

Network Code on Emergency and Restoration - Implementation Guide for the Critical Tools and Facilities

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1 INTRODUCTION

The Analysis in this document was done for requirements on critical tools and facilities as defined in NC ER (i.e. with a relevance to real-time operation in the state of Emergency and Restoration).

NC ER reference the definition of critical tools and facilities in SO GL. According to that definition firstly all relevant means and facilities are analysed. At the end, the summarized list of critical tools and facilities for TSO and for relevant DSO and SGU are listed. All identified critical tools and facilities have to fulfil the requirements from NC ER.

Remark: Relevant DSO and SGU are identified by TSO as essential for restoration. In most cases are those relevant DSOs and SGUs directly connected to transmission system. Some of them could operate a cross-border line.

1.1 CRITICAL TOOLS AND FACILITIES DEFINITION

The TSOs' critical tools and facilities are listed in SO GL (on a general level) in article 24(1). Each TSO shall ensure the **availability, reliability and redundancy** of the following items:

- (a) facilities for monitoring the system state of the transmission system, including state estimation applications and facilities for load-frequency control;
- (b) means to control the switching of circuit breakers, coupler circuit breakers, transformer tap changers and other equipment which serve to control transmission system elements;
- (c) means to communicate with the control rooms of other TSOs and RSCs;
- (d) tools for operational security analysis; and
- (e) tools and communication means necessary for TSOs to facilitate cross-border market operations

Article 24(2) of SO GL involves the DSOs and SGUs in cases where they have a role regarding the tools listed above:

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

Article 24(3) of SO GL sets a deadline for each TSO's continuity plan and states a requirement for an annual review of the plan:

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

1.2 REQUIREMENTS FOR THE CRITICAL TOOLS AND FACILITIES IN NC ER

In NC ER, the following requirements for the Critical Tools and Facilities listed in SO GL:

- Article 41 states requirements for the voice communication systems, e.g. 24 h availability in case of loss of primary power supply
- Articles 42(1) and 42(2) set a 24 h availability requirement for the critical tools and facilities
- Articles 42(3) and 42(4) set a requirement for the TSOs for a geographically separated backup control center
- Article 42(5) sets a 24 h requirement for substations essential for the TSOs' Restoration Plan
- Articles 43...49 set requirements for testing and monitoring

1.3 PURPOSE OF THE DOCUMENT

This implementation guide has been developed by the European Network of Transmission System Operators for Electricity (ENTSO-E) and it should be **read in conjunction with the NC ER**.

The purpose of this document is to ease the understanding, implementation of NC ER with regard to Critical Tools and Facilities by making a more concrete interpretation of the SO GL's list of Critical Tools and Facilities, to co-ordinate the interpretation between the TSOs and to help to harmonize the implementation in different countries.

The document has been developed in recognition of the fact that the NC ER, which is a legally binding document, inevitably cannot provide the level of explanation, which some parties may desire. Therefore, this document aims at providing all parties with the necessary information and explanation for the requirements specified in the NC ER, as well as the document outlines the necessary steps of the work.

1.4 LEGAL STATUS OF THE DOCUMENT

This document accompanies the Network Code on Emergency and Restoration, but is provided for information only. The mandatory requirements for all involved parties are from the NC ER. In addition this document describes principles/commitments of the involved parties to meet the requirements from NC ER.

Therefore this document has no legally binding status.

2 TSOs CRITICAL TOOLS AND FACILITIES

2.1 ANALYSIS

2.1.1 Facilities for monitoring the state of the transmission system

According to SO GL Article 24(1)(a), these are the "facilities for monitoring the system state of the transmission system, including state estimation applications and facilities for load-frequency control".

At least the following systems and facilities should be considered by each TSO:

- SCADA system
- Energy Management System (EMS) with e.g. state estimator and contingency analysis
- The European Awareness System (EAS)
- The TSO's Control centre (including any regional control centres) and the backup control centre
- Relevant parts of Data warehouse & connecting LAN
- Load Frequency Control system (LFC)
- mFRR control system
- telecommunication systems (data and voice)

Remark to LFC/mFRR: Includes the tool for activation on TSO side and the redundancy of communications to enough FRR providing units to be able to balance the system (not necessary to all of them).

2.1.2 Means to control the switching of transmission system elements

According to SO GL Article 24(1)(b), these are the "means to control the switching of circuit breakers, coupler circuit breakers, transformer tap changers and other equipment which serve to control transmission system elements".

At least the following systems and facilities should be considered by each TSO:

- control centre SCADA (main, backup & possible regional control centres)
- substation SCADA, for the substations identified as essential for restoration
- data communications to essential substations,
- data and voice communications to control rooms
- substation bay controller (redundancy not needed, see figure 1)
- substation local data communication (redundancy not needed, see figure 1)

Remark to control rooms: Control rooms means all control rooms controlling the substations identified as essential for restoration. That includes the control rooms of TSO (main, backup & possible regional control centres), the control rooms of relevant DSOs and of relevant SGUs .

2.1.5 Tools and communication means necessary to facilitate cross-border market operations

These tools are stated in SO GL Article 24(1)(e). Relevant are the market systems connected to EMS. The needed of this means is strictly related with the suspension of market activities.

They seems not to be very critical for emergency and restoration state, especially not during the time the market activities are suspended.

At least the following should be considered:

- voice communication between the TSOs

2.1.6 Business continuity plan

Business continuity plan is stated in SO GL Article 24(3). This topic is connected to SO GL and not to ER.

Business continuity plan covers a brighter scope of topics as here analysed, but each TSO have to assure that all identified critical tools and facilities are covered by Business continuity plan.

2.2 IDENTIFIED TSOs CRITICAL TOOLS AND FACILITIES FOR ER

According to the previous Analysis in 2.1, summarized each TSO shall ensure the **availability, reliability and redundancy** of the following items:

- The TSO's Control centre (including any regional control centres) and the backup control centre
- SCADA system
- control centre SCADA (main, backup & possible regional control centres)
- substation SCADA, for the substations identified as essential for restoration
- telecommunication systems (data and voice)
- Electronic Highway
- voice communication between the TSOs
- data communications to essential substations,
- data and voice communications to control rooms
- substation bay controller (redundancy not needed, see figure 1)
- substation local data communication (redundancy not needed, see figure 1)
- Energy Management System (EMS) with e.g. state estimator and contingency analysis
- The ENTSO-E Awareness System (EAS)
- Relevant parts of Data warehouse & connecting LAN
- Load Frequency Control system (LFC)
- mFRR control system

According to their specific, each TSO is free to extend this list of items.

Remark to control rooms: Control rooms means all control rooms controlling the substations identified as essential for restoration. This includes the control rooms of TSO (main, backup & possible regional control centres), the control rooms of relevant DSOs and of relevant SGUs .

Remark to LFC/mFRR: Includes the tool for activation on TSO side and the redundancy of communications to enough FRR providing units to be able to balance the system (not necessary to all of them).

3 DSOs OR SGUs CRITICAL TOOLS AND FACILITIES

This chapter is valid only for DSOs and SGUs which are identified by TSO as essential for restoration. In most cases are those **relevant DSOs and SGUs** directly connected to transmission system. Some of them could operate a cross-border line.

3.1 ANALYSIS

3.1.1 Facilities for monitoring the state of the system

At least the following systems and facilities should be considered:

- SCADA system
- DSO Energy Management System (EMS)
- The Control centre
- Relevant parts of Data warehouse & connecting LAN
- telecommunication systems (data and voice)

3.1.2 Means to control the switching of system elements

At least the following systems and facilities should be considered:

- main control centre SCADA
- substation SCADA, for the substations identified as essential for restoration
- data communications to essential substations,
- data and voice communications to control rooms
- substation bay controller (redundancy not needed, see figure 1)
- substation local data communication (redundancy not needed, see figure 1)

3.1.3 Means to control the switching of system elements

SO GL Article 24(1)(c) defines the means to communicate with the control rooms of other TSOs and RSCs as a critical tool.

For the DSOs or SGUs, voice and data communication only to relevant TSO needs to be considered.

3.1.4 Tools for operational security analysis

Not applicable to DSOs or SGUs.

3.1.5 Tools and communication means necessary to facilitate cross-border market operations

Not applicable to DSOs or SGUs.

3.1.6 Business continuity plan

Business continuity plan is stated in SO GL Article 24(3). This topic is connected to SO GL and not to ER.

The relevant TSO shall share parts of the business continuity plan which affect DSOs and SGUs with the DSOs and SGUs concerned. Each DSO or SGU have to assure that their identified critical tools are covered by Business continuity plan.

3.2 IDENTIFIED DSOs OR SGUs CRITICAL TOOLS AND FACILITIES FOR ER

According the previous Analysis in 3.1, summarized each **relevant DSO or SGU** shall ensure the **availability, reliability and redundancy** of the following items:

- SCADA system
- DSO Energy Management System (EMS)
- The Control centre
- Relevant parts of Data warehouse & connecting LAN
- telecommunication systems (data and voice)
- main control centre SCADA
- substation SCADA, for the substations identified as essential for restoration
- data communications to essential substations,
- data and voice communications to control rooms
- substation bay controller (redundancy not needed, see figure 1)
- substation local data communication (redundancy not needed, see figure 1)

According to their specific, each DSO or SGU is free to extend this list of items.

4 CONCLUSION FOR THE CRITICAL TOOLS AND FACILITIES

All identified critical tools and facilities (for TSO in 2.2, for relevant DSOs or SGUs in 3.2) have to fulfil the requirements from NC ER as stated in Chapter 1.2.