event and therefore it might be useful to have a time delay for the LFDD. 19. Wording “ensure to minimize” is not appropriate 20. Proposition about relays functionalities: ensure that no upstream active power flow is disconnected by load shedding relays. 21. Implementation time and derogation 22. To avoid hazards for human health and environment, concerned structures shall as far as possible be excluded from demand disconnection. 23. Minor editorial comments
Changes made	1. Change 2. Wording of par. 2 improved 3. No change 4. No change 5. Change. 6. Change 7. No change 8. No change 9. No change 10. No change 11. Change 12. Partially changed 13. No change 14. No change 15. No change 16. Change 17. No change 18. No change 19. Change 20. No change 21. No change 22. No change 23. Partially adapted
Explanation for change or no change	1. LFSM “underfrequency” is now the term used in this article to be fully consistent with NC RFG. 2. To clarify that TSO in the design of SDP has to foresee that measures, which do not affect consumers, are activated before automatic disconnection of consumption (LFDD) and that LFSM is an automatic measure. LFSM is not equivalent to Primary Load Frequency Control. It is a complementary measure. 3. Provisions of other NCs have to be respected in any case. 4. Definition of gradient is not necessary as it is a common mathematical function. 5. TSO and DSO are responsible for their respective grids and shall then collaborate during design and implementation of the LFDD. In any case, operational limits have to be considered, even in emergency, to avoid endangering more the system. 6. Wording adapted to be more explicit. 7. The settings of Limited Frequency Sensitive Mode will be defined at national level, following the procedure required in NC RFG. NRA will be notified elements from the SDP covering the general description of LFDD. 8. This wording is consistent with NC DC and NC OS. 9. Individual consumption of each residential consumer is for sure lower than consumption of bigger facilities, but aggregated all together, they represent a much higher volume, that a LFDD scheme has to use in order to be efficient. This is current practice. Bigger facilities can provide DSR; DSR is requested to be used before shedding load. 10. Under Frequency Control Scheme covers all frequencies below 49,8Hz: LFSM, Energy storage disconnection… even if the LFDD level of harmonization is higher. 11. Load instead. 12. The definition refers to "used to balance the system". When a device can be used to balance

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	the system, it must be considered also in Emergency State as solution. Cost recovery is done through Market Rules defined at national level. This automatic disconnection could also be considered in the future as a service as defined in new Art.8 for household... 13. ENTSO-E has performed a study aiming at defining a technically optimised frame for LFDD in Europe. Such a study can only be based on a model and assumptions. The model used is the one already used for embedded generation retrofit study. A gap analysis compared to current practices is being developed by ENTSO-E. 14. Total Load is used in regulation and correspond exactly to the current definition of Reference Load in Continental Europe Operational Handbook. "Reference" was misleading because it is not a fixed value in MW, it is the real-time value of the sum of all loads at all voltage levels (including losses) in a TSO geographical scope. 15. The parameters are not directly dependent on the size of the area, but are dependent on its dynamic characteristics. 16. The description of the Demand disconnection based on frequency gradient has been completed. The NC now gives principles to be respected in case of implementation of such a function. It is not mandatory in the code. 17. The consultation of DSOs is covered by Art.8 about design of the System Defence Plan. 18. Covered by the "operating time of the relays" that includes time needed for frequency measurement. 19. "ensure" has been replaced everywhere in the article. 20. NC ER defines a functional target for LFDD, but do not enter the technical implementation (relays functionalities…) that can be defined at national level in coordination between TSO and DSOs. 21. Higher implementation time could be considered unacceptable for a Network Code. Framework guidelines explicitly stipulate that no derogation are possible for system operators in the NC (except for islands…). 22. This is covered by the "needs of high priority SGU" in Article 8. 23. .

Article 14 – Automatic over Frequency control scheme (Article 15 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Technical precision expected 2. Objective scope 3. Consistency with other NC 4. External technical consideration 5. External technical consideration 6. Cost recovery 7. Cost recovery/Efficiency 8. National scrutiny
Changes made	1. Changes 2. Changes 3. Changes 4. Changes 5. No change 6. No change 7. No change 8. No change
Explanation for change or no change	1. Wording improved to avoid misinterpretations 2. Article 14 has been modified 3. Title of Article 14 will be modified to "Automatic over-frequency control scheme" as well as other mentions of "high" or "low" frequency, with the exception of Low Frequency Demand Disconnection which uses terminology introduced in NC DC and therefore has to be consistent with it. 4. HVDC will be included - keeping in mind that there are HVDC interconnections also inside the synchronous area and this will only help in island situations 5. Each TSO will consider this in the SDP. 6. See general answer on cost recovery

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	7. See general answer on cost recovery. The NC aims at harmonizing the requirements. 8. See general answer on national scrutiny

Article 15 – Voltage deviation management procedure (Article 16 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Cost recovery 2. Technical precision expected 3. Technical precision expected 4. External technical consideration 5. Technical precision expected 6. Consistency with other NC 7. Technical precision expected 8. Technical precision expected 9. Technical precision expected 10. Technical precision expected 11. Technical precision expected
Changes made	1. No change 2. Changes 3. No change 4. No change 5. No change 6. Changes 7. No Change 8. No Change 9. No Change 10. No Change 11. No Change
Explanation for change or no change	1. See general answer on cost recovery 2. Wording improved to avoid misinterpretations 3. TSOs are always obliged to comply with national legislation 4. Impact for system users shall be minimized all the time (Article 8(3)) 5. In some cases (identified in the SDP) a unit in DSO grid has very high impact on TSO grid; higher than TSO-connected units far away. 6. Reference to NC OS has been improved 7. Voltage and Reactive Power ranges are agreed when DSO is connecting to the TSO. Setpoints are used in real-time operation. Still, it is reasonable to expect that quality of maintaining the setpoint by DSO is lower than by PGM. 8. NC ER applies only in Emergency State therefore amendment is not necessary 9. TSOs have to implicitly respect provisions of other codes as explained in Supporting Document. Also, Article 10 in NC OS already refers to relevant articles of NC RfG and DC. 10. Article 10(13) of NC OS uses "set-point" 11. The set-point is defined during real-time operation therefore obtaining NRA approval is impossible. However, changing voltage or reactive power does not introduce substantial additional cost so NRA approval is not necessary.

Article 16 – Automatic scheme against Voltage collapse (Article 17 in version submitted to ACER)

Summary	The main comments received on this article are the following : 1. An On Load Tap Changer Blocking scheme, a Low Voltage Demand Disconnection scheme and Special Protection Schemes for Voltage management shall only be implemented if necessary, based on the assessment by the TSO. 2. It should be stated which transformers the On Load Tap Changer Blocking scheme applies to. 3. The On Load Tap Changer Blocking scheme and Low Voltage Demand Disconnection scheme shall be subject to NRA approval.

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Changes made	1. Change 2. No change 3. No change
Explanation for change or no change	1. According to 20(3) [NC DC] the TSO shall make an assessment of the necessity of the On Load Tap Changer Blocking scheme, Low Voltage Demand Disconnection scheme and Special Protection Schemes for Voltage management. NC ER is changed accordingly. 2. This is specified in 20(4) [NC DC] and NC ER refers to this specification. 3. The elements of the System Defence Plan to be notified to NRA are listed in the code. The notification includes (among other things) the general principles and conditions triggering the System Defence Plan measures.

Article 17 – Power flow management procedure (Article 18 in version submitted to ACER)

Summary	The main comments received on this article are the following : 1. Editorial comments. 2. Energy contracted under a CRM should be delivered, even if its delivery may move the system hosting the CRM resource into the alert or emergency state. 3. Cost recovery for the Significant Grid Users should be defined in NC ER 4. In addition to the SGUs' technical constraints, the legal and security constraints shall also be taken into account when the TSO is giving instructions regarding the Active Power set-point. 5. The TSO should only give instructions regarding the Active Power set-point to Power Generating Modules, not Demand Facilities. 6. Treatment of Type A Power Generating modules should be reconsidered. 7. Instructions regarding the Active Power set-point should be approved by the NRA. 8. A time frame should be specified for the SGUs' response to the TSO's instructions on the Active Power set-point. 9. Communication between the TSO and the SGU's connected to Distribution System shall always go through the DSO.
Changes made	1. Some changes 2. No change 3. No change 4. Change 5. No change 6. New definition of Service Provider 7. No change 8. Change 9. No change
Explanation for change or no change	1. Editorial comments were taken into account. 2. See general answer on Capacity Remuneration Mechanism. 3. Cost recovery for the SGUs is covered at the national level. 4. Legal and security constraints regarding the Active Power set-point have been included in General Provisions of NC ER, article 5. 5. Demand Facilities providing Demand Side Response are subject to TSO instructions on Active Power set-point. Other Demand Facilities will be covered by the requirement to take into account the technical etc. constraints. 6. See general answer on Service Provider 7. NRA approval for instructions regarding the Active Power set-point in Alert or Emergency state is not possible due to the fact that immediate actions are required. 8. A requirement for a reasonable response time is added to NC ER. 9. If direct communication channels between TSO and the SGU in the Distribution system already exist, NC ER will allow to use them. Also, in some urgent situations it may not be possible to communicate through the DSO. The DSO shall in any case always be notified.

Article 18 – Assistance for Active Power Procedure (Article 19 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Consistency with other NC

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	2. Cost recovery 3. Capacity Remuneration Mechanism 4. Include a new definition in NC ER ("firm") 5. External technical considerations 6. Significant Grid Users and Service Providers 7. Interactions between TSOs and DSOs 8. Typo
Changes made	1. No change 2. No change 3. No Change 4. No Change 5. Changes 6. New definition of Service Provider 7. Changes 8. Changes
Explanation for change or no change	1. Consistency with other NC : Elements have been added to the Supporting Document ("Assistance for Active Power and manual Demand Disconnection procedures" section) in order to justify the applicability of the term Responsibility Area Adequacy defined in NC OPS. 2. See general answer on Cost recovery 3. See general answer on Capacity Remuneration Mechanism 4. Include a new definition in NC ER : "firm" is considered clear enough 5. External technical considerations: Power Generating Modules technical constraints are taken into account when activating the assistance for Active Power. It is generally covered by Art. 8, but it has been added in Art. 18(2) also for more clarity. 6. See general answer on Service Providers 7. Interactions between TSOs and DSOs : a coordination has been added in Article 10 (Activation of the System Defence Plan) 8. .

Article 19 – Manual Demand disconnection procedure (Article 19 in version submitted to ACER)

Summary	The main comments received on this article are the following : 1. Communication between the TSO and the SGU's connected to Distribution System shall always go through the DSO. Manual disconnection of SGUs connected to the Distribution Systems only by the DSO. Cf. DSOs position that all actions on the Distribution system should be agreed with and executed by the DSOs. 2. The information flow should be hierarchical: TSO contacts the DSOs and SGUs connected to the Transmission System. These DSOs in turn contact the DSOs and SGUs connected to their Distribution System. 3. Cost recovery for the Significant Grid Users should be defined in NC ER 4. The TSO shall notify the NRA without delay the amount of demand to be manually disconnected.
Changes made	1. No change 2. No change 3. No change 4. No change in this Article
Explanation for change or no change	1. The manual demand disconnection in Article 19 is carried out by opening breakers in the Distribution System to the extent that the instruction from the TSO is fulfilled. These actions shall be planned in advance by the DSO. In very urgent and extreme cases however, it may be necessary for the TSO to disconnect load by opening breakers in the Transmission System. 2. See the previous point. The DSO's plan may also include actions that will be carried out in the indirectly connected Distribution Systems. 3. Cost recovery for the SGUs is covered at the national level. 4. The TSO will inform the NRA according to principles set forth in Article 37. The details will be reported to the NRA after the incident.

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Article 20 – Design of the Restoration Plan (Article 21 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Consistency with other NC 2. Consistency with other part of NC ER 3. Consultation/Coordination processes and National Scrutiny 4. Cost recovery 5. Include a derogation process in NC ER 6. Efficiency 7. External technical considerations 8. Objective/scope of NC ER 9. Significant Grid Users and Service Providers 10. Interactions between TSOs and DSOs 11. Technical precisions expected 12. TSO responsibility 13. Editorial comments & Typo
Changes made	1. Grid User replaced by System User 2. No Change 3. Changes 4. No Change 5. New definition of Service Provider 6. Changes 7. Changes 8. No change 9. New definition of Service Provider 10. Changes 11. Changes 12. No change 13. Changes
Explanation for change or no change	1. Consistency with other NC • The term "Grid Users" has been replaced by "System User" defined in Directive 2009/72/EC as follow: *System user means a natural or legal person supplying to, or being supplied by, a transmission or distribution system.* • The term "Island Operation" is defined in NC RFG. The word "controlled" cannot be added for consistency reasons. • Retrofitting and modifications pursuant to Art. 9(4), 10(3) and 31(8) of NC OS are taken into account in the design of the Restoration Plan: Art.20(2) of NC ER stipulates that "the expected behaviour of load and generation" shall be taken into account. 2. Consistency with other part of NC ER: Frequency management procedures are present in System Defence Plan and Restoration Plan. This is not redundant as the procedure of the System Defence Plan aims at stabilizing the frequency at the moment of the incident while the procedure of the Restoration Plan aims at restoring frequency within Operational Security Limits after designation of the Frequency Leader (about 15 min after the incident). 3. Consultation/Coordination processes and National Scrutiny: See general answer. Consultation on Restoration Plan is extended to "neighbouring TSOs and Synchronous Area TSOs". 4. Cost recovery: See general answer. 5. Include a derogation process in NC ER: See general answer related to Service Providers. 6. Efficiency: See general answer. 7. External technical considerations: Taking into account that: - Restoration Plan is established in consultation with DSOs and SGUs and their restrictions will consequently be taken into account. - It is explicitly mentioned in Art. 20(2) that "each TSO shall take into account specific needs of SGUs listed as high priority SGUs" when designing the Restoration Plan. - The focus of the TSO is on the global power system. Endangering the DSO network and SGUs will be avoided, but it is impossible to guarantee this for every DSO and SGU in every incident. - Legal clauses about asset damages are included in contracts for connection as well as for network access. DT for NC ER considers it is not necessary to add a requirement in Art. 20(3) about

	"damages on the assets of Grid Users or System Operators" or to make explicit reference to "safety and environmental measures". Art. 20(2) is modified and includes now "characteristics of underlying DSOs' Networks". In addition Art. 20(2) and (4) are merged for more clarity: capabilities of SGUs including PGM are taken into account. If DSOs have the possibility to operate islanded networks, they will be considered as power sources for bottom-up restoration of the system. It is covered by Art. 20(6c) that refers to the Island Operation capability which is applicable to any network including distribution network: *The independent operation of a whole or a part of the Network that is isolated after its disconnection from the interconnected system, having at least one Power Generating Module or HVDC System supplying power to this Network and controlling the Frequency and Voltage.* 8. Objective/scope of NC ER: As explained in whereas (7), NC ER defines common requirements to be implemented within each national Restoration Plan. These requirements are inspired by current practices in Europe, but they go much further toward harmonization. Thus, NC ER ensures all TSOs in Europe will have in the future an harmonised base for their Restoration Plan which can be considered as the European Restoration Plan. 9. Significant Grid Users and Service Providers: See general answer. 10. Interactions between TSOs and DSOs: DSOs and SGUs shall be involved in the process to identify Restoration Service Providers. It is now covered by Art.20. 11. Technical precisions expected • NC ER has been modified: "minimum necessary measures are activated" changed in "only necessary measures are activated". • The description of the Restoration Plan" has been changed for more clarity: "context triggering the measures of the Restoration Plan" is now "conditions triggering…". 12. TSO responsibility: It is TSO's (or DSO's when notified by TSO) responsibility to inform Service Providers what measures they have to implement and be prepared for, depending on their identification as described in Art. 20(5). This process is covered by Art. 21. 13. Editorial comments • DT in charge of NC ER prefers not to add a mention about "voltage level" at "point of connection" in Art. 20(7), considering current wording does not prevent from including in the Restoration Plan Black Start units connected at any voltage level. • Art. 20(11) only stipulates elements of Restoration Plan that shall be notified to NRAs. Of course the full Restoration Plan design, implementation and activation is covered by NC ER all along chapter 3.

Article 21 – Implementation of the Restoration Plan (Article 22 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Consistency with other NC 2. Consultation/Coordination processes and National Scrutiny 3. Cost recovery 4. Include a derogation process in NC ER 5. Significant Grid Users and Service Providers 6. Interactions between TSOs and DSOs 7. Technical precisions expected 8. Editorial comments
Changes made	1. No change 2. Changes 3. Changes 4. Changes 5. Changes 6. Changes 7. Changes 8. No change
Explanation for change	1. Consistency with other NC: DT in charge of NC ER considers that notification of Service

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or no change	Providers concerning the implementation of measures is necessary even if the corresponding capabilities are mostly covered by connection codes. Indeed, in some cases, capabilities described in NC DC or RFG have to be requested explicitly by TSOs based on assessment. In some other cases, implementation does not apply only to new installations. Finally, the capabilities defined in NC DC or RFG are not always the only thing to be implemented (e.g. communication channel with type A PGM identified as Service Providers to cease active power). 2. Consultation/Coordination processes and National Scrutiny: DSOs and Service Providers shall indeed be involved in the definition of the implementation deadlines. Therefore, Art. 20(1) and (11) of NC ER have been completed and the definition of deadlines is now part of the design phase performed in consultation with DSOs and SGUs and notified to NRAs. 3. Cost recovery: See general answer. 4. Include a derogation process in NC ER: See general answer related to Service Providers. 5. Significant Grid Users and Service Providers: See general answer. 6. Interactions between TSOs and DSOs: As NC OS, NC ER needs to take into consideration cases when a TSO communicates directly to DSOs or Service Providers even if they are not connected to its network and cases when this communication is made indirectly through DSOs. Indeed, existing communication channels shall be used. If already today a direct communication between TSO and SGUs connected to a DSO is in place, this should not be hindered by the code. Furthermore in specific situations like restoration sometimes a communication via DSO isn't possible or too slow. Therefore in this case a contract between the TSO and SGU will be established. This communication principle applies all along NC ER for activation of measures and it is logical to apply the same principle for notification of the measures to be implemented. In any case, DSOs will be informed of the notification (Art. 9(2b)). The extension of the notification cascading process including Network Operators with no Connection Point to the Transmission Network has been introduced in NC ER. Article has been modified to include the notification of the TSO by the Network Operator after this Network Operator has received confirmation of the implementation by the Defence Service Provider. 7. Technical precisions expected • For more clarity the wording “make available” has been replaced by “implement and maintain”. • As in the rest on NC ER, the “measures” to be implemented and maintained do not refer to “measurements” but more generally to the means allowing the actions of the System Defence Plan. DT in charge of NC ER considers the current wording is sufficiently understandable. 8. Editorial comments: Art. 21(3) refers to “notified DSOs” and not “all DSOs” because if a DSO has not been notified by a TSO first, it means that neither this DSO nor the Network Operators, SGUs… connected to its Distribution System have to implement any Restoration Plan measure. In this case, of course, the DSO does not have to notify anything.

Article 22 – Activation Of The Restoration Plan (Article 23 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. COST RECOVERY for cost incurred by activation of measures in the restoration plan 2. TSO should observe legal and technical limitations of DSOs, SGUs and PGMs 3. Activated measures should be notified to the NRA (NATIONAL SCRUTINY) 4. Clarify the expression “stabilised”
Changes made	1. New definition of Restoration Service Provider 2. No change 3. No change 4. No change
Explanation for change or no change	1. See general answer on Cost recovery 2. Legal and technical limitations are taken into account via the Coordination process 3. NRA are not involved in Restoration procedures. The NRA can be notified if national legislation asks for this. 4. clarify in supporting document.

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Article 23 – Re-energization procedure (Article 24 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. NRA approval of restoration plan needed?
Changes made	1. No change
Explanation for change or no change	1. See general answer on national scrutiny

Article 24 – Re-energisation Strategy (Article 25 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. new paragraph: In the coordination with the TSO, DSO can start island operation in his own network? 2. Also high priority grid users must be taken into account. 3. When activating the Re-energisation procedure, each TSO shall define, SUBJECT TO NRA APPROVAL, on A strategy to apply, taking into account 4. DSOs with islanding capability should be informed about the expected duration to decide whether to start re-energization of their network area bottom-up. 5. The maximum frequency tolerance must be specified in line with NC LFC&R, Articles 11 6. §24.2: Proactive frequency management would be realistic for larger demand and generation carried out in coordination with the DSO. 7. In order to do this(§24,3) the TSO will need to be aware of automatic connection of demand and generation - there would need to be some process for the relevant party to inform the TSO of such demand / generation. 8. §24.4: During Re-energisation, DSOs shall, in **coordination and collaboration** with the TSO, connect the agreed part of their Network. 9. During Re-energisation, DSOs shall, after being consulted by the TSO, connect the amount of generation and **/ OR Demand** requested by the TSO. 10. Add new paragraph covering needs to be a clear reference to cost recovery to avoid the costs of providing support to another TSO in an Emergency, Black Start or Restoration State falling upon consumers in another TSO's area. 11. Typo
Changes made	1. No change 2. Change 3. No change 4. No change 5. No change 6. No change 7. Change 8. Change in Article 5 9. Add to §24.4: **/ OR Load** 10. No change 11. Change
Explanation for change or no change	1. No added value since such island is not forbidden 2. Add to 28.1: e) the "high priority grid users" pursuant to Article 32(10) [NC OS] 3. NRA are not involved in Restoration procedures. The NRA can be notified if national legislation asks for this 4. Already defined in 1b 5. The term and valued are defined in NC LFCR. No added-value in repeating the reference (general principle applied to all NC). 6. Clarifying proactive and not monitoring. No need to change the code. 7. The code gives now DSOs the responsibility to take into account the automatic re-connection on their grids. 8. See general answer on Consultation-Coordination 9. Clarifying accepted 10. See general answer on national scrutiny 11. .

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Article 25 – Frequency management procedure (Article 26 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. New term: should be defined
Changes made	1. No change
Explanation for change or no change	1. No definition needed: the concept is developed in the article 25.

Article 26 – Appointment of Frequency Leaders (Article 27 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. The title of the article should set out what's expected – in this case it's not just the appointment but also what the leader is being **obliged** to do. 2. **K-factor** not included in definitions. 3. §26.5: When a TSO is appointed as Frequency Leader of a Synchronised Region, this TSO shall inform all other TSOs, **NRAs, DSOs and Significant Grid Users** of the Synchronous Area of its appointment.
Changes made	1. No change 2. No change 3. No change
Explanation for change or no change	1. Current title seems appropriate enough. 2. k-factor is defined in NC OS. Reference to NC LFCR included. Definition in NC OS §2.2: K-Factor means a factor used to calculate the frequency bias component of the ACE of a LFC Area or a LFC Block 3. NRAs and other parties are informed when entering into Emergency, Blackout or Restoration State. It is not feasible to inform NRAs about all actions taken during restoration. NRAs will be informed afterwards with a report about all taken actions. It is also not feasible for the TSO to notify all market players in advance of Blackouts etc.

Article 27 – Frequency management after Frequency Deviation (Article 28 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. Manual activation of Frequency Restoration Reserves and Replacement Reserves must remain possible for all TSOs of the Synchronous Area but only under instruction from the Frequency Leader. 2. AGC to be suspended until the Frequent Leader analyses the situation and provides proper instructions. 3. Clarity required with regard to "Load Frequency Control" in Para 2. 4. It is not clear which Load Frequency Control settings are referred to.
Changes made	1. Changes 2. No change 3. No change 4. Changes
Explanation for change or no change	1. This is only the first step. Manual activation coordinated by the frequency leader is described in §3. 2. This is already covered by §2. 3. Load-Frequency Control is operated by the TSO and defined in NC LFCR 4. Load Frequency Control settings are described in NC LFC&R. For sake of clarity, "settings" have been, replaced by "operating mode".

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Article 28 – Frequency management after Synchronous Area split (Article 29 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. Manual activation at the demand of the Frequency Leader must remain possible (similar to §27)
Changes made	1. Changes
Explanation for change or no change	1. This is only the first step. Manual activation coordinated by the frequency leader is described in Art. 28(3).

Article 29 – Resynchronisation Procedure (Article 30 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. Breakers can be closed, lines can't. 2. Limits to be specified. 3. Clarify that voltage angle as well as amplitude must be controllable.
Changes made	1. Changes 2. No change 3. No change
Explanation for change or no change	1. "Closing lines" changed to "connecting lines". 2. This kind of parameters has to be defined at Synchronous Area level. 3. No different from normal operations.

Article 30 – Appointment of a Resynchronisation Leader (Article 31 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. NRA should be informed on who is resynchronisation leader 2. DSO and SGU should be informed on who is resynchronisation leader 3. Additional criterion: Resync leader should have overview over both synch regions. Service of RSCI (regional initiative) seems indispensable 4. Article should define how the resync leader is chosen 5. confusion possible: the resync leader shall be the freq. leader 6. unclear: paragraph 3(b): the resync leader needs f measurements of both regions: do we mean EAS? then this is pointless
Changes made	1. no change 2. no change 3. no change 4. no change 5. no change 6. no change
Explanation for change or no change	1. The NRA is not part of the resynchronisation process. The NRA can be notified if national legislation asks for this or the TSO deems it necessary. 2. This information is not considered valuable for DSOs and SGUs. 3. RSCIs nowadays do not have a clear role yet in network operations, and in a blackout situation might not even have electricity. The TSOs coordinating a synchronisation however can exchange the necessary information and act accordingly. 4. we think that this is clear enough 5. It is possible that a TSO has to synchronise two regions without being the frequency leader as a fall-back solution. 6. Frequency measurement in the synchronised region can be provided by EAS.

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Article 31 – Resynchronisation strategy (Article 32 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. Remove the paragraph 1.about the definition of the actual operating maximum limitations and settings because of this values should in advance be defined in the restoration plan, not at the moment of a resynchronisation 2. Remove clause i about the definition of the actual operating maximum difference between Frequencies of the two Synchronised Regions because of this frequency value is already defined in 29(1)c 3. Frequency Leaders shall inform all NRAs and Market Participants in addition to TSOs within their Synchronised Regions of the planned Resynchronisation. In the interest of openness and transparency it is important that NRAs are fully informed about all actions taken during the system Restoration phase. In addition to NRAs as this resynchronisation is a major step to restoring the market(s) it is important that market participants are informed as well.
Changes made	1. No change 2. No change 3. No change
Explanation for change or no change	1. The restoration plan includes maximum technically possible and recommended values for frequency, phase angle and voltage differences as theoretical limitations for the closing lines in order to realize successful resynchronisation of split areas. In case of a real resynchronisation the Resynchronisation Leader shall define anyway the real limitations and settings the actual operating conditions taking into consideration. The effective settings of the mentioned values shall and possible be defined only in knowledge of the actual operating conditions. The formulation of the present article 31 is enough detailed and explicit. 2. Same explanation as in point 1. In 29(1)c are defined only the theoretical limitations. Article 31 deals with the practical realization of a necessary resynchronisation. 3. In article 31 we refer to an actual operating and identification process in case of a resynchronisation. The market operation is basically suspended during this period in all probability. The successful resynchronisation does not mean the fully restoration of normal operation of power system. NRAs are not operative organisations and have not overview, responsibility and power of disposal during the process of resynchronisation. Therefore we do not propose to change this article. To send notification to NRA by the competent TSO about a restoration event is an important duty of course in accordance with national legislation, but only after closing the whole restoration process. In the same way the information exchange with Market Participants can be important and possible only after the successful restoration process in the frame of market interactions.

general comments to chapter 4 – Market Interaction

Summary	The main issues are the following : 1. Suggest that Chapter 4 alone should fall under the governance of a special stakeholder group with market expertise. 2. Clarify Market Activities. 3. Define Market Activities Restoration 4. Include a definition of Market Activities Suspension Trigger 5. Include a definition of Market Activities Restoration Trigger 6. Missing are specific timelines as to when different steps shall be undertaken (e.g. when exactly after the entry into force of the Code the TSOs shall develop the triggers
Changes made	1. No change 2. No change 3. No change 4. No change 5. Partially changed. 6. Changed.
Explanation for change	1. A reasonable suggestion given the strong relation to market activities. To be also discussed with EC.

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or no change	2. Article 3(1) lists what can be suspended. 3. The corresponding definition of the restoration trigger is clear enough. 4. Already included. 5. New definition. 6. In the last article of this NC, provisions have been included that specifies timelines as to when several steps shall be undertaken .

Article 32 – Market activities suspension triggers and market activities restoration triggers (Article 19 - Procedure for suspension of market activities - in version submitted to ACER)

Summary	The main issues are the following: 1. Provide a timetable by which the Market Suspension Triggers shall be defined, by which time the NRAs shall approve or by which time the Triggers shall be implemented. 2. Defining a set of Market Activities Suspension Triggers, not in consultation with, but taking account of stakeholder views expressed via public consultation. 3. Suggested to introduce also Market Restoration Triggers in the Netcode. But we leave it up to the discretion of each Member State to define the %. 4. Several definitions of Market Activities Suspension, Market Activities Suspension Triggers has been proposed. Also Market Activities Restoration Trigger. 5. Market Suspension Triggers should be harmonised on a synchronous area level, also by NRAs. 6. When triggers are met, a waiting period of 1 hour is proposed. 7. Relate the percentage of Demand Disconnection in the LFC area of the TSO, to the amount of load shedded in the first step of the Automatic Low Frequency Control Scheme according to Art.13. 8. Addition in Article 2(3)(d): a significant decrease of Cross Zonal capacities i.e. going below the sum of the monthly and yearly allocations. 9. Add article: *When defining the Market Activities Suspension Triggers, each TSO shall also make sure that such defined Triggers can be practically monitored in real time by the TSO*. 10. Consider several market suspension grades, and according market suspension triggers, as depending on the gravity of the emergency, different types of market suspension would be useful.
Changes made	1. No change 2. No change 3. Change 4. Partially changed 5. No change 6. Partially changed 7. No change. 8. Partially changed 9. Changed 10. No change
Explanation for change or no change	1. Although in itself not a bad idea, we think it is not strictly necessary. If we do not define it, is must be ready when the NC is applicable. 2. How to consult must be arranged nationally; market participants listed here is meant to be very wide and certainly incorporates all interested parties. 3. Introducing Market Restoration Triggers is reasonable and could help clarifying. 4. Introducing a definition of Market Activities Suspension is not necessary as the current definition of Market Activities Suspension Triggers is sufficient. A definition for Market Activities Restoration Trigger has been added. 5. Harmonisation of these triggers would be ideal, but given the extreme diversity of Market arrangements (e.g. pricings of aFRR, balancing mechanism and roles) of each TSO, this is impossible. NC ER provides parameters to be taken into account when defining the triggers. 6. Inclusion of a waiting period while leaving its duration to national arrangements. 7. Relate Demand Disconnection to automatic load shedding according to Article 13 could be confusing because market activities could be suspended also in case of manual demand disconnection. In other words there is no direct link between the two proposed parameters. 8. We acknowledge that the term 'significant' requires in this case a quantification. As also the situation that Cross Zonal capacities drops below the sum of the allocated year and month capacities is no reason to suspend any market activity, we propose to consider the situation that all cross zonal capacities on a bidding zone border is reduced to zero, as a parameter. 9. Triggers to be monitored by TSOs in real-time and trigger and can be assessed by TSOs based on information coming from BRP and/or BSP through email, phone call… 10. Not necessary as the current draft already foresees in this flexibility

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Article 33 – Procedure for market activities suspension (Article 34 - Rules and conditions for suspension and restoration of market activities - in version submitted to ACER)

Summary	The main issues are the following: 1. Suspension of market activities in coordination with DSOs. 2. Article 3(1) leaves room for TSOs to decide differently upon suspension of markets when exactly the same conditions occur. 3. Art. 3(2) remains silence on the legal entities that has appointed a task. These should be included. 4. Proposed is the following paragraph: *All market participants shall inform TSOs by which information channels they wish to be informed of the suspension of any of the above mentioned market activities or any combination thereof*. 5. Proposed is to delete 3(3). 6. Proposal to request Significant Grid Users to operate at an Active Power set point as instructed by the TSO, instead of keeping their last Active Power set point. 7. Each party must be able to suspend market activities. 8. The necessity for article 4(4) is questioned and doubted.
Changes made	1. No change 2. No change 3. Changed 4. Partially change. 5. Changed. 6. Changed 7. No change 8. No change
Explanation for change or no change	1. DSO has no role in suspending market, unless specified otherwise in national legislation. 2. We think this fear is without foundation. 3. It seems indeed reasonable to inform such third parties, like settlement administrators. This is now covered by communication Procedure 4. The organisation of communication will be defined in coordination between TSOs and market participant representatives (see Art. Communication procedure) but a specific information channel cannot be defined by each market participant. 5. Covered by Communication Procedure. 6. At first, SGU should keep actual Set-Point, until further instruction by the TSO. As soon as possible, the TSO will instruct a Set-Point, but in a first time, for clarity reason, the preferred option is to keep Active Power unchanged. 7. This NC describes the relation between monopolists (TSO, DSO) and users (connected entities, BRPs, NEMOs, traders, BSP's). It is not the intention that each 'relevant' party, which could be interpreted as an individual legal entity can make sure that market activities can be suspended. 8. If we do not add this article, the rights of TSOs during Emergency or Blackout are not clear enough.

Article 34 – Procedure for market activities restoration (Article 35 in version submitted to ACER)

Summary	The main issues are the following: 1. Proposed is to add in 5(1) a new par. "e) When practicable, after approval of the NRA." 2. TSOs can only restore market activities in coordination with DSOs. 3. Rephrase 5(1)(a): the Market Activities Restoration Triggers are cumulatively met. 4. Art. 5(1)(c) remains silence on the legal entities that has appointed a task. These should be included. 5. Proposed in art. 5(3) is to add: "…each TSO <u>in coordination with neighbouring TSOs'</u> shall select…".
Changes made	1. Partially 2. No change 3. Partially changed 4. Changed 5. No change
Explanation for change	1. In the current liberalised energy sector, a NRA shall never disagree with restoring market activities: after all, restoring relieves the market of the burden of a central dispatch system.

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or no change	According to Communication Procedure, TSO shall inform NRA of the launching. In the current draft, the restoration is decided by NEMO and/or TSO 2. DSOs has no formal role in market activities, unless specified otherwise in national legislation. 3. Probably more accurate: the applicable Market Activities Restoration Triggers are met. 4. It seems indeed reasonable to inform such third parties, like settlement administrators. 5. The coordinated Capacity Calculator consists of TSOs of the region, per default including neighbouring TSOs.

Article 35 – Communication procedure (Article 36 in version submitted to ACER)

Summary	The main issues are the following: 1. Proposed is to add in 6(1) a new par. f) Approval of the NRA. 2. Proposed to add explicitly the DSOs. 3. Art. 6(1) remains silence on the legal entities that has appointed a task. These should be included. 4. Art. 6(1)(b): ~~Global~~ Update on the restoration process by TSOs; 5. Provide a timeline by which the TSO shall develop communication procedure. 6. Proposed to add a new sentence in art. 6(3); And any third party shall forward the information mentioned in the previous article to its Balance Responsible Parties and/or other relevant participants without delay. 7. Proposed is to rephrase art.6(3): Each NEMO shall forward the information mentioned in paragraph 2 (…).
Changes made	1. No change. 2. No change. 3. Change. 4. Change. 5. No change. 6. Change. 7. Change.
Explanation for change or no change	1. In the current liberalised energy sector, a NRA shall never disagree with restoring market activities: after all, with this ends the burden of a central dispatch system. In par 2 the information flow to NRA is already foreseen. 2. Not necessary as they are already covered by the term Market Participants. 3. It seems indeed reasonable to inform such third parties, like settlement administrators. 4. Indeed, the word global does not have much added value. 5. Although In itself not a bad idea, we think it is not strictly necessary. If we do not define it, is must be ready when the NC is applicable. 6. It is good that also third parties, who have been tasked under the Guideline Balancing with some TSO activities including market administration, inform its members. The risk (if that is a correct term at all) that some parties, especially BRPs, will be informed more than once, does not compensate for the importance of the assurance of being informed. 7. Proposal is more precise.

Article 36 – Settlement principles (Article 37 in version submitted to ACER)

Summary	The main issues are the following : 1. Addition of "without market suspension" in par.1. 2. Delete par.1 because with the option to suspend market activities already before reaching the Emergency State (article 2, paragraph 2) market participants already have no option to get their positions balanced by market activities. In consequence, the usual settlement rules and prices might not be applicable. 3. Replace "regulatory period` with "regulatory grid access tariffs" in par.2. 4. Add a sentence "Each NRA shall determine the deadlines of provisional settlement and final settlement." 5. Replace "national law" with "national legal framework" in par.2. 6. Add in par.2 that also any third party to whom a relevant TSO process has been assigned or delegated pursuant to the Network Code on Electricity Balancing shall settle its imbalance with TSOs. 7. Added has the notion that TSOs shall act as settlement coordinators between generators and suppliers.

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	8. Proposed is to delete the sentence "*The rules and principles shall be in line with the ones defined pursuant to [CACM] and [FCA] if any*." in par.2. 9. DSOs requests more clarity on the possible conditions in which additional market data can be required from the DSO to support the application of adapted settlement rules by the TSO. 10. A request to force that the "*settlement of Emergency State with suspension of market activities according to Article 2, Blackout State or Restoration State shall be governed by rules and principles…..*", instead of "*… may be governed…*".
Changes made	1. Change. 2. No change. 3. Change. 4. No change. 5. No change. 6. No change. 7. No change. 8. Change. 9. No change. 10. No change
Explanation for change or no change	1. Addition adds clarity. 2. The comment misunderstands the reading of Article 2(2): it is not the intention to suspend market activities before reaching Emergency State, i.e. whilst being in Normal or Alert State. 3. It is more precise. 4. This deadline should be agreed at national level (and most probably on a case by case basis). 5. The term "national law" has been used in line with the approach taken under the CACM guidelines, as adopted in Comitology on 5 December 2014. 6. Settlement always relates to the three mentioned parties; settlement administrators could perform or execute the settlement but are no financial party in the blackout settlement itself. 7. ENTSOE strongly prefers to leave it up to the discretion of each NRA to decide who will coordinate what and when. Forcing TSOs to do so, is a bridge too far: perhaps is some countries it is an official task of another legal entity; perhaps in some cases the NRA (and market parties) does not even want its TSO to perform this task for everybody. 8. This deletion is ok as it is redundant. 9. The request relates to settlement and as ENTSO strongly believes this can best be arranged on a national level, each DSO can discuss its wishes nationally. 10. Leaving 'may' results in the badly needed flexibility required to mitigate the specific needs of each individual Member State.

Article 37 – Information Exchange (Article 38 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Require and collect information from type A SGUs 2. If "At least" is used, the information must be limited to relevant topics 3. Islanding of DSOs 4. use 'controlled' island operation. 5. The characteristics (operational limits / activation time and time critical processes) have to be known upfront 6. seek information during Normal or Alert State. 7. Information is also necessary for other parties! 8. for emergency/restoration relevant DSOs need information 9. English should be the language for cross border communication. 10. It is not clear what the TSOs are informing the parties of. 11. DSOs should only inform TSOs about what they can see and are able to detect. Small DSOs do not even process SCADA systems. 12. If the TSO does not inform Type A generators, how shall they know to meet obligations in the Restoration Plan? 13. Information of the SGUs connected to the Distribution Systems only by the DSO. 14. For those parties bound to a Transparency Regulation providing information could either place them and / or the TSO in breach of those obligations.
Changes made	1. New definition of Service Provider 2. No change 3. No change

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	4. No change 5. No change 6. Changed 7. Changed 8. Changed 9. No change 10. Changed 11. No change 12. No change 13. No change 14. No change
Explanation for change or no change	1. Type A SGUs identified in the Restoration Plan shall not endanger the restoration process. Therefore some kind of "control" needs to be established. 2. This is in consistency with the other NCs. 3. For some DSOs this is a common practice. TSO will ask for this information and DSOs which are able to do islanding provide the information. 4. No additional value seen in the use of "controlled". 5. Information need to be known upfront but especially in Emergency it is important to know if there are changes in the named characteristics. 6. In general NC ER only covers Emergency, Blackout and Restoration state. Nevertheless this was added in the code. 7. Information from TSOs to the other parties is dealt with in separate Paragraphs. E.g. 37(2c) which was agreed on with DSOs. 8. New paragraph was added dealing with this topic. (37(2c) 9. The requirement is covered by Article 30(16) NC OS. 10. Includes now: ...about the current system state and if available additional information. 11. If this is the case a DSO would not be considered as necessary for the restoration process. Therefore the DSO would not need to provide the information. 12. The requirement is covered by Article 37(3). 13. This is in consistency with NC OS. 14. Network operators are bound by Confidentiality obligations (Article 6), covering all sensitive information. These information are not used to intervene on the market, but for operational purposes.

Article 38 – Voice communication channels (Article 39 – Communications systems - in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. Cost recovery 2. Requirements for Type A and Type B PGM are unrealistic 3. Right of derogation and appeal is required 4. A maximum time for the backup power supply should be defined 5. Next to the voice channel a secure data channel should be required 6. Clarification of "TSOs, DSOs and SGU identified in the System Defence Plan or restoration Plan"
Changes made	1. No change 2. New definition of Service Provider 3. Change 4. No change 5. No change 6. New definition of Service Provider
Explanation for change or no change	1. See general answer on cost recovery 2. . 3. See general answer on national scrutiny 4. NC ER will not limit the number just give the minimum value. TSOs will not tell DSOs or SGUs to have more without all parties agreeing on it. 5. Covered by NC OS 6. No change necessary. If a TSO, DSO or SGU is "identified in the System Defence Plan or Restoration Plan" this means that the TSO, DSO or SGU provides services.

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Article 39 – Tools and Facilities (Article 40 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Use of the term 'at least' allows the TSO to specify a value without any limit in excess of 24hours. The maximum restoration time for Critical Grid Users is less than 24 hours. Installing back up power supply for 24 hours and more leads only to useless costs. 2. This article refers to both tools and facilities so the title of the article should reflect this. 3. See the general response for Service Provider. 4. The scope of critical tools and facilities of this requirement should be defined more clearly. 5. Define an "amount of stored energy" which a substation has to keep available rather than only a time frame. 6. It is impractical and unreasonable to expect domestic or even small and medium generators to make available critical tools and facilities for at least 24 hour backup. 7. Primary power supply is not defined in the glossary. 8. Given the statement in whereas (6) (b) to "…in the procurement of services necessary to allow the activation of the plan" there needs to be reference here to the measures being procured. 9. A right of derogation and appeal (to the NRA) is required. 10. Approved costs are refunded to DSOs and TSOs, for significant grid users there must be a refundation. 11. Please define in detail what "operational" means
Changes made	1. No change 2. Changes 3. No change 4. No change 5. No change 6. No change 7. No change 8. New definition of Restoration Service Provider 9. Change 10. New definition of Restoration Service Provider 11. No change
Explanation for change or no change	1. Supply needs to be established in less than 24h but still it is seen as a necessity to be able to communicate for 24h or more. These are two different issues which should not be mixed up. 2. Changed 3. Only if it is needed for restoration. This also includes substations connecting SGUs. 4. This is defined in NC OS. 5. There is no specific timeframe mentioned for substations in the code. 6. They are not DSO-s or SGU-s 7. Primary power supply is a term commonly used. 8. To be covered by service provider definition. 9. See general the general response on Service Provider. 10. . 11. "Operational" means to be able to operate the main functions (without restrictions).

Article 40 – General principles (Article 41 in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. Necessity of testing of equipment needed for restoration and defence plan 2. TSO's equipment needs to be tested too 3. Coordinate tests with SGUs, DSOs and market participants 4. TSO should not test itself, test should be done by independent entity or NRA 5. Reference to procured services to be tested as described in whereas(6)(b) 6. Costs for Tests should be borne by TSO alone, so that only what is really necessary is tested 7. Impact of testing on households 8. Impact of testing on grid users should be as little as possible and, if occurring, be considered as force majeure 9. TSO shall not only consult with DSOs, SGUs and PGMs, but coordinate with them

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Changes made	1. No change. 2. First sentence changed according to proposal 3. Reference to Article 40(2) added 4. No change 5. New definition of Service Provider 6. No change. 7. New definition of Service Provider 8. Change Paragraph 3 accordingly 9. CONSULTATION COORDINATION: clarify in the supporting document
Explanation for change or no change	1. Equipment needs to be tested periodically, on devices as well as procedures. Experience shows that such tests are necessary, as proper functioning of seldom used equipment and procedures cannot be guaranteed. 2. Better choice of words so that TSO's are included in testing 3. Agreement of parties on testing of capabilities and equipment 4. This is part of TSO responsibility. 5. To be covered by service provider definition. 6. Testing should be part of the service provided 7. . 8. New sentences added: The test shall be conducted in a way that any impact on Grid Users is as minimal as possible. 9. The design of the test plans is an ex ante measure. That is for this reason consultation is foreseen, and not coordination. In the absence of agreement, it would be possible for a party to contest the decision taken by the TSO before the NRA or other competent regulatory authority. Clarification to be made in supporting document or recital.

Article 41– Compliance testing of Power Generating Module capabilities (Article 42 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. TEST PERIODICITY of Black Start test. Some of comments do reduce periodicity, some to be left to contract details. 2. CONSISTENCY of Black Start test. Black Start test should be to contracted units. 3. TEST PERIODICITY of Houseload Operation should not be defined. 4. TEST ORGANISATION of Houseload Operation to avoid disturbance in system and to have reproducible results. 5. CONSISTENCY of Houseload Operation. Houseload Operation test should be to contracted units. 6. COST RECOVERY of Houseload Operation. Market participants must be given reasonable notice of periodic assessments and account should be taken of practical times to carry out testing including the physical capability of the plant and the costs.
Changes made	1. No change 2. New definition of Service Provider. 3. No change 4. No change 5. New definition of Service Provider. 6. No change
Explanation for change or no change	1. NC ER establishes the minimum periodicity (three years), but more frequency is possible according to National Rules. 2. To be covered by service provider definition. Tests shall be performed by units providing services as Restoration Service Provider. These units are used in the Restoration because they have capabilities, that need to be tested. Thus not only new PGM shall be tested, but all those involved in restoration processes. 3. NC ER establishes the no periodicity. It introduces compliance in case of changes in modernisation of the equipment having an impact on its Houseload Operation capability and, or after two unsuccessful consecutive tripping in real operation. See description in supporting document. 4. Conditions for the test are defined in NC RfG. 5. To be covered by service provider definition. Tests shall be performed by units providing services as Restoration Service Provider. These units are used in the Restoration because

	they have capabilities, that need to be tested. Thus not only new PGM shall be tested, but all those involved in restoration processes. 6. Information to market participants should be covered by Transparency.

Article 42 – Compliance testing of Demand Facilities providing Demand Side Response (Article 43 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. The proper functioning is assessed in commissioning test 2. Tests of private households are not possible. 3. The periodicity of the tests 42 (1) should not be defined by the NC ER but on national level. 4. The periodicity of the tests 42 (2) should not be defined by the NC ER but on national level 5. There should be a reference related to these services must be procured. 6. According to Article 43 (1) of NC DC, It should be clarified that low Frequency Demand Disconnection test only concerns Transmission Connected Demand Facilities. 7. Closed Distribution Networks should be included in (1). 8. Adding to 42 (2) the following sentence: "After any modernisation of the equipment having an impact on its Demand Side Response capability, or after two unsuccessful Responses in real operation, the test shall be done again". 9. Clarity over equipment certificates is missing
Changes made	1. No change 2. New definition of Service Provider. 3. No change 4. Changed 5. New definition of Service Provider 6. Partially changed 7. Changed 8. Partially changed 9. No change
Explanation for change or no change	1. Supporting Document explains why these tests are needed 2. To be covered by service provider definition. It has been included in Supporting Document the possibility of performing the tests in aggregated way for households. 3. NC ER establishes the minimum periodicity. Supporting Document explains why these tests are needed 4. NC ER has been modified and the periodicity of tests has to be defined at national level now. 5. To be covered by service provider definition. 6. Removed the reference and rephrased the article to be consistent with the NC DC 7. To be consistent with Article 44 of NC DC. 8. Modernization is covered by NC DC. Test after two unsuccessful responses had been added to article 42 (1). 9. It is clarified in the Supporting Document

Article 43 – Compliance testing of HVDC capabilities (Article 44 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. The proper functioning is assessed in commissioning test 2. The periodicity of the tests should not be defined by the NC ER but on national level. 3. Adding the following sentence: "Each HVDC System with Black Start capability, which is identified in a Restoration Plan, shall perform Black Start Capability test after any modernisation of the equipment having an impact on its Black Start capability following the methodology described in NC HVDC".
Changes made	1. No change 2. No change 3. No change

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Explanation for change or no change	1. Supporting Document explains why these tests are needed 2. NC ER establishes the minimum periodicity. Supporting Document explains why these tests are needed. 3. It is already covered by NC HVDC.

Article 44– Compliance testing of LFDD relays (Article 45 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. NATIONAL SCRUTINY of test. test procedures must not have impact on customers, and be defined in detail on national level. 2. EFFICIENCY of test. Defining a common inspection period for many different types and models of relays will rise costs without providing any proven benefit. 3. TEST PERIODICITY of test should not be defined in NC. 4. INTERNAL CONSISTENCY. Relays in TSO installations must also be tested.
Changes made	1. No changes 2. Changed 3. Changed 4. Changed
Explanation for change or no change	1. The procedure has already defined in NC DC. 2. NC ER has been modified and the periodicity of tests has to be defined at national level now. 3. Same answer than above. 4. To be consistent.

Article 45 – Testing of communication systems (Article 46 in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Clarify what should be tested in 45 (1): Communication channels and/or backup communication channels 2. A periodicity of one year for testing backup communication channels is not reasonable. These tests should be performed at regular intervals. 3. The periodicity of the tests 45 (1) should not be defined by the NC ER but on national level. 4. To delete Significant Grid Users in article 45 (1) 5. Adding to Article 45 (1) that these tests are for Significant Grid Users providing procured services to the Relevant Network Operator. 6. Need of these tests for Households
Changes made	1. Changed 2. Changed 3. No change 4. New definition of Service Provider 5. New definition of Service Provider 6. Partially changed
Explanation for change or no change	1. Both communication channels and backup communication channels have to be tested. NC ER has been modified to take into account accordingly. 2. The article 45 (1) has been modified in order to consider the tests of communication systems and backup power supplies. The periodicity of the tests for backup power supplies has been established in 5 years, in line with Article 46 (3). 3. NC ER establishes the minimum periodicity. Supporting Document explains why these tests are needed. 4. To be covered by service provider definition. 5. To be covered by service provider definition. 6. This article is only applicable for Significant Grid Users identified in the Restoration Plan.

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Article 46 – Testing of TSO facilities (Article 47 – Testing of tools and facilities - in version submitted to ACER)

Summary	The main comments received for this article are the following : 1. Testing of grid protection relays 2. Editorial comments: rename the article with "compliance testing"
Changes made	1. No change 2. No change
Explanation for change or no change	1. Standard grid protection relays are covered by Article 14 [NC OS] 2. "Compliance testing" is used every time compliance tests are defined in other NC (RFG, DC, HVDC), to ensure consistency .

Article 47 – Periodic review of System Defence Plan (Article 48 – Compliance testing and periodic review of System Defence Plan - in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. Monitoring of LFDD implementation shall also include TSO installation, when relevant 2. Use of the yearly written notification 3. Review of the System Defence Plan shall also be performed at least every year and before implementation of any modernisation of equipment or grid structure having impact on the System Defence 4. NRA should review the Plan, or approve the reviewed plan, instead of the TSO 5. Consultation process should be used when amending the Plan 6. Editorial comments
Changes made	1. Paragraph 1 changed 2. No change 3. Partially 4. No change 5. No change 6. References in paragraph 3 have been changed
Explanation for change or no change	1. . 2. The yearly written notification is foreseen in NC DC and NC ER is using this requirement. It corresponds to current practice in many TSOs; the notifications are aggregated by DSO thus their number is limited. 3. The review every 5 years is a complete review of the whole plan. In addition, in case of change in its grid, the TSO will adapt the impacted part of the plan, this being part of the usual process in each TSO. The five years full review aims at checking consistency of successive adaptations. Clarifications given in the code and in the Supporting Document. 4. Paragraph 3 includes a reference to Article 8, which requires the notification of the plan to the NRAs or other relevant national authorities and their possible approval if competent under national law. 5. Paragraph 3 includes a reference to Article 8, which requires consultation. 6. .

Article 48 – Compliance testing and periodic review of Restoration Plan (Article 49 - Compliance testing and periodic review of Restoration Plan - in version submitted to ACER)

Summary	The main comments received for this article are the following: 1. SCOPE OF THE TESTS. The TSO shall identify the critical aspects of the Plan and ensure testing of those parts. 2. NATIONAL SCRUTINY on simulation test. Any simulation testing must be subject to NRA approval. 3. INTERNAL CONSISTENCY of simulation performed and measures being procured - no link to whereas (6) (b) statement.

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	4. TYPO. Restoration Plan – capital letters. 5. TEST ORGANISATION Test procedures should be prepared together by TSO, DSO and significant grid users. 6. REVIEW OF THE PLANS shall be done after major grid modifications not only periodically. 7. NATIONAL SCRUTINY of Restoration Plan approval. NRA should review the Plan, instead of the TSO. 8. TEST ORGANISATION. Defining set the criteria for effectiveness.
Changes made	1. No change. 2. No change. 3. No change. 4. Changed. 5. Changed. 6. No change. 7. No change. 8. No change.
Explanation for change or no change	1. TSO shall have the right to test any part of the restoration plan. 2. Simulations approval can be required on national law. 3. This is consistent with NC OS. 4. Typing mistake. 5. It is logical. 6. It is common practise. No need to regulate. Minimum periodicity only regulated. 7. Paragraph 4 includes a reference to Article 21, which requires the notification of the plan to the NRAs or other relevant national authorities and their possible approval if competent under national law. 8. In the Supporting Document added that criteria will be defined at National Level

Article 49 – Testing of communication procedure

No comments received on this article

Article 50 – Monitoring

Summary	One comment was received on this article: 1. It asks to align the wording on other NCs and Guidelines and particularly the CACM Guidelines.
Changes made	1. Change
Explanation for change or no change	1. Wording aligned on the CACM Guidelines, as approved in comitology on 5 December 2014.

Article 51 – Stakeholder Advisory Group

Summary	The main comments received for this article are the following: 1. They relate to the organisation of the stakeholder involvement in the implementation of the NC ER.
Changes made	1. Partially changed
Explanation for change or no change	1. Article 51 of NC ER has been aligned on the final provision for stakeholder involvement in the CACM Guidelines approved in comitology on 5 December 2014.

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Article 52 – Amendments of contracts and general terms and conditions

Summary	The main comments received for this article are the following : 1. Increase the time to amend the contracts
Changes made	1. No Change
Explanation for change or no change	1. The article is consistent with other NC.

Article 53 – Entry into force

Summary	The main comments received for this article are the following : 1. Missing date for enter into application
Changes made	1. Change
Explanation for change or no change	1. .

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8.5 APPENDIX 5 ASSESSMENT OF THE NC ER AGAINST REQUIREMENTS OF THE FRAMEWORK GUIDELINES

Purpose

Table: FG, NC ER & other NCs. The NC ER defines, according to the OS FG, the following requirements to be found in the table, which also lists the chapter that defines the requirement, followed by the link to other Network Codes.

	REQUIREMENT OF THE FRAMEWORK GUIDELINE	EXTENT TO WHICH THE PROVISION IS MET
1. General provisions		
Scope and Objectives	The Network Code(s) developed according to these Framework Guidelines will be applied by electricity system operators and significant grid users, taking into account possible public service obligations and without prejudice to the regulatory regime for cross-border issues pursuant to Article 38 of Directive 2009/72/EC (henceforth referred to as the "Electricity Directive") and to the responsibilities and powers of regulatory authorities established according to Article 37(6) of the Electricity Directive.	Regulatory issues and NRA scrutiny are covered in Article 3 and in Article 4, specifying provisions with involvement of NRAs or other competent authorities at the national level. The scrutiny level takes into account the responsibilities of TSOs regarding Operational Security as set up by the Directive 2009/72/EC. Recitals, aligned on the recitals of NCs OS, OPS and LFCR, are provided to clarify that the measures to be taken by TSOs under the network code are subject to the relevant provisions of Directive 2009/72/EC and Regulation 714/2009 for the competences of NRAs or other authorities.
	The Network Code(s) will be evaluated by ACER, taking into account their degree of compliance with these Framework Guidelines and the fulfilment of the following objectives: maintaining security of supply, supporting the completion and functioning of the internal market in electricity and cross-border trade, delivering benefits to the customers and facilitating the EU's targets for penetration of renewable generation.	The ER supporting document develops how the Network Code contributes to the objectives addressed by the FGL in particular through a harmonised definition of System Defence Plan and Restoration Plan, with the objective to minimize the impact of major incident, and to go back as soon as possible to normal situation. The design of the Plans has to take into account all types of generation; thus RES are fully integrated in the Plans that each TSO has to design and implement.
	All Transmission System Operators' (TSOs) actions with regard to system operation within a Synchronous Area or between them could bear cross-border character due to law of physics. Rulebooks on system operation already exist in the different Synchronous Areas, but the debate with the Expert Group1 revealed problems that have not been tackled by these rules – prominent example is the event on 4 November 2006 – hence, a more coherent framework is needed.	The chapter on System Defence Plan defines minimum measures to be implemented by all TSOs, giving a framework for more coherent organisation of European TSO to face Emergency States. In particular, Article 14 develops a single target for the Low Frequency Demand Disconnection: one common description, with implementation parameters harmonised at SA level. When designing the plans, TSOs need to assess consistency of measures of the plans of TSOs in their Synchronous Area.
	The Network Code(s) for System Operation shall elaborate on relevant subjects that should be coordinated between TSOs, as well	TSOs, DSOs and relevant grid users participation is enforced through the different processes addressed by the Network Code. Article 6 aims at defining

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	as between TSOs and Distribution System Operators (DSOs); and with significant grid users, where applicable.	two types of cooperation: the “consultation” process and the “coordination” process. For each process, the steps are detailed, and the relationship between all involved parties are described. The requirements of the Network Code that need such cooperation refer to one of these processes defined in Article 6..
	The Network Code(s) for System Operation shall ensure provision of an efficient functioning of the interconnected Transmission Systems to support all market activities.	A dedicated chapter has been introduced to clarify the impacts on market activities when System is in Emergency or Blackout State. Such clarity is requested by market participants, who need to know in advance what will happen in these situations and how different situations will be handled. As recalled in the FGL, the objective is to continue market operation as long as possible, as well as to restart it when conditions for restoration are met, allowing proper functioning of market.
1.2 Structure	Therefore, focus is to be laid on the three key challenges: • To define harmonised security principles; • To clarify and harmonise TSOs’ roles, responsibilities and methods; and • To enable and ensure adequate data exchange.	The NC ER obliges TSOs to produce harmonised system defence plans and restoration plans, within a detailed mandatory scope. The NC ER defines a role of TSO in all processes dealing with emergency, blackout and restoration activities. The NC ER uses mainly the data exchanged within the framework established by NC OS. It also sets up exchange of information specific for Emergency, Blackout and Restoration State, using secure/redundant voice and data communication systems.
	The following objectives for these Framework Guidelines were set out, to address the identified challenges: • To operate the electric power system in a safe, secure, effective and efficient manner; • To enable the integration of innovative technologies; • To apply same principles for different systems; • To make full use of information and communication technologies.	By increasing the level of coordination between TSOs, the Network Code will facilitate increased cross border, while maintaining Operational Security at the highest level.
1.3 Links and dependencies	There is close interrelationship between issues related to System Operation, grid connection, cross-border capacity allocation and congestion management, grid development and maintenance, obligations for data provision and the functioning of balancing and reserve power markets. In drafting the Network Code(s) the European Network of Electricity Transmission Operators for Electricity (ENTSO-E) should take into consideration, at least, the following existing requirements and proposed separation of issues in drafting the Network Code(s) Issues which are relevant to more than one Framework Guidelines are as a minimum mentioned in all the relevant Framework	Cross checking for consistency with all other already developed Network Codes and guidelines have been carried out. Interrelationships are developed throughout the Network Code, each time referring to the dedicated article. Major links with NC RfG, NC DC and NC HVDC is the use, in NC ER, of capacities required for grid users’ equipment. Major links with GL CACM, NC EB and NC FCA is the market rules to be applied and/or adapted in Emergency and Restoration. NC OS is the umbrella Network Code, defining all principles referred to in NC ER. Major links with NC LFCR are the description of Load Frequency Controller and Frequency Limits. NC OPS introduces intraday Adequacy, which is used in NC ER.

	Guidelines and specified in more detail where necessary. This approach, in the interests of completeness and clarity on important issues, may result in some duplication amongst different Framework Guidelines. In drafting the relevant Network Code(s) ENTSO-E shall ensure that they are appropriately coherent and compatible.	
1.5 Application	The Network Code(s) shall establish minimum standards and requirements related to System Operation. In developing the Network Code(s) ENTSO-E should take into consideration the rulebooks on System Operation that already exist for each Synchronous Area. The Network Codes on system operation shall be drafted with due attention to the Network Code amendment process. In particular, ENTSO-E shall ensure that the level of detail in the code is sufficiently high level to facilitate incremental innovation in technologies and approaches to system operation without requiring code amendments.	Before starting the drafting, a survey on existing practices in Europe has been performed, to take into consideration the starting point. Level of details is specifically described within the supporting document pointing out the global three layer framework developed by the Network Code, addressing in a consistent way the pan European, Synchronous Area and regions levels. NC ER aims at defining the functional target of measures to be implemented, without defining technical solutions for this implantation, in order to enable relevant flexibility and improvements of these in a changing environment.
	The Network Code(s) shall take precedence over the relevant national codes and international standards and regulations, without prejudice to the Member States' right to establish national rules which do not affect cross-border trade. Where there are proven benefits, and if compatible with the provisions of the Network Code(s), any national codes, standards and regulations which are more detailed or more stringent than the Network Code(s) should retain their applicability.	Reference to national laws is developed in particular in Article 4.
	Where the minimum standards and requirements, introduced by the Network Code(s) deviate significantly from the current standards and requirements, there should be a cost-benefit analysis performed by ENTSO-E that justifies and demonstrates additional benefits from the proposed standard or requirement. The cost-benefit analysis should be provided to stakeholders when ENTSO-E consults on the Network Code(s). The cost-benefit analysis should be submitted to ACER alongside the Network Code(s) and will be taken into consideration by ACER in providing its opinion on the Network Code(s).	Current practices are described in the Appendix 2 of this document. For the requirement on LFDD, the technical background is provided in Appendix 3 of this document. Impact assessment under development.
1.6 Roles and responsibilities	The Network Code(s) shall apply to system operators and all significant grid users already, or to be, connected to the Transmission or distribution Network. Any grid user not deemed to be a Significant Grid User shall not fall under the requirements of the Network	The NC ER refers to significant grid users, aligned with NC OS. The Article 1(7) defines who are the Significant Grid Users within the scope of NC ER. Network codes introduces a notion of Defence and Restoration Service Provider to give the possibility for entities to provide services to TSOs on

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	Code(s).	contractual basis.
	For the purpose of these Framework Guidelines DSOs shall be treated as grid users where they have to comply with the TSO's requirements in the Network Code(s). They are treated as system operators where they implement Network Code(s) provisions with respect to significant grid users connected to the distribution system or in undertaking system operation actions. Unless otherwise stated, reference to DSO implied DSO as grid user.	DSO's in NC ER are addressed consistently with NC OS. Appropriate requirements deal with their involvement in operational processes. In the context of Emergency and Restoration, they are most of the time considered as system operators.
	The approach to establishing significant grid users is set out in the Framework Guidelines on Electricity Grid Connections, and relevant details shall be set out in the Network Code(s) developed according to the Framework Guideline on Electricity Grid Connections.	The NC ER is aligned with NC OS.
1.7 Derogations	For minimum standards and requirements that impact on significant grid users, the derogation process set out in the Framework Guidelines on Electricity Grid Connections, and to be established in the Network Code(s) developed accordingly, shall apply.	The NC ER is aligned with NC OS.
	For system operators there shall be no possibility for derogation from the requirements of the Network Code(s) developed according to these Framework Guidelines.	The NC ER does not allow derogations for TSOs and DSOs, where they are considered as system operators.
1.8 Adaptation of existing arrangement to the Network Code(s)	System operators and relevant significant grid users shall amend all relevant clauses in contracts and/or all relevant clauses in general terms and conditions in accordance with the terms of the Network Code(s) on System Operation. The relevant clauses shall be amended within a fixed time limit after entry into force of the Network Code(s), defined in the Network Code(s), but not exceeding three years. This requirement shall apply regardless of whether the relevant contracts or general terms and conditions provide for such amendment.	Amendments of relevant clauses in contracts are treated in Article 52.
	The Network Code(s) shall provide a transition time within which system operators and relevant significant grid users have to apply the new standards and requirements. The transition period shall be consulted on with relevant stakeholders. In general the transition period should not exceed two years. Different transition periods for compliance can be set for new grid users and for pre-existing grid users and also for different minimum standards and requirements.	Implementation timescales for newly developed requirements are defined in Article 53.

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2. Minimum standards and requirements for system operation General System Operation Characteristics		
Scope and Objectives	Achieving and maintaining normal functioning of the power system with a satisfactory level of security and quality of supply, as well as efficient utilisation of infrastructure and resources.	The supporting document describes the key concepts developed by NC ER to fulfil scope and objectives set up in Article 1.
Criteria	The Network Code(s) shall provide criteria (performance indicators) against which the quality of System Operation can be monitored. In particular, adequate criteria should be proposed for security of supply, quality of supply and for the quality of the data delivered as input for congestion management in comparison with the effective use of the Transmission System represented by real-time data. The Network Code(s) shall foresee the publication of a yearly report by ENTSO-E on the evolution of system operation performance. This report shall provide a detailed assessment of the performance per country, including the selected performance criteria and their evolution over time. The format and content of the report shall be approved by the NRAs and ACER.	The performance indicators for NC ER are those defined in NC OS, as umbrella Network Code. Performance indicators in NC OS also cover Emergency, Blackout and Restoration states. In particular, these states are related to Scale 2 and Scale 3 events of the Incident Classification Scale that foresees publication of reports.
Methodology and Tools	The Network Code(s) shall define common principles, requirements, standards and procedures within the Synchronous Areas throughout the EU.	The Network Code establishes common principles, requirements, standards and procedures for all time frames and key processes dealing with emergency, blackout and restoration activities. Level of detail is specifically described within the supporting document pointing out the global three layer framework developed by the Network Code addressing in a consistent way on the pan European, Synchronous Areas and regional levels. In particular regarding methodologies the Network Code is introducing a detailed scope of the measures based on existing operational handbooks (national grid codes) and leaving the specifies to be detailed outside the Network Code in order to enable relevant flexibility and improvements of these in a changing environment.
	Network code(s) shall be in line with experiences, best known operational practices and lessons learnt from experiences.	Before starting the drafting, a survey on existing practices in Europe has been performed, to take into consideration the starting point and lessons learnt.
	No provision in the Network Code(s) shall prevent market arrangements being used for the provision and use of Ancillary Services.	A dedicated chapter has been introduced to clarify the impacts on market activities of Emergency and Restoration situations. Such clarity is requested by market participants, who need to know in advance what will happen in these situations and how different stages/processes will be handled. As recalled in the FGL, the objective is to continue market operations for as long as possible, as well as to restart it in well-defined conditions, allowing proper functioning of

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		market.
Roles and Responsibilities	In addition to provisions set out in Chapter 1.6 the Network Code(s) should further clarify the roles and responsibilities related to System Operation, especially considering differences in the tasks of TSOs and DSOs (e.g. caused by national obligations).	Roles of TSOs and DSOs where relevant are defined within each process handled by the NC ER.
Information Exchange	The Network Code(s) shall define a harmonised standard for timing and content of information (real-time and other) between TSOs and/or DSOs within ENTSO-E as well as outside of ENTSO-E, where applicable.	The NC ER uses mainly the data exchanged within the framework established by NC OS. It also defines additional exchange of information for the need of emergency, blackout and restoration situations.
	The Network Code(s) shall set the requirement for DSOs to execute the instructions given by the TSOs.	The NC ER includes such principles ("Notification") for the DSOs, especially when referring to implementation and activation of measures.
	Further, the Network Code(s) shall define for every Significant Grid User • which information it is obliged to provide to the TSO or DSO that, it is connected to, and how this data shall be provided, • requirements to be able to receive and to execute the instructions sent by the TSO and/or DSO to ensure the Operational Security of the system.	The NC ER uses mainly the data exchanged within the framework established by NC OS. It also defines additional exchange of information for the need of emergency, blackout and restoration situations. The NC ER includes Notification principles for the Significant Grid Users, especially when referring to implementation and activation of measures.
	The TSO and the DSO shall agree how these instructions are delivered in practice. This applies also for those DSOs connected to another DSO's Network.	The NC ER is aligned with NC OS and in addition Article 6 of NC ER defines how the coordination and consultation processes are to be performed in practice
	Obligation for data delivery: The significant grid users are obliged to provide the TSOs with information required for System Operation. The Network Code(s) should lay down the necessary enforcement measures in case of non-compliance of the significant grid users with this obligation. The TSOs are obliged and entitled to exchange the information provided by significant grid users with other TSOs for reasons of Operational Security. In doing that, the TSOs should fully respect data protection laws and regulation, most notably the requirement of not disclosing the received data to any Market Participant but only to the affected and responsible TSOs. System operators should be allowed to establish an equally reliable and credible information exchange regime by considering other data sources in a more efficient way.	Enforcement measures are covered by NC OS as umbrella code. Confidentiality is covered by Article 7.

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	Network codes shall set out the transparency requirements for TSO's actions with a significant impact to market functioning and to ensure non-discrimination between grid users.	Transparency requirements are covered in the chapter Market Interactions, and by the chapter related to information exchanges.
Implementation Issues	The Network Code(s) shall be elaborated and be modified in a coherent and coordinated way, taking into account forthcoming changes and challenges caused by increasing cross-border exchanges, changes in technology and socio-economic developments.	The articles on periodic review of System Defence Plans and Restoration Plans enforce TSO to continuously update their plans, to take into account on-going changes and evolutions of the systems.
Topic 5 Emergency and Restoration		
Scope and Objectives	The remedial actions may include e.g. the activation of active or reactive power reserves, automatic load shedding or any other emergency measure. Recovery or restoration from the alert or critical to the normal operating state shall occur as fast, effectively, reliably and efficiently as possible in order to avoid new disturbances and/or further deterioration of system security.	Article 9(4) defines measures of the System Defence Plan, to be activated in addition to remedial actions, defined in NC OS. Some of these measures are manual, other are automatic; both aiming at avoiding extension of a phenomena, and at stabilizing the system as soon as possible. Article 21 defines procedures of the Restoration Plan, to be use in order to go back to Normal State as fast as possible.
	Ensuring that all efforts in restoration after a major disturbance or a blackout are well coordinated and led by the TSOs within a synchronous area and that no individual measures or attempts to restoration of supply adversely affect the overall common goal of the re-establishment of System Operation as soon as possible.	Articles related to activation of System Defence Plan (article 11) and Restoration Plan (article 23) require coordination with DSOs, Significant Grid Users, and neighbouring TSOs, with the objective to avoid adverse measures. In case of grid split or major Frequency Deviation, articles 26 to 29 refer to Frequency Leader, who is in charge of coordinating TSOs for LFC operating mode, re-energisation and reserves activation, to organise all actions so that they contribute in the same direction.
Criteria	The key criteria for emergency and restoration shall include at least the following: • Share of alert situations – and finally severe disturbances and blackouts – handled in an optimised manner, based on the existing power system and resources;	The System States (including criteria to enter into Emergency, Blackout and Restoration) are defined in NC OS, which also requires real-time exchange of system states information between TSOs.
	• Evidence of training, simulations, tests and exercises executed to demonstrate proper emergency and restoration plans;	The article 30 of NC OC deals with training for all system states, thus including Emergency and Restoration processes. NC OS also requires inter-TSO training. NC ER (article 49) requires periodic simulations to demonstrate that the Plans allow to reach their objectives.
	• Emergency prevention and restoration plans shall – besides technical needs – consider cost-benefit issues on macroeconomic and market level.	Articles on design include an obligation for the TSO to respects these principles (see articles 9(3)(b) and 21(3)(b) and general answer on "Efficiency" in Appendix 4 of this document).

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Methodology and Tools	TSOs shall maintain emergency and restoration plans and have regular training for emergency and restoration, including actions across borders, where appropriate.	The article 30 of NC OS deals with training for all system states, thus including Emergency and Restoration processes. NC OS also requires inter-TSO training. NC ER (article 49) requires periodic simulations to demonstrate that the Plans allow to reach their objectives.
	The network code(s) shall define: • The criteria for assessing when the power system is in the normal operating state and when it diverges from the normal state. This shall be defined for each synchronous area and shall be communicated between the synchronous areas and EU-wide, respectively within ENTSO-E;	The System States (including criteria to enter into Emergency, Blackout and Restoration) are defined in NC OS, which also requires real-time exchange of system states information between TSOs.
	• The process, principles and main characteristics for the elaboration of predetermined emergency and restoration plans and related activities on synchronous area level. The principles should be agreed at EU-level. Specific needs of grid users based on national regulation should be taken into account with a high priority level in the elaboration of restoration plans (e.g. fast power restoration on nuclear plants).	The design of System Defence Plan and Restoration Plans are covered by dedicated articles, which give principles to be applied in all Member states, according to the NC applicability. The “design” articles include a reference to the specific needs of the SGU listed as high priority SGU in the NC OS.
	• Application of the restoration plans and procedures for remedial actions;	The activation of measures of the System Defence Plan and of the procedures of the Restoration Plan are determined according to criteria listed in articles 11 and 23.
	• Principles and characteristics which cause the operating state to differ from the normal operating state, e.g. out-of-range disturbances, flows in the transmission network and on interconnections; active power reserves (automatically and manually activated reserves); reactive power reserves; status of network control system and stability of the system (voltage, frequency and angle);	The System States (including criteria to enter into Emergency, Blackout and Restoration) are defined in NC OS.
	• Load shedding procedures, involving DSOs where necessary, including criteria and taking into account local islanding provisions, responsibilities and efficiency evaluation, but also the design of	The Low Frequency Demand Disconnection scheme is described in the article related to automatic Low Frequency control scheme. This scheme is harmonised through the description of a common target for the Low Frequency Demand Disconnection: one common description, with implementation parameters

	automatic load shedding systems. A non-discriminatory, transparent and efficient manner of the load shedding shall be ensured;	harmonised at SA level. The efficiency of the required LFDD plan has been simulated via a dedicated study (presented in the supporting document). DSO involvement in the LFDD plan is clearly stated: in design phase, in implementation phase (including yearly reports on current implementation values) and in activation phase. In some countries, LFDD relays are installed at transmission level; the NC ER allows both possibilities.
	• Common principles in system protection settings to ensure system security, efficient usage and reliability (also during critical operating state and restoration state); the related procedures shall be co-ordinated among TSOs to ensure interoperability within and between synchronous areas. System protection shall limit the consequences of operational disturbances to a minimum;	When designing its system defence plan, including specific system protections schemes, the TSO has to coordinate with neighbouring TSOs, and the measures used shall not endanger the operational security of the neighbouring grids.
	• Minimum requirements to inform significant grid users in case of alert and critical operating states. Duties of significant grid users in such situations shall be clearly stated.	The article on Information exchange includes such a minimum requirement, towards DSO, Significant Grid Users, NEMOS and NRAs.
	• Procedure for restoration of regular market operations after technical restoration.	Procedures for suspension and restoration of market activities are defined in article 33. Rules and conditions for suspension and restoration of market activities are defined in article 34.
Roles and Responsibilities	TSOs shall ensure access (contracted or otherwise procured) to sufficient black-start capacities and islanding capabilities to allow for the efficient and fast restoration.	In the design of the Restoration Plan, each TSO shall define the power sources (units capable of black start, houseload operation and island operation) necessary to re-energize its system using bottom-up strategy, i.e. without support from neighbouring TSOs.
	The restoration plans are to be evaluated and maintained/adjusted by TSOs regularly and their operating staff shall be trained to manage these exceptional incidents. TSOs shall develop procedures to test the restoration plans. The process for this shall be described transparently and communicated to all involved parties by TSOs.	Both System Defence Plan and Restoration Plan have to be periodically reviewed, to allow their continuous update, defined in articles 48 and 49 Training of the operators is covered by article 30 of NC OS; such training shall include internal training sessions, to allow operators to be skilled in emergency and restoration procedures, as well as inter-TSO training, to be skilled on coordinated restoration of a wide area. Testing part of the Restoration Plan (i.e. re-energisation path from a black start unit) is required in the NC ER. The organisation of these parts has to be in consultation with involved parties.
	The TSOs are responsible for remedial actions in the case of disturbances within their power systems and shall enforce orders (within the context of maintaining the electric power system operational security and integrity) to significant grid users in order to efficiently restore the system operation. For each interconnection	The general principle regarding the responsibility is that the TSO is responsible to design the system defence plan and the restoration plan, in consultation with DSO and Significant Grid Users. Then, the TSO notifies to each party the measures that have to be implemented to its installations; each party being thus responsible for proper implementation and availability of the measures,

	TSOs shall define a procedure and who is responsible, including responsibility boundaries.	according to the notification. The same principle is in place for activation of measures. For interconnection, the NC ER requires a coordination between neighbouring TSOs.
	Restoration related organisation and procurement of black-start and islanding capabilities, as well as ancillary services shall be assigned exclusively to the TSOs, which shall have the duty and power to decide on any subsequent applicability at the DSO level. This is important in order to prevent any contradictory measures which might occur if restoration is attempted at the same time from the transmission and distribution level.	Previous statement applies here.
	The DSOs shall support the restoration according to the plan.	Previous statement applies here.
	In a critical operating state the significant grid users shall comply with instructions from TSOs and participate in emergency planning, restoration procedures and exercises planned and carried out by TSOs.	Previous statement applies here.
	TSOs' coordinated restoration plans shall be submitted to regulatory authorities for opinion.	Elements of the system defence plan and of the restoration plan shall be notified to the NRA. The NC ER foresees to notify main elements listed (details in the NC ER), because it must be avoided to submit all detailed settings, parameters etc to the NRA (focus on main topics in order ease the update process) The concept of notification leaves the leeway to the NRA to provide an opinion.
Information exchange	The network code(s) shall foresee minimum requirements for blackout-proof communication in case of emergency and restoration.	Blackout-proof communication channels are required in article 39.
	Any synchronous system-wide event shall be analysed by the TSOs and communicated to ENTSO-E, market participants and relevant regulatory authorities (ACER and NRAs).	The NC OS requires the TSO to produce a yearly report, following the methodology described in the Incidents Classification Scale, and covering at least the scale 2 (=Emergency) and scale 3 (=Blackout) incidents.
	The requirements and the data to be transmitted to the TSO are specified in the agreement concluded between the significant grid users and the TSO (or DSO) concerning connection and access to the grid.	Minimum data to be exchanged during Emergency, Blackout and Restoration States are defined in the NC ER (article 38); this shall be respected in the agreement concluded with the significant grid users and with the DSOs.