Elia System Defence Plan (non-confidential version)

Summary	This document sets out the System Defence Plan designed by Elia pursuant to the criteria of Commission Regulation (EU) 2017/2196 and the Federal Grid Code (FGC). The Minister of Energy has approved the confidential version of this document, excluding those aspects specified in the corresponding Ministerial Decree of 19 December 2019.	
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Status	☐ Draft	☒ Final version approved by the Minister of Energy

Previous versions

Version	Date	Author	Summary of changes
1.00	18 December 2018	ELIA	Comments from CREG, FPS Economy - DG Energy, and the Governmental Coordination and Emergency Centre (CGCCR) References to new 2019 FGC Minor changes made by stakeholders

Contents

1 Introduction

This document sets out Elia's System Defence Plan and describes the automatic and manual measures intended to prevent blackouts, limit the spread of disruption and stabilise the grid during a state of emergency with a view to restoring a normal or alert state as quickly as possible with minimal impact on grid users.[1]

Elia compiled this document pursuant to the provisions of Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a network code on electricity emergency and restoration (NC E&R) and to other network codes, the Royal Decree of 22 April 2019 establishing a federal technical regulation for the management of and access to the electricity transmission system (the FGC), other relevant legal provisions as well as any pertinent local legislation.

Elia devised this Plan in consultation with distribution system operators (DSOs), the relevant significant grid users (SGUs), CREG, FPS Economy - DG Energy and the other transmission system operators (TSOs) within the Continental Europe synchronous area.

References to the 'rescue code' in other legislative or regulatory texts are considered to be referring to the System Defence Plan as per FGC Article 261(1).

Pursuant to FGC Article 378 and without prejudice to the NC E&R or the System Operation Guideline (SOGL), **the rescue code** drawn up in accordance with Articles 312 to 315 of the Royal Decree of 19 December 2002 establishing a federal technical regulation for the management of and access to the electricity transmission system **shall continue to apply until the date of the entry into force of the** System Defence Plan under FGC Article 261(1).

Any technical or organisational measures for which the implementation deadlines specified in this Plan fall after the date on which this Plan was approved by the Minister of Energy shall only apply from the time they are implemented onwards.

When devising this System Defence Plan, Elia ensured that:

- the measures contained within the Plan, enacted mainly by individual SGUs, complement rather than counteract one another;
- the measures are sufficient to deal with the anticipated problems; and
- the measures activated are limited to those necessary to deal with a given problem, consequently minimising the impact on grid users, limiting the duration of any disruption and maximising efficiency.

Pursuant to NC E&R Article 4, Elia shall make use of market-based mechanisms as far as possible to ensure network security and stability.

Pursuant to NC E&R Article 50(3), Elia shall review the effectiveness of this Plan at least once every five years. This review shall take into account the following as a minimum:

- The development and evolution of its grid since the previous review or initial design;
- The capacities of new equipment installed on the transmission and distribution systems since the previous review or initial design;
- The SGUs that have begun operating since the previous review or initial design, alongside the corresponding capacities and relevant services offered;
- The tests and incident analyses conducted on the grid, pursuant to SOGL Article 56(5); and
- The operational data collected during normal operation and after a disruption.

[1] System states are described in section 5

Pursuant to NC E&R Article 6(1), when designing or reviewing their respective restoration plans all European TSOs must ensure consistency with the corresponding measures contained within the plans of other TSOs in their synchronous area as well as those of neighbouring TSOs belonging to another synchronous area. Such measures include the following as a minimum:

a) Inter-TSO assistance and coordination in an emergency state (section 7.6);
b) The frequency deviation management procedure (section 7.1);
c) The assistance for active power procedure (section 7.4).

Elia submitted the necessary documentation to Coreso (the regional technical security coordination centre for electricity) in June 2019. Coreso will draw up a technical report on the consistency of the measures within three months of receiving said documentation.

The non-confidential version of the System Defence Plan will be appended to the relevant connection agreements. Elia has shared the confidential version only with the competent authorities. Only the names of the sections deemed confidential have been retained in this non-confidential version.

Table 1 below provides a very simplified overview of the defensive measures that can be enacted to return flows (including imports), voltage or frequency to within safe operational limits in real time as well as those measures to be enacted should a (potential) shortage be detected in advance. These measures are described in greater detail later on in this document.

			In the event of real-time incidents						In the event of a (risk of) shortage
			Current	Voltage		Frequency		Import	(generation + import) < load
			Too high	Too low	Too high	Too low	Too high	Too high	
POTENTIAL DEFENSIVE MEASURES	PGMs, HVDC, Storage	More MW injection into the grid	x			x		x	x
		Less MW injection into the grid	x				x		
		More MVAr injection into the grid		x					
		Less MVAr injection into the grid			x				
	Demand facilities, HVDC, Storage	More MW offtake from the grid	x				x		
		Less MW offtake from the grid	x			x		x	x
		More MVAr offtake from the grid			x				
		Less MVAr offtake from the grid		x					
	System operator	Disconnect a connection	x	x	x				
		Block transformer tap changers		x					
		Reduce voltage set point by 5%				x		x	x
		Disconnect electric storage heaters				x		x	x
		Activate shortage procedure							x
		Automatic demand disconnection				x			
		Inter-TSO assistance		x	x	x	x	x	x
		Manual demand disconnection	x	x				x	x

Table 1: Overview of defensive measures

2 Legal framework

In accordance with the NC E&R, Elia is required to design a System Defence Plan in consultation with the relevant DSOs, SGUs, the national regulatory authority (NRA), neighbouring TSOs as well as TSOs belonging to the same synchronous area.

In the event of conflict between the NC E&R and any other legislation, the superior legislation shall take precedence.

2.1 Powers of approval

Pursuant to NC E&R Article 4(5), the Belgian TSO shall notify the NRA or any other entity specified by the Member State of the System Defence Plan by 18 December 2018 at the latest.

Pursuant to FGC Article 259, the Minister of Energy approves, on the proposal of the TSO and after consulting CREG, the proposals referred to in NC E&R Article 4(2)(c), (d) and (g).

Pursuant to FGC Article 261, the TSO is required to submit, after consulting CREG and DG Energy, a proposed system defence plan to the Minister of Energy by 18 December 2018. Elia submitted its initial proposal to the Minister of Energy on 18 December 2018. On 26 June 2019, Elia received a letter from said Minister requesting that it submit a new, amended proposal in September 2019. Elia submitted an amended proposal on 30 September 2019.

Pursuant to Article 2 of the Ministerial Decree approving the proposed system defence and restoration plans as per Articles 261 and 262 of the Royal Decree of 22 April 2019 establishing a federal technical regulation for the management of and access to the electricity transmission system, the proposed defence plan has been approved, excluding those few aspects specified.

Certain parts of this System Defence Plan refer to other related documents. Section 12 contains a list of such documents, some of which are only available in-house. Elia does not seek the Minister of Energy's approval for these documents. Public authorities may ask to consult these documents for information purposes.

2.2 Legal provisions concerning the Load-Shedding Plan

Pursuant to FGC Article 261(4), the Minister of Energy devises the Load-Shedding Plan based on TSO proposals.

Pursuant to FGC Article 261(4), the Load-Shedding Plan may contain the following measures:

1. The obligation for the TSO to:
    a. interrupt some or all grid connections;
    b. interrupt or modify interconnections with other networks within the control area.
2. The obligation for consumers (or certain categories of consumers) throughout the country or in certain parts thereof to reduce their offtake of electricity from the grid to within the set limits;
3. A ban on using electricity for certain purposes.

Pursuant to NC E&R Article 11(5), the System Defence Plan comprises a manual demand disconnection procedure and an automatic low frequency demand disconnection (LFDD) system. As such, the Load-Shedding Plan is included as part of the System Defence Plan.

Pursuant to the 'Load-Shedding Plan' Ministerial Decree, the Load-shedding Plan can be enacted in connection with the procedures listed below:

- The procedure protecting the grid from **unexpected phenomena** that undermine the integrity of the grid without warning;
- The procedure protecting the grid in the event of an **announced shortage or risk of a shortage for a considerable, foreseeable or otherwise, period of time.**

In connection with the Load-Shedding Plan, demand disconnection can take place either automatically via LFDD (section 7.8.4) or manually via the manual demand disconnection procedure (section 7.6).

2.3 Provisions concerning providers of system defence services on a contractual basis

Some measures of the System Defence Plan are based on capacities that should be made available on a voluntary basis. According to the NC E&R, Elia uses these voluntary capacities through defence service providers (DSPs) on a legal or contractual basis.

Elia does not deem it beneficial to use DSPs on a contractual basis, since they can voluntarily participate in defensive measures by making reserves available via existing flexibility platforms which continue to operate when the system is in a state of emergency, as per the rules on the suspension and restoration of market activities.

In the event of a residual lack of security of supply in the control area and after the activation of all balancing energy bids and contractual reserves between TSOs, Elia may decide, after having called upon the support of neighbouring TSOs, to launch the assistance for active power procedure as set out in section 7.4.

As such, Elia is not required to contract any additional defence services.

However, Elia does not rule out using DSPs on a contractual basis in the future. In that case, general terms and conditions reflecting the purpose of the service in question will have to be proposed, as per the NC E&R.

2.4 Diagram of the legal framework

Figure 1 provides a simplified overview of potential events on the grid, the applicable defensive measures and the legal framework in force.

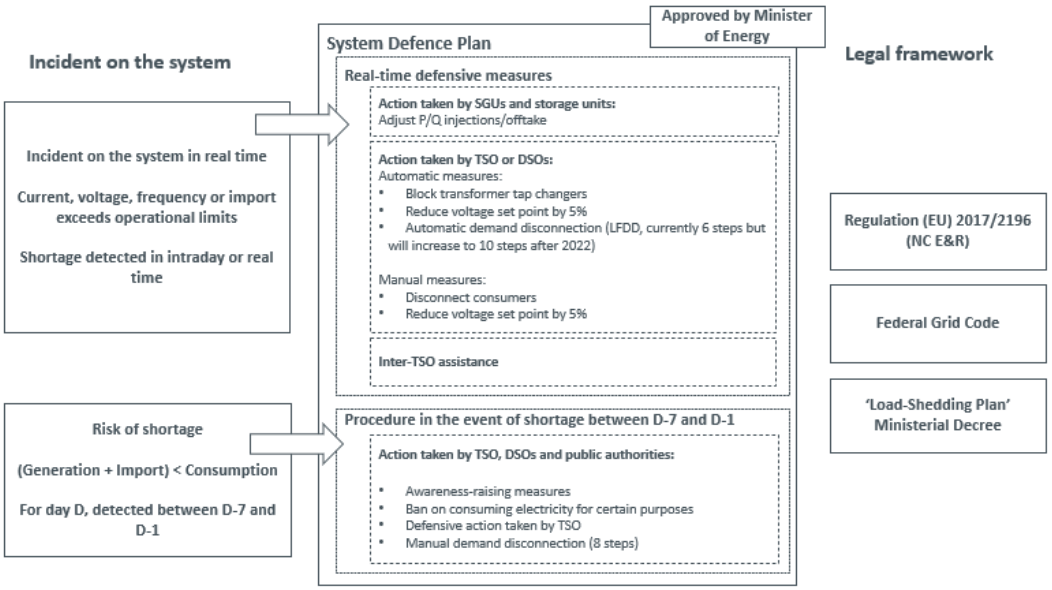


Figure 1: Overview of potential events on the grid, defensive measures and the legal framework

3 Conditions for activating the System Defence Plan

The automatic procedures of the System Defence Plan are activated once the conditions detailed in sections 7.8**Error! Reference source not found.**, 7.9 and 7.10 are met, in coordination with the identified SGUs and DSOs, the TSOs involved and the DSPs.

In addition to those systems activated automatically, Elia shall manually launch a System Defence Plan procedure when:

- the **system is in an emergency state** in accordance with the criteria set out in section 5.3 and none of the remedial measures under SOGL Article 22 are available to restore normal grid operations; or
- **Elia's operational security analysis** indicates that the activation of a System Defence Plan measure is necessary, in addition to the available remedial measures, to ensure the operational security of the transmission system.

Without prejudice to the state of the system (as explained in section 5) and, where applicable, the activation of remedial actions as per SOGL Article 22, the System Defence Plan or the Restoration Plan, Elia shall take all measures it deems necessary to avoid endangering personnel or damaging equipment as a result of a situation of which Elia is aware.

When Elia has to take measures to avoid endangering personnel or damaging infrastructure or activates measures under the System Defence Plan or Restoration Plan, it will promptly notify CREG and DG Energy of its actions and will compile a report containing a detailed explanation of why and how it took action and the impact thereof.

This report is sent to CREG, DG Energy and, where appropriate, the affected stakeholders, as per and without prejudice to the provisions of NC E&R Articles 14(4), 18(4), 20(3) and 22(4).

4 List of significant grid users and high priority significant grid users

Pursuant to NC E&R Article 11(4)(c), the System Defence Plan includes a list of the SGUs responsible for implementing within their facilities those measures resulting from the mandatory requirements set out in the network codes on requirements for generators (NC RfG), demand connection (NC DCC) and high-voltage direct current (NC HVDC) or in national legislation, as well as a list of measures to be implemented by those SGUs.

Elia identifies the SGU capacities for direct use in its System Defence Plan in section 4.1 and provides a detailed list in Annex 1.

Without prejudice to NC E&R Article 4(2)(c) and (d) and Article 50(5), the list of identified SGUs and the list of high priority SGUs relevant to the System Defence Plan are sent to the Minister of Energy by 1 October every year at the latest.

These identified SGUs are a subset of the following categories of grid users to which the NC E&R applies pursuant to NC E&R Article 2(2):

a) Existing and new type C and D power generating modules (PGMs) pursuant to NC RfG Article 5;
b) Existing and new type B PGMs pursuant to NC RfG Article 5 when they are identified as SGUs in accordance with NC E&R Articles 11(4) and 23(4);
c) Existing and new demand facilities connected to a transmission system;
d) Existing and new closed distribution systems connected to the transmission system;
e) Providers of redispatching of PGMs or demand facilities by means of aggregation and providers of active power reserves in accordance with SOGL Title 8; and,
f) Existing and new high-voltage direct current (HVDC) systems and power park modules connected to direct current in accordance with the criteria set out in NC HVDC Article 4(1).

4.1 List of identified significant grid users

Elia has identified the following System Defence Plan requirements that SGUs[2] are required to satisfy by law:

Type of user	**Capacity used in the System Defence Plan**	**Legal obligation pursuant to**
Existing and new PGMs with a maximum active power greater than or equal to 25 MW. This does not include backup generators installed within these PGMs.	Obey an instruction from the TSO concerning the set point for the exchange of active or reactive power with the system, taking into account the technical capacities of the PGM in question.	FGC Article 261(2)

Table 2: Type, capacity and legal provisions with regard to designated SGUs

Annex 1 contains a detailed list of identidfied SGUs.

Elia intends to use a limited number of resources in order to ensure an efficient response to the transmission system being in an emergency state. As a result, Elia wants to use a small

[2] Legally, 'SGU' refers to infrastructure. In order to be able to implement those measures required by Elia under the System Defence Plan in such infrastructure, Elia contacts the grid user that signed the connection contract covering the infrastructure in question.

number of PGMs with a maximum active power greater than or equal to 25 MW, rather than using more PGMs with lower active power.

4.2 High priority significant grid users

4.2.1 List of high priority significant grid users relevant to the System Defence Plan

The list of high priority SGUs relevant to the System Defence Plan contains the following:

- **Priority connections** as per FGC Article 261(6);
- **Additional couplings** from the list drawn up by the Minister of Economy or Energy in consultation with the TSOs and DSOs in question, as per FGC Article 261(6), for which the Ministers have given the order to restore the power supply;
- **Structural injecting cables** as described in the 'Load-Shedding Plan' Ministerial Decree.

4.2.2 General terms and conditions for disconnecting and re-energising high priority significant grid users

These general terms and conditions are in accordance with:

- FGC Article 261(6);
- the 'Load-Shedding Plan' Ministerial Decree.

The principles governing the disconnection and re-energisation of high priority SGUs in the event of **manual** demand disconnection apply as per section 7.6.

The principles governing the disconnection and re-energisation of high priority SGUs in the event of **automatic** demand disconnection apply as per section 7.8.4.

If high priority SGUs are disconnected, Elia and the other system operators will cooperate and use all available means to restore the power supply to these high priority SGUs as quickly as possible.

5 Classification of system states

SOGL Article 18 sets out harmonised requirements for system management applicable to TSOs, regional security coordinators (RSCs), DSOs and SGUs. The article describes the various critical system states (normal, alert, emergency, blackout and restoration); these are detailed below.

5.1 Normal

A transmission system is in the normal state when all of the following conditions are met:

- **Voltage and power flows** are within operational security limits:
    - Voltage ranges at the connection point between 110 kV and 300 kV: 0.90 pu – 1.118 pu
    - Voltage ranges at the connection point between 300 kV and 400 kV: 0.90 pu – 1.05 pu
    - Current limits in terms of thermal rating, including transitory admissible overloads, taking into account the type of components such as overhead lines (Cu, Al), underground cables, transformers and so on, as well as ambient conditions (wind, solar radiation, temperature, etc.)
- The **frequency** meets the following criteria:
    - The steady state system frequency deviation is within the standard frequency range, equal to approx. 50 MHz; or
    - The absolute value of the steady state system frequency deviation is not larger than the maximum steady state frequency deviation (200 MHz) and the system frequency limits established for the alert state are not met.
- **Active and reactive power reserves** are sufficient to withstand contingencies from the contingency list defined in accordance with SOGL Article 33 without violating operational security limits.

  The operation of the control area of the TSO in question is and will remain within operational security limits following the activation of remedial actions in the wake of a contingency from the contingency list defined in accordance with SOGL Article 33. This list encompasses the following:

  a) Components of the Belgian grid:
  - Individual lines or cables with a rated voltage of 380 kV to 30 kV;
  - Individual generators connected to the transmission system;
  - Individual main busbars with a rated voltage of 380 kV;
  - Individual couplings between different main busbars with a rated voltage of 380 kV;
  - Transformers between different transmission networks (e.g. 380 kV/150 kV, 220 kV/70 kV, 150 kV/36 kV) – this does not include transformers to distribution networks.

  b) Grid components in northern France that may have a significant impact on the Belgian grid: 380 kV or 220 kV lines, key generators, 380 kV or 220 kV busbar couplings, transformers between 380 kV and 220 kV, 380 kV or 220 kV busbars;
  c) Grid components in the Netherlands that may have a significant impact on the Belgian grid: 380 kV lines, key generators, 380 kV busbar couplings, BritNed and NorNed HVDC connections.

5.2 Alert

A transmission system is in the alert state when:

- **Voltage and power flows** are within the operational security limits (identical to those for the normal state):
    - Voltage ranges at the connection point between 110 kV and 300 kV: 0.90 pu – 1.118 pu
    - Voltage ranges at the connection point between 300 kV and 400 kV: 0.90 pu – 1.05 pu
    - Current limits in terms of thermal rating, including transitory admissible overloads, taking into account the type of components such as overhead lines (Cu, Al), underground cables, transformers and so on, as well as ambient conditions (wind, solar radiation, temperature, etc.)

AND

- The **TSO's reserve capacity** is reduced by more than 20% for longer than 30 minutes without any way to offset said reduction through real-time operation;

OR

- Frequency meets the following criteria:
    - The absolute value of the steady state system frequency deviation is not larger than the maximum steady state frequency deviation (200 MHz); and
    - The absolute value of the steady state frequency deviation has continuously exceeded 50% of the maximum steady state frequency deviation (200 MHz) for a period of time longer than the alert state trigger time (5 minutes) or has continuously exceeded 50% of the standard frequency range (approx. 50 MHz) for a period of time longer than the time to restore frequency (15 minutes);

OR

- At least one contingency from the contingency list defined in accordance with SOGL Article 33 results in the violation of the TSO's operational security limits, even after the activation of remedial actions.

  Contingencies are classified as follows:
    - Ordinary contingency: loss of a 380 kV-30 kV line or cable, a generator, a 380 kV busbar coupling, a transformer, a 380 kV busbar;
    - Exceptional contingency: loss of a high-voltage pylon (that supports several lines). These contingencies are not typically included in operational security analyses, except in the event of anticipated wind speeds greater than 130 km/h;
    - Out-of-range contingency: loss of several nuclear reactors or an entire high-voltage substation. These contingencies are not included in operational security analyses unless there is a clear risk of them occurring.

5.3 Emergency

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

- There is at least one violation of a TSO's operational security limits, defined as follows:
    - Voltage ranges at the connection point between 110 kV and 300 kV: 0.90 pu – 1.118 pu
    - Voltage ranges at the connection point between 300 kV and 400 kV: 0.90 pu – 1.05 pu
    - Current limits in terms of thermal rating, including transitory admissible overloads, taking into account the type of components such as overhead lines (Cu, Al), underground cables, transformers and so on, as well as ambient conditions (wind, solar radiation, temperature, etc.)
- The frequency does not meet the criteria for the normal or alert state;
- At least **one measure of the TSO's system defence plan is activated**;
- There is a **fault affecting the operation of tools, means and facilities** as per SOGL Article 24(1), resulting in the unavailability of those tools, means and facilities for **longer than 30 minutes**.

  The tools, means and facilities referenced in SOGL Article 24 are listed below:

(a) Facilities for monitoring the state of the transmission system, including state estimation applications and facilities for load-frequency control (LFC).

This encompasses the following applications and facilities:
- An Energy Management System (EMS) with, for instance, a state estimation and security analysis tool;
- The ENTSO-E Awareness System (EAS);
- Elia's control centres, including regional and backup control centres;
- The data warehouse and LAN connection;
- The frequency restoration controller for the LFC area;
- The FRR manual control system;
- Telecommunication systems (data and voice).

(b) Means to control the switching of circuit breakers, coupling circuit breakers, transformer tap changers and other equipment that serves to control transmission system elements.

Such systems and facilities include but are not limited to:
- SCADA at (main, backup and regional) control centres;
- Substation SCADA for those substations identified as key to the Restoration Plan;
- Communication of data to key substations;
- Data and voice communication to control rooms;
- Substation bay controller;
- Local communication of data within a substation.

(c) The means to communicate with the control centres of other TSOs and RSCs:
- Only voice communication is taken into account for RSCs;
- Voice and data communication systems between TSOs are taken into account, including the Electronic Highway and EAS.

(d) Tools for operational security analysis, including the EMS with, for example, a SCADA, state estimation and security analysis tool.

(e) Tools and means of communication required by Elia to facilitate cross-border electricity market activities, i.e. market tools associated with the EMS, such as the

tool for managing nominations, schedules, the activation of energy bids, and so on.

5.4 Blackout

A transmission system is in the blackout state when at least one of the following conditions is met:

- **Loss of more than 50% of demand**[3] in the control area of the TSO in question;
- **Total absence of voltage for at least 3 minutes in the control area** of the TSO in question, consequently triggering restoration plans.

5.5 Restoration

A transmission system is in the restoration state when a TSO in the emergency or blackout state begins to activate measures under its restoration plan.

The restoration state can occur after a blackout or system split, i.e. the division of the Continental Europe synchronous area into multiple asynchronous parts.

[3] Demand is understood as 'total load'.

6 Roles and responsibilities under the System Defence Plan

The specific role played by each of the entities listed below is vital to the efficient implementation of System Defence Plan procedures.

- Transmission system operators
- Significant grid users[4]
- Distribution system operators[5]
- Restoration service providers
- Balance responsible parties
- Balancing service providers

The System Defence Plan describes the strategy and working methods used by Elia and these entities to stabilise the grid in a coordinated manner following an incident.

6.1 Transmission system operators (TSOs)

Elia enacts those System Defence Plan measures specific to the transmission system and keeps them in place for as long as required.

Elia is responsible for updating the procedures contained within the System Defence Plan and organises regular training for personnel.

In the event of an incident, Elia analyses the situation and contacts those parties involved in implementing the System Defence Plan procedures in question.

Elia decides whether to suspend or restore energy market activities in accordance with the 'Rules for suspension and restoration of market activities' and the 'Specific rules for imbalance settlement and settlement of balancing energy'. These rules must be approved by CREG.

At Elia's request, neighbouring TSOs will provide all possible support, provided that they themselves are not in an emergency, blackout or restoration state.

6.2 Significant grid users (SGUs)

6.2.1 Operators of power generating modules (PGMs)

The grid is stabilised following an incident primarily by restoring the balance between the generation and consumption of active and reactive power. Good cooperation between Elia and PGM operators is therefore of paramount importance. As mentioned previously, Elia intends to use a limited number of resources in order to ensure an efficient response to the transmission system being in an emergency state. As a result, Elia wants to use a small number of PGMs with a maximum active power greater than or equal to 25 MW, rather than using more PGMs with lower active power. 'PGM' in this section refers to PGMs with a maximum active power greater than or equal to 25 MW.

Should a PGM be disconnected for reasons of operational security, the reconnection with the grid must be coordinated with Elia in real time, meaning that automatic connection to the

[4] The list of SGUs is given in section 4.
[5] For the avoidance of doubt, references to 'DSO' in this document should be understood as 'public DSO' and not 'closed DSO'.

grid following any disruption is not permitted. This also applies to PGMs with a maximum active power lower than 25 MW.

PGM operators shall make all appropriate efforts to comply with Elia's instructions without undue delay.

Operators of PGMs with a maximum active power greater than or equal to 25 MW must designate a point of contact that is available 24/7, has sufficient knowledge and authority to provide Elia with clear information about the capacities and limitations of the module in question and can follow Elia's instructions.

6.2.2 Demand facilities connected to the transmission system

Demand facilities connected to the transmission system must designate a point of contact that is available 24/7 and can provide Elia, at the latter's request, with information on the state of its facilities and the possibility of adjusting its active and reactive power exchange with the transmission system.

6.2.3 Closed distribution system operators (CDSOs) connected to the transmission system

CDSOs connected to the transmission system must designate a point of contact that is available 24/7 (dispatching). In particular, the point of contact must be able to provide Elia, at the latter's request, with information on the state of its closed distribution system and on the possibility of adjusting the amount of active and reactive power exchanged with the transmission system via the connection point.

As the system operator in question, the CDSO connected to the transmission system must help those entities connected to its closed distribution system to obey Elia's instructions.

6.3 Distribution system operators (DSOs)

All DSOs must implement the procedures of the System Defence Plan (section 7) at Elia's request without undue delay.

All DSOs must take the action necessary to enact the load-shedding plan according to Elia's instructions, taking into account regional legislation and insofar as the DSOs have the technical means to do so.

All DSOs must take the action necessary to restore power to high priority SGUs that have been disconnected, as per the cooperation agreement (CA) between Elia and the DSOs (confidential).

Every DSO must designate a point of contact that is available 24/7 (dispatching) and can provide Elia with information on the state of its facilities. This involves in particular:

- providing Elia, at the latter's request, with information on the state of its distribution system and on the possibility of adjusting the amount of active and reactive power exchanged with the transmission system via the connection points;
- facilitating compliance with the instructions issued by Elia to SGUs connected to the distribution system.

6.4 Balance responsible parties (BRPs)

The obligations applicable to BRPs as per the 'General terms and conditions for BRPs' continue to apply as long as market activities are not suspended under the 'Rules for

suspension and restoration of market activities' and the 'Specific rules for imbalance settlement and settlement of balancing energy' as published on Elia's website.

Under these rules, during a period of 'TSO-controlled dispatching', BRPs are not responsible for maintaining the balance of their respective portfolios, as this could reduce the efficiency of the restoration of the transmission system to a normal or alert state. Elia will notify the BRPs about the timing of the suspension and restoration of market activities as per the communication procedure set out in these rules.

When the system is in 'TSO-controlled dispatching' mode, Elia will send instructions directly to PGM operators.

When the system is in a state of restoration following a system split, the obligations applicable to BRPs as set out in the 'General terms and conditions for BRPs' or the FGC shall continue to apply.

6.5 Balancing service providers (BSPs)

The obligations applicable to BSPs as per the 'General terms and conditions for BSPs' continue to apply as long as market activities are not suspended under the 'Rules for suspension and restoration of market activities' and the 'Specific rules for imbalance settlement and settlement of balancing energy' as published on Elia's website.

Elia will notify the BSPs about the timing of the suspension and restoration of market activities as per the communication procedure set out in these rules.

When the system is in 'TSO-controlled dispatching' mode, Elia will send instructions directly to PGM operators.

When the system is in a state of restoration following a system split, the obligations applicable to BSPs as set out in the 'General terms and conditions for BSPs' or the FGC shall continue to apply.

7 Procedures within the System Defence Plan

Pursuant to NC E&R Article 11(5), the System Defence Plan includes the following technical and organisational measures as a minimum:

(a) System protection schemes, including as a minimum:

i) an automatic underfrequency control scheme as per Article 15;

ii) an automatic overfrequency control scheme as per Article 16; and

iii) an automatic scheme protecting against voltage collapse as per Article 17.

(b) System Defence Plan procedures, including as a minimum:

i) the frequency deviation management procedure as per Article 18;

ii) the voltage deviation management procedure as per Article 19;

iii) the power flow management procedure as per Article 20;

iv) the assistance for active power procedure as per Article 21; and

v) the manual demand disconnection procedure as per Article 22.

In addition to these minimum requirements, section 7.5 of this System Defence Plan details the procedure to be adopted in the event of a shortage in accordance with the 'Load-Shedding Plan' Ministerial Decree.

7.1 Frequency deviation management procedure

7.1.1 Frequency emergency criteria

Figure 2 shows the emergency criteria for the scale and duration of frequency deviations (red zones) as applied in the Continental Europe synchronous area.

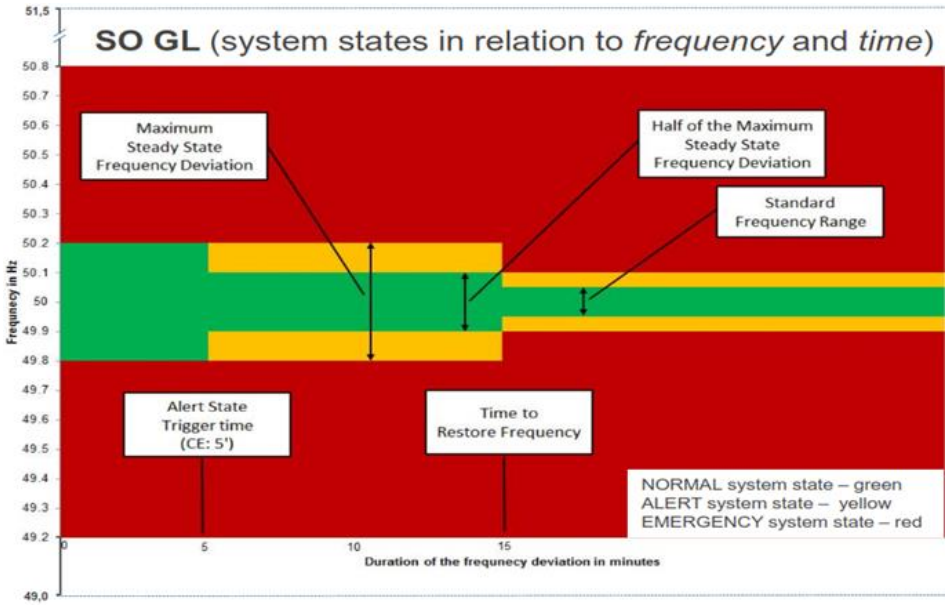


Figure 2: Emergency criteria for the scale and duration of frequency deviations

7.1.2 Description and purpose

The measures of the frequency deviation management procedure set out in the System Defence Plan were developed in accordance with NC E&R Article 18.

This procedure is intended to stabilise frequency after an incident, **prior to the appointment of a Frequency Leader.**[6]

This procedure shall come into force on the day following the approval of the System Defence Plan.

The frequency management procedure aims to restore rated frequency following the division of the synchronous area into several synchronous regions or during system restoration, and is part of the Restoration Plan.

7.1.3 Measures within the frequency deviation management procedure

The 'Elia imbalance area operational procedure' (confidential) provides an overview of the measures to be taken in the event of frequency deviations.

If the steady state frequency falls outside the **49.95–50.05 Hz** range for more than **15 minutes**

or

If the steady state frequency falls outside the **49.90–50.10 Hz** range for more than **5 minutes:**

Activation of the **extraordinary procedure for frequency monitoring** and countermeasures in the event of major steady state frequency deviations (confidential).

Phase 1: **Swissgrid** (even months) **or Amprion** (odd months) **will immediately contact the relevant TSOs**, based on the Area Control Error (ACE) deviation, by telephone and will send them an email confirming the planned actions.

Phase 2: If frequency does not noticeably improve, **Swissgrid or Amprion will hold a larger scale teleconference** so that the relevant partners (Swissgrid, Amprion, RTE, REE, Terna) are in contact with one another no later than 20 minutes after the 50 MHz frequency limit has been exceeded, or no later than 10 minutes after the 100 MHz frequency limit has been exceeded.

If during phase 1 the responsible TSOs declared that they were unable to respond to the frequency deviation due to the lack or exhaustion of measures, the participant TSOs are expected to suggest and roll out all possible measures in accordance with their own (market and security) rules.

[6] The Restoration Plan describes the process for appointing a Frequency Leader.

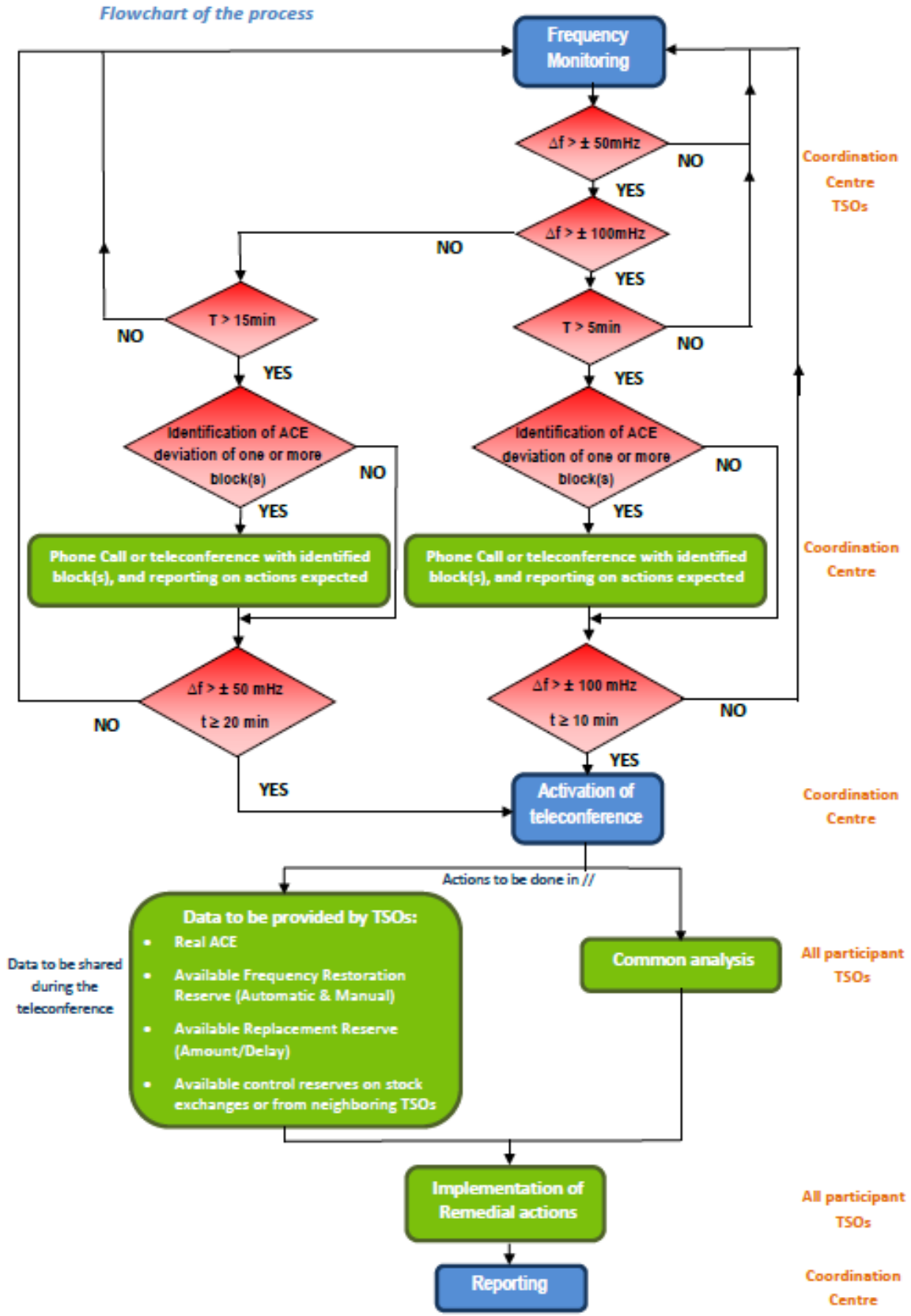


Figure 3: Overview diagram of the extraordinary procedure for frequency monitoring

If the steady state frequency falls outside the **49.90–50.10 Hz** range for more than **15 minutes:**

- Manual activation of the **Emergency Elia notification**

7.1.3.1 In the event of underfrequency

If the steady state frequency is **less than or equal to 49.80 Hz**:

- Automatic activation of the **Emergency Elia notification;**
- The frequency restoration controller for the LFC area will automatically switch to **frozen mode**, allowing the Elia System Engineer (SE) to assess the situation and take manual control. This means that the active power set points for the PGMs participating in the aFRR remain unchanged. Until this is released, the frequency restoration controller for the LFC area remains passive and the ACE signal is no longer automatically set to zero.

  Elia can manually or automatically override the output signal of the frozen mode of the frequency restoration controller for the LFC area to speed up system stabilisation. These measures must be applied with caution to avoid congestion;
- Automatic activation of **LFSM-U;**[7]
- Automatic response of energy storage units as described in section 7.8.3;
- If the steady state frequency falls **below 49.70 Hz**:
  - The hydroelectric pumped-storage power plants operating in pump mode are automatically shut down by local frequency relay;
  - The following actions are **automatically** activated by Elia (they can also be activated manually):
    - Issue of a request (via a SCADA-to-SCADA signal) to DSOs and CDSOs (where appropriate) to shut down the storage heaters and boilers;
    - Reduction of the voltage set point by 5% on the automatic voltage control systems of distribution transformers.
- In order to stabilise the frequency, rate of change of frequency permitting, Elia may submit a request to **modify the active power set point** of certain PGMs with a maximum active power greater than or equal to 25 MW, as per the market rules in force at that time and taking into account the impact on congested areas;
- If necessary to stabilise the frequency, Elia may disconnect the **following SGUs** directly or indirectly via DSOs or CDSOs:
  - Demand facilities and closed distribution systems connected to the transmission system;
  - The HVDC interconnector between Belgium and the UK, following consultation with NGESO and NLL in real time.

  These SGUs remain disconnected until Elia issues further instructions.

  If Elia disconnects an SGU, Elia will, within 30 days of the incident, draw up a report containing a detailed explanation of why this action was taken and the impact thereof. Elia will submit the report to CREG and make it available to those grid users on which this action has had a substantial impact.
- As a last resort: activation of the manual demand disconnection procedure described in section 7.6.

[7] In accordance with the NC RfG.

Once the frequency has stabilised, the frequency management procedure set out in the Restoration Plan must be applied to return the frequency to its normal value.

If Elia disconnects an SGU, Elia will, within 30 days of the incident, draw up a report containing a detailed explanation of why and how this action was taken and the impact thereof, and will submit the report to CREG.

Pursuant to FGC Article 13, this report is also sent for information purposes to DG Energy and, where appropriate, to the various parties concerned, without prejudice to the provisions of NC E&R Articles 14(4), 18(4), 20(3) and 22(4). CREG will issue an opinion on the appropriateness of the action taken.

7.1.3.2 In the event of overfrequency

If the steady state frequency is **greater than or equal to 50.20 Hz**:

- Automatic activation of the **Emergency Elia notification;**
- Automatic activation of **LFSM-O.**[8]

If necessary to stabilise the frequency, Elia may disconnect the **following SGUs** directly or indirectly via DSOs or CDSOs:

- PGMs with a maximum active power greater than or equal to 25 MW;
- The HVDC interconnector between Belgium and the UK, following consultation with NGESO and NLL in real time.

These SGUs remain disconnected until Elia issues further instructions.

If Elia disconnects an SGU, Elia will, within 30 days of the incident, draw up a report containing a detailed explanation of why this action was taken and the impact thereof, and will submit the report to CREG.

Pursuant to FGC Article 13, this report is also sent for information purposes to DG Energy and, where appropriate, to the various parties concerned, without prejudice to the provisions of NC E&R Articles 14(4), 18(4), 20(3) and 22(4). CREG will issue an opinion on the appropriateness of the action taken.

7.2 Voltage deviation management procedure

7.2.1 Description and purpose

The voltage deviation management procedure set out in the System Defence Plan was developed in accordance with NC E&R Article 19.

This procedure is intended to **return the voltage to within normal operational limits** or support a neighbouring TSO in an emergency state at said TSO's request.

This procedure shall come into force on the day following the approval of the System Defence Plan.

7.2.2 Activation criteria

The voltage deviation management procedure **can be activated manually by Elia** when the voltage falls outside the operational limits specified in the NC E&R:

- 0.9 pu – 1.05 pu for 400 kV connection points

[8] In accordance with the NC RfG.

- (360 kV – 420 kV) for 400 kV
  - Elia's operational limits: (370 kV – 418 kV)
  - Physical limit: 420 kV

- 0.9 pu – 1.118 pu for 150 kV and 220 kV connection points
  - (198 kV – 245 kV) for 220 kV
    - Elia's operational limits: (208 kV – 242 kV)
    - Physical limit: 245 kV
  - (135 kV – 168 kV) for 150 kV
    - Elia's operational limits: (143 kV – 165 kV)
    - Physical limit: 170 kV

The voltage deviation management procedure can be activated **in an emergency state at the request of TenneT NL or RTE,** in which case Elia must make available as much reactive power capacity as possible without pushing its transmission system into an emergency or blackout state. If Elia is in a state of emergency, it can request voltage support from TenneT NL and RTE.

7.2.3 The procedure

The voltage deviation management procedure comprises the following actions:

- Activation of the **Emergency Elia notification** and preparation of a **local analysis** (EMS analysis mode, PSOS support, etc.) of the situation;
- Based on the results of the analysis, Elia could take the following actions:
  - Use reactive power devices (tap changers, reactors, capacitor banks, SVCs, etc.) in coordination with DSOs or CDSOs;
  - Request (or monitor, if applicable) additional voltage/reactive power support from PGMs with a maximum active power greater than or equal to 25 MW;
  - Request minimum or maximum values of reactive power from specific PGMs with a maximum active power greater than or equal to 25 MW, if deemed necessary and safe;
  - Request additional reactive power support from the HVDC converter connected to the Gezelle substation (Nemo Link) or from any future HVDC converter connected to the Belgian transmission system. Elia may ask NLL to generate or absorb additional reactive power (via manual MVAr offset). Elia must make such a request to NLL by telephone, as per Annex N of the operational protocol;[9]
  - Request reactive power support from TenneT NL or RTE to make available additional reactive power capacities.
- If the above measures are not sufficient, Elia may decide to activate the manual demand disconnection procedure described in section 7.6 of this document.

[9] This document is only available within Elia and is not submitted for approval.

7.3 Power flow management procedure

7.3.1 Description and purpose

This procedure was devised in accordance with NC E&R Article 20 and is intended to **return power flows to within operational limits**.

7.3.2 Preliminary measures

The following measure should be considered before activating this procedure:

- Countertrading or redispatching as described in Commission Regulation (EU) 2015/1222 (capacity allocation and congestion management)

7.3.3 Activation criteria

The power flow management procedure **can be manually activated** by the Elia SE when the real-time power flows fall outside the operational limits.

Elia's operating criteria (confidential) set out the operational limits of various grid components.

7.3.4 The procedure

The following action could be taken when activating this procedure:

- Activation of the **Emergency Elia notification.**
- The following manual actions could be taken directly or indirectly via the CDSOs, depending on the situation:
    - Disconnecting/reconnecting the identified SGUs;
    - Modifying the set points of the identified SGUs. The instructions can be issued directly to the SGU's control centre or via BRP dispatching.
- If necessary to eliminate the overload, Elia may disconnect the **following SGUs** directly or indirectly via DSOs or CDSOs:
    - PGMs with a maximum active power greater than or equal to 25 MW;
    - Demand facilities and closed distribution systems connected to the transmission system;
    - HVDC networks.
- Elia may take the following action in order to return power flows on cross-border grid components or components close to a border to within operational limits:
    - Ask neighbouring TSOs to activate reserves at a specific point in their control area;
    - Ask neighbouring TSOs to modify the positions of phase-shifting transformers.
- If the above actions prove insufficient, Elia may enact the following measures:
    - **Manual or automatic opening of a cross-border interconnection** only in coordination with other TSOs;
    - Activation of the **manual demand disconnection procedure** described in section 7.6 wherever necessary to eliminate the overload. The impact of

manual demand disconnection on grid users compared to the impact of the loss of one or more overloaded grid components must be assessed.

These SGUs remain disconnected until Elia issues further instructions.

If Elia disconnects an SGU, Elia will, within 30 days of the incident, draw up a report containing a detailed explanation of why and how this action was taken and the impact thereof, and will submit the report to CREG.

Pursuant to FGC Article 13, this report is also sent for information purposes to DG Energy and, where appropriate, to the various parties concerned, without prejudice to the provisions of NC E&R Articles 14(4), 18(4), 20(3) and 22(4). CREG will issue an opinion on the appropriateness of the action taken.

The relevant DSOs and CDSOs must be notified of any SGUs disconnected directly.

7.4 Assistance for active power procedure

7.4.1 Description and purpose

This procedure was devised in line with NC E&R Article 21. **In the event of a lack of adequacy in the control area in real time**, this procedure is intended to **offset the ACE** when the available balancing energy bids and inter-TSO contracts are insufficient.

7.4.2 Prior action pursuant to Elia's balancing rules and the LFC block operational agreement

Before activating the assistance for active power procedure:

- If Elia's reserve capacity is reduced by more than 20% for longer than 30 minutes and if there is no way to offset this reduction through real-time system operation, activate the **alert state** in EAS:

$$\left.\begin{array}{l}\left[\frac{\mathrm{FCR}_{target}-\mathrm{FCR}_{actual}}{\mathrm{FCR}_{target}}\right] x\ 100 > 20 \text{ or} \\ \left[\frac{FRR_{target}-FRR_{actual}}{FRR_{target}}\right] x\ 100 > 20\end{array}\right\} \quad \mathrm{t} > 30 \text{ min}$$

  The target dimension values of FCR and FRR (sum of aFRR and mFRR) for a certain period of time are compared with the actual available reserves in real time, with reserves that were already activated earlier being considered available reserves.

  Reserves that are not available due to a forced or scheduled interruption (even if not available during the contractual replacement period) are regarded as actually unavailable.

  The availability of Elia's reserve capacity is based on:

  - nominations identified on the bidding market platform (BMAP) for non-CIPU units;
  - D-1 nominations for CIPU units[10] and the Nomination Reserve Transfer (NRT) via the intraday secondary market.

  BMAP provides an overview and alert system.

  The Elia System Operator decides to activate the alert state.

- **Activate all available balancing energy reserves** in accordance with the 'Elia area imbalance operational procedure' (confidential) at the time of the lack of adequacy in the control area.

  This operational procedure reflects the current balancing rules, which are available on the Elia website at https://www.elia.be/en/electricity-market-and-system/system-services/keeping-the-balance

- **Activate the Balancing Warning[11]** signal once all R3 (mFRR) reserves are activated, so that the BSPs send more energy bids and activate additional energy bids.

[10] All nominations will need to be recorded on BMAP in the future.
[11] The Balancing Warning signal is not part of the System Defence Plan. This signal is issued in normal or alert state to request more energy bids from BSPs in order to try to avoid activating measures under the System Defence Plan. The signal is activated by the System Engineer within the Elia NCC depending on the operational security of the system.

- **Activate low-coordinable and slow flexibility**

7.4.3 Activation criteria

The assistance for active power procedure can be **activated manually** by the Elia SE **depending on the system's operational security in the event of a lack of adequacy in the control area** in real or near real time and prior to any potential suspension of market activities or manual demand disconnection.

7.4.4 The procedure

When activating the assistance for active power procedure, the following actions could be taken in descending order of priority:

- Activation of the **Emergency Elia notification;**
- Activation of **inter-TSO assistance in an emergency state** as per NC E&R Article 14. Depending on the available cross-border capacity and power flows on the system, the Elia SE decides whether to ask neighbouring system operators to activate reserves in their control area as per the corresponding Agreement on Grid and System Operation Management (AGSOM).

If inter-TSO emergency assistance is not sufficient, depending on the operational security of the system the Elia SE can activate one or more of the following actions:

- **Actions that can be activated manually**:
    - Issue of a request to the DSOs to disconnect storage heaters and boilers;
    - Reduction of the voltage set point by 5% on the automatic voltage control systems of distribution transformers, as described in section 7.1.3.1
    - Shutdown or disconnection of pumped-storage power stations operating in pumped mode, provided that they have not already been activated by market mechanisms.
- Activation of the manual demand disconnection procedure described in section 7.6 of this document.

7.5 Procedure in the event of shortages

7.5.1 Description and purpose

If Elia detects a lack of adequacy in the control area (shortage) for a given day D within a period starting on day D-7 and ending at 6 p.m. on day D-2, Elia immediately notifies the competent authorities and the CGCCR and initiates the shortage procedure.

The **shortage procedure** describes the (restricted) process and interaction between Elia and the competent authorities in accordance with the 'Load-Shedding Plan' Ministerial Decree.

In the event of a (risk of) shortage, Elia suggests ways to limit demand in order to reduce electricity consumption in the Belgian control area, including:

- the obligation for consumers (or certain categories of consumers) throughout the country or in certain parts thereof to reduce their offtake to within the set limits;
- a ban on using electricity for certain purposes.

The summary table of measures intended to limit demand was updated by DG Energy, following consultation with the Minister of Energy, in the second half of 2018.

This table (which is provided in Annex 2) lists the measures that the TSO may recommend, including an assessment of the potential reduction in consumption (confidential).

Elia implements the shortage procedure as per its in-house procedures.

If the above measures are not sufficient, Elia may decide to activate the manual demand disconnection procedure described in section 7.6 of this document.

In order to avoid manual demand disconnection, Elia will make optimal use of the transmission capacity of available transmission components, including lines between areas, in real time and while also taking into account reserve margins for limiting the impact of an unexpected breakdown of a grid component or PGM, in consultation with neighbouring TSOs.

7.5.2 Communication in the event of a detected shortage

If Elia detects a lack of adequacy in the control area for a given day D within a period starting on day D-7 and ending at 6 p.m. on day D-2, Elia immediately notifies the competent authorities and the CGCCR.

After sending the notification, Elia organises a technical briefing geared towards the federal and regional Ministers of Energy, the federal Minister of Economy, the Minister of the Interior, the Director General for Energy at DG Energy and the Director of the CGCCR, covering the volume, locations and period in question and the proposed measures.

Elia publishes details of the shortage for the next seven days on www.offon.be and uses the following colour codes to indicate the shortage situation for each day:

- Green: normal
- Orange: risk of shortage detected
- Red: risk of load shedding detected
- Black: load shedding announced

If Elia detects a lack of adequacy in the control area for a given day D after 6 p.m. on D-2, Elia will immediately notify the CGCCR and the Minister of Energy.

7.6 Manual demand disconnection procedure (confidential)

7.7 Inter-TSO assistance and coordination in an emergency state

This procedure was devised in accordance with NC E&R Article 14.

At the request of a TSO in an emergency state, Elia shall, via interconnectors, provide all assistance possible to said TSO, provided that this does not trigger an emergency, blackout or restoration state on its transmission system or the interconnected transmission systems.

Elia may also request assistance from other TSOs when its own balancing energy reserves are exhausted. Depending on the available cross-border capacity and power flows on the system, the Elia SE decides which neighbouring TSO(s) it will ask to activate reserves in their respective control area(s). Neighbouring TSOs are obliged to activate their reserves as long as they are not in an emergency, blackout or restoration state and the requested assistance could not trigger such a state.

Mutual assistance agreements in the event of emergencies are established with each neighbouring system operator in the corresponding AGSOMs.[12]

Should Elia request assistance from other TSOs not directly connected to Elia's control area, Elia shall notify the TSOs located between them and request their consent.

Should assistance be provided via the HVDC interconnector between the UK and Belgium, this may involve the actions described in the 'Procedure for activation of Emergency Assistance NGESO' (confidential), while the procedures for new HVDC interconnectors will be based on the relevant operational protocols.

An 'emergency measure' comprises one of the following actions:

- Local emergency action: additional assistance for voltage/reactive power;
- Inter-TSO emergency assistance;
- Emergency instructions.

Elia may manually disconnect any transmission system component having a significant cross-border impact, including interconnectors, provided that:

- Elia coordinates this with the neighbouring TSOs; and
- this action will not trigger an emergency or blackout state on the remaining interconnected transmission system.

Elia may **manually disconnect**, **without any coordination**, any transmission system component having a significant cross-border impact, including interconnectors, in exceptional circumstances involving a breach of operational security limits, to avoid **endangering personnel** or **damaging equipment**.

If Elia disconnects an SGU, Elia will, within 30 days of the incident, draw up a report containing a detailed explanation of why and how this action was taken and the impact thereof, and will submit the report to CREG and any neighbouring TSOs. Elia will also make the report available to those SGUs affected by the disconnection. Pursuant to FGC Article 13, this report is also sent for information purposes to DG Energy and, where appropriate, to the various parties concerned, without prejudice to the provisions of NC E&R Articles 14(4), 18(4), 20(3) and 22(4). CREG will issue an opinion on the appropriateness of the action taken.

[12] The AGSOM is amended as soon as there are any major modifications to the physical connections between the TSOs in question or if there are any changes to the other agreements included in the AGSOM.

7.7.1 Voltage deviation management procedure

Pursuant to NC E&R Article 19, neighbouring TSOs in an emergency state may request that Elia make available all reactive power capacities it can without triggering an emergency or blackout state on Elia's system (section 7.2.3).

7.7.2 Power flow management procedure

A TSO may ask a neighbouring TSO to take the following action in order to return power flows on cross-border grid components or components close to a border to within operational limits:

- Activate reserves at a specific point in their control area;
- Modify the positions of phase-shifting transformers.

See also section 7.3.4.

7.7.3 Assistance for active power procedure

Pursuant to NC E&R Article 21, if other TSOs request assistance for active power from Elia, Elia must:

- make available its unshared energy bids;
- activate the available balancing energy in order to supply the TSO in question with the corresponding electricity flows; and
- request assistance for active power from its BSPs and any SGUs connected in its LFC area that do not already provide a balancing service to the TSO, in order to supply the TSO in question with the corresponding assistance.

Once the requested active power has been activated, the requesting TSO and Elia shall be entitled to use:

- the available cross-zonal exchange capacity if the activation takes place before the intraday cross-zonal market gate closure time and if the provision of the cross-zonal capacity in question has not been suspended;
- additional capacity that may be available due to the system's real-time state, in which case the TSOs receiving and making the request shall coordinate with the other significantly impacted TSOs.

Once Elia and the requesting TSO have agreed on the conditions for supplying assistance for active power, the agreed volume of active power and the timeslot for the supply thereof are fixed, unless Elia's transmission system enters an emergency or blackout state.

7.8 Automatic underfrequency control scheme

7.8.1 Description and purpose

The measures of the automatic underfrequency control scheme set out in the System Defence Plan were devised in accordance with NC E&R Article 15.

The automatic underfrequency control scheme comprises:

- a Low Frequency Demand Disconnection (LFDD) plan; and
- a Limited Frequency Sensitive Mode - Underfrequency (LFSM-U) in the LFC area.

7.8.2 Limited Frequency Sensitive Mode - Underfrequency

LFSM-U must be activated when the system is in an emergency state following a serious disruption that triggered a significant shortfall in generation and all purchased FCRs are deployed. NC RfG Article 15(2)(c) specifies that PGMs with a maximum active power greater than or equal to 25 MW must be equipped with an active power frequency response in LFSM-U capability.

LFSM-U is automatically activated on PGMs when the frequency drops below 49.80 Hz.

When LFSM-U is activated, the FCR providing units' LFSM-U response shall resume from the overall FCR activation as of LFSM-U intervention.

Should frequency drop below 49.80 Hz and up to and including the frequency ranges specified in SOGL Article 154(6), the PGMs must further increase their power output, if necessary up to their maximum capacity, technical limitations permitting.

The corresponding LFSM-U response must have the same droop adopted for normal and alert states (target value = 5%, acceptable within the range of 2% to 12%) and must in no way jeopardise the stability of the PGMs supplying FCRs.

Elia must take into account previously agreed coordinated actions in normal and alert states intended to restore frequency.

LFSM-U is automatically activated on the HVDC interconnector between the UK and Belgium when the frequency in Belgium falls below 49.80 Hz and results in a reduction of the active power flow from Belgium to the UK or an increase in the active power flow from the UK to Belgium by up to XXX MW at a droop of XXX%.

If during an activation of LFSM-U on the Belgian side the LFSM-U frequency thresholds are also triggered on the UK side, the following provisions apply:

- Automatic freeze of assistance (active power response is frozen);
- The original active power set point is restored after a normal operational ramping rate (XXX MW/min).

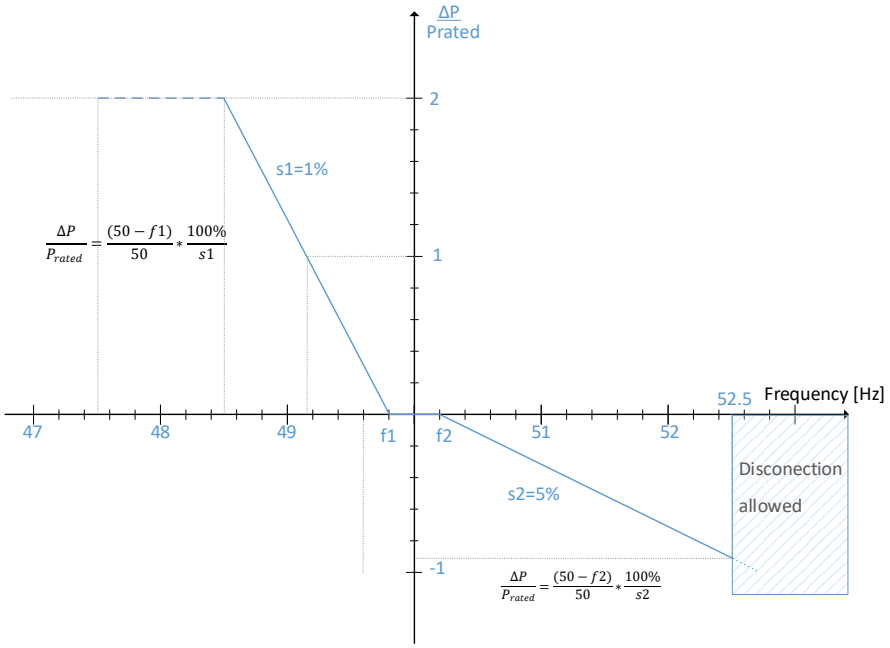
When the rate of change of frequency permits, LFSM-U should be activated before LFDD.

7.8.3 Automatic switching and disconnection of energy storage units

Energy storage units must contribute to frequency stability in the event of large frequency fluctuations by adapting their active power output.

Energy storage units operating in load mode will automatically disconnect at a random frequency threshold between 49.01 Hz and 49.2 Hz.[13] This range prevents the disconnection of a large number of storage units at a specific frequency threshold.

The maximum total disconnection time must be as short as technically possible, taking into account measurement, relay calculation time, the switching of auxiliary circuits and the opening time for circuit breakers. Intentional delays are not permitted.



Parameters	Values
f1	49.8 Hz
f2	50.2 Hz
s1	1%
s2	5%
Control time	As quickly as possible and no longer than 15 seconds
Response time	As quickly as technically possible (no intentional delays), specific provisions agreed with the TSO may apply

Figure 1: Active power frequency response of energy storage units

[13] This frequency range is specified in the agreement governing the connection of energy storage units.

7.8.4 Low frequency demand disconnection plan (confidential)

7.8.5 Overview of action taken automatically during system frequency collapse

When the frequency drops, the following actions are activated **automatically**:

- From 50.00 Hz to 49.80 Hz:
  - Activation of all available FCRs (primary reserves)
- When f = 49.80 Hz:
  - Activation of the Emergency Elia notification;
  - Activation of LFSM-U;
  - Switch frequency restoration controller for the LFC area (aFRR control) to frozen mode;
  - The energy storage devices automatically adjust their energy injection/offtake according to the droop as per section 7.8.3.
- When f = 49.70 Hz:
  - Activation of U-5%, as per section 7.1.3.1;
  - Shutdown of electric storage heaters and boilers;
  - Shutdown of hydroelectric pumped-storage power plants operating in pump mode.
- When 49 Hz < f < 49.20 Hz:
  - Automatic disconnection of the storage units while they are still operating in load mode
- When f = 49.00 Hz:
  - Activation of the first steps of the LFDD plan
- When f = 48.50 Hz:
  - Activation of all steps in the LFDD plan
- When f < 48.50 Hz:
  - PGMs could disconnect from the grid, speeding up frequency collapse

These actions are summarised in Figure 5.

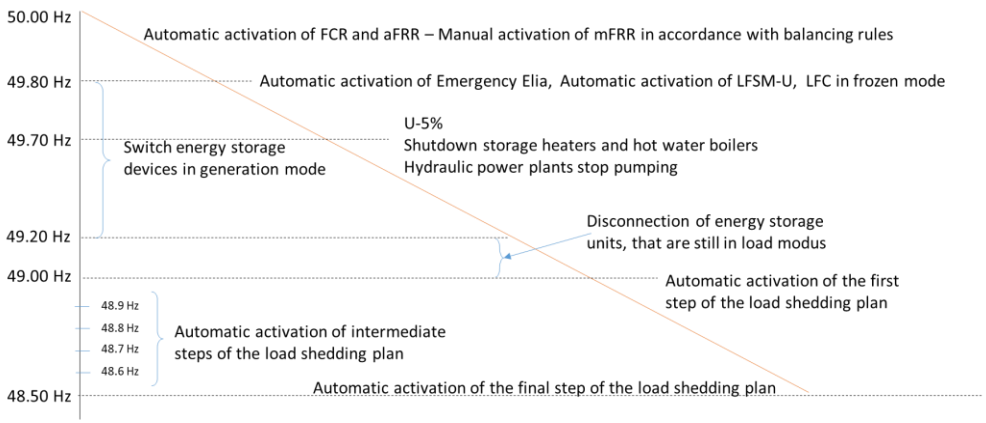


Figure 5: Automatic actions to be taken in the event of a drop in frequency

7.9 Automatic overfrequency control scheme

7.9.1 Description and purpose

The measures of the automatic overfrequency control scheme set out in the System Defence Plan were devised in accordance with NC E&R Article 16. This scheme is intended to avoid a potential mass disconnection of PGMs in the event of excessively high frequencies, with a risk of system collapse. The automatic overfrequency control scheme automatically reduces the total active power injected in each LFC area of the Continental Europe synchronous area.

7.9.2 Limited Frequency Sensitive Mode - Overfrequency

Limited Frequency Sensitive Mode - Overfrequency (LFSM-O) must be activated when the system is in an emergency state following a serious disruption that triggered a significant excess in generation and all FCRs are deployed.

Pursuant to NC RfG Article 13(2), all PGM types must be capable of activating the provision of active power frequency response in LFSM-O.

LFSM-O is automatically activated on PGMs when the frequency exceeds 50.20 Hz.

Should frequency exceed 50.20 Hz and reach the frequency ranges specified in SOGL Article 154(6), the PGMs must further reduce their power output down to their minimum capacity, technical limitations permitting.

The corresponding LFSM-O response must have the same droop adopted for normal and alert states (target value = 5%, acceptable within the range of 2% to 12%) and must in no way jeopardise the stability of the PGMs supplying FCRs.

When LFSM-O is activated, the FCR providing units' LFSM-O response shall resume from the overall FCR activation as of LFSM-O intervention.

Elia devises its automatic overfrequency control scheme taking into account the capabilities of the PGMs with regard to LFSM-O and of the energy storage units in its LFC area.

The LFSM-O systems within Belgian PGMs were deemed to satisfy the requirements of NC E&R Article 16(2)(a) and (b) and Elia therefore did not consider it necessary to establish a step-by-step linear process for disconnecting generation and/or HVDC systems in its LFC area.

Elia must take into account previously agreed coordinated actions in normal and alert states intended to restore frequency.

Pursuant to NC E&R Article 16(2), the TSOs within the Continental Europe regional group recommend the following parameters for LFSM-O on PGMs:

Frequency threshold for activating LFSM-O	50.2 Hz
Reduction ratio of active power injection	Recommended 5%

7.9.3 Automatic response of energy storage units

Energy storage units must contribute to frequency stability in the event of large frequency fluctuations by adapting their active power output as shown in Figure 4.

Energy storage units automatically adjust their injection or offtake based on Figure 4 when frequency exceeds 50.20 Hz.

7.9.4 Automatic response of HVDC interconnectors

LFSM-O is automatically activated on the HVDC interconnector between the UK and Belgium when the frequency in Belgium exceeds 50.20 Hz and results in a reduction of the active power flow from the UK to Belgium *or an increase in the active power flow from Belgium to the UK* by up to XXX MW at a droop of XXX%.

If during an activation of LFSM-O on the Belgian side the LFSM-O frequency thresholds are also triggered on the UK side, the following provisions apply:

- Automatic freeze of assistance (active power response is frozen)

The original active power set point is restored after a normal operational ramping rate (XXX MW/min).

7.10 Automatic scheme against voltage collapse

7.10.1 Description and purpose

The measures of the automatic scheme against voltage collapse set out in the System Defence Plan were devised in accordance with NC E&R Article 17.

Various protective voltage-management systems at local level are present at several locations on the grid and are also partly managed centrally by Elia. However, these systems are used in normal and alert states and continue to operate without special intervention in an emergency state; they do not need to be activated specifically.

Blocking on-load tap changers on distribution and interconnection transformers is an effective way to prevent the voltage on the primary transmission system from continuing to drop after an incident and running the risk of total voltage collapse, as a result of the actions taken by on-load tap changers to maintain the voltage on the secondary distribution system.

Elia has adopted a blocking scheme for on-load tap changers intended to **prevent voltage collapse by blocking voltage regulation** on distribution transformers.

The HV/MV transformers' tap changer controller has a blocking function that is used if voltage on the primary side drops 5% compared to the rated voltage.

If the voltage on the primary side falls below 95% of the rated voltage, the set point of the voltage on the secondary side is reduced by 5%. This reduces the flow of reactive power from the high-voltage primary system towards the medium-voltage secondary system, which prevents any further reductions in voltage on the primary side of the system.

The blocking scheme is implemented locally on:

- distribution transformers between the Elia grid and the distribution systems;
- 220/70 kV and 150/36 kV interconnection transformers between transmission systems.

The direction of the flow of reactive power is not considered a blocking criterion.

It takes no more than several milliseconds to initiate blocking once the threshold has been detected.

LFDD is not considered a defensive measure.

7.10.2 Activation criteria

The blocking scheme is automatically activated if the voltage on the primary side drops below 95% of the rated voltage.

7.10.3 The procedure

The blocking scheme is activated **automatically**.

7.10.4 Summary of operation

a) Blocking method: on site based on the voltages measured locally.

b) The frequency threshold at the connection point: if the voltage on the primary side drops by 5% compared to the rated voltage, the transformer on-load tap changer is blocked.

c) The direction of the flow of reactive power is not considered a blocking criterion.

d) It takes no more than several milliseconds to initiate blocking once the threshold has been detected. Deliberate delay is not permitted.

8 Exchange of information in a state of emergency, blackout or restoration

The exchange of information if the transmission system is in an emergency, blackout or restoration state is determined in accordance with NC E&R Articles 38 and 40.

8.1 Emergency Elia notification

8.1.1 Description

The Emergency Elia notification is intended to inform the relevant stakeholders that the system is in an emergency state **and** that one or more measures of the System Defence Plan have been or may be activated in the near future.

The Emergency Elia notification must not be sent if no actions under the System Defence Plan are required.[14]

However, if the emergency state criteria are met (see section 5.3), Elia must notify the other TSOs by setting the system state to emergency in EAS (if relevant for the other TSOs).

Receiving the Emergency Elia notification warns recipients that they must **be ready to obey Elia's instructions without undue delay**.

The Emergency Elia notification is sent by the Elia National Control Centre (NCC) from SCADA to SCADA via the TASE2 protocol to the following entities (these must implement the actions requested by Elia in case of the activation of Emergency Elia):

- Distribution system operators;
- Balance responsible parties operating PGMs;
- PGM operators that are not balance responsible parties;
- Fluxys Belgium (gas transmission system operator);
- Other relevant entities that have a SCADA system.

BRPs operating PGMs with a maximum active power greater than or equal to 25 MW or an HVDC interconnection must stop all tests and must be ready to obey other instructions issued by Elia without undue delay.

When the system returns to normal or alert state, Elia shall send a notification that the system is no longer in an emergency state.

The DSOs, BRPs and other relevant entities are asked to have the ON and OFF signals duly acknowledged by a human operator.

Elia sends the Emergency Elia notification to the following entities that do not have a SCADA system:

- Nominated energy market operators;
- Regulatory authorities and the relevant public authorities (CREG, DG Energy, CGCCR);
- Balancing service providers;
- Significant grid users;

[14] There is no direct correlation between the activation of the emergency state in EAS and the issue of the Emergency Elia signal.

- Other relevant entities.

Elia will seek out the most appropriate communication channels for sending notifications to multiple stakeholders simultaneously (e.g. website, WhatsApp, text message, iMessage, RSS, Twitter). The relevant entities will be required to sign up to these information services in advance. Wide-scale rollout is scheduled for 2019 and Elia will notify stakeholders of the practical arrangements over the course of the year.

8.1.2 Activation criteria

Emergency Elia is activated **manually** by the SE of the Elia NCC when:

- the system is in an emergency state as per SOGL Article 18(3);

  AND

- action under the System Defence Plan may be required.

The Emergency Elia notification is **automatically** activated when:

- the frequency drops below 49.80 Hz;
- the frequency exceeds 50.20 Hz.

8.2 Blackout Elia notification

8.2.1 Elia blackout notification sent to relevant stakeholders

The Blackout Elia notification is intended to inform grid users and relevant stakeholders that the system is in a blackout state (see section 5.4) and to provide updates on the restoration procedure.

If the blackout criteria are met, Elia must notify the other TSOs by setting the system state to 'blackout' in EAS.

Receiving a Blackout Elia notification warns grid users that they must **be ready to obey Elia's instructions without undue delay**.

When the system returns to normal or alert state, Elia issues a notification indicating that the system is no longer in a blackout state.

Elia sends the Blackout Elia notification to the following entities:

- Distribution system operators;
- Restoration service providers;
- Balance responsible parties;
- Nominated electricity market operators;
- Regulatory authorities and the relevant public authorities (CREG, DG Energy, CGCCR);
- Balancing service providers;
- Significant grid users;
- Coreso (regional security coordination centre);
- Fluxys Belgium (gas transmission system operator);
- Other relevant entities.

Elia will seek out the most appropriate communication channels for sending notifications to multiple stakeholders simultaneously (e.g. website, SCADA-to-SCADA protocols, email, text message). The relevant entities will be required to sign up to these information services in advance. Wide-scale rollout is scheduled for 2019 and Elia will notify stakeholders of the practical arrangements over the course of the year.

8.2.2 Elia blackout notification sent to public authorities (confidential)

8.3 Grid Restoration Elia notification

The Grid Restoration Elia notification is intended to notify grid users that the system is in a restoration state in accordance with NC E&R Articles 38(3)(d) and 40(2).

These notifications contain the following information:

- The date and time at which the system entered a restoration state;
- The cause of the restoration state (blackout or system split);
- Updates on restoration.

If the restoration state criteria are met (see section 5.5), Elia must notify the other TSOs by setting the system state to 'restoration' in EAS.

Receiving a Grid Restoration Elia notification warns grid users that they must **be ready to obey Elia's instructions without undue delay**.

When the system returns to normal or alert state, Elia issues a notification indicating that the system is no longer in a restoration state.

Elia sends the Grid Restoration Elia notification to the following entities:

- Distribution system operators;
- Restoration service providers;
- Balance responsible parties;
- Nominated electricity market operators;
- Regulatory authorities;
- Public authorities;
- Balancing service providers;
- Significant grid users;
- Coreso (regional security coordination centre);
- Fluxys Belgium (gas transmission system operator);
- Other relevant entities.

Elia will seek out the most appropriate communication channels for sending notifications to multiple stakeholders simultaneously (e.g. website, SCADA-to-SCADA protocols, text message, email, RSS). The relevant entities will be required to sign up to these information services in advance. Wide-scale rollout is scheduled for 2019 and Elia will notify stakeholders of the practical arrangements over the course of the year.

If the restoration state is caused by **system split**, Elia will send the following information as a minimum to the following parties:

- Neighbouring TSOs:
    - The scale and boundaries of the synchronised region(s) to which its control area belongs;
    - Restrictions on the operation of the synchronised region;
    - The maximum duration and quantity of active and reactive power that can be supplied over the interconnectors; and
    - Any other technical or organisational restrictions.

- The Frequency Leader of its synchronised region:
    - Restrictions intended to maintain island operation;
    - The additional load and generation available; and
    - The availability of operational reserves.

9 Communication requirements

The exchange of information is key to guaranteeing the operational security of the transmission system during every state, including emergency, blackout and restoration. To be able to collect all the necessary information from all stakeholders involved in any system state, it is important to establish reliable communication between all involved, even when the public communication network is no longer operational.

Elia will make every effort to send the notifications referred to in section 8 to stakeholders in good time.

Elia will ensure maximum operational security of the communication channels it manages during the various system states. In accordance with the recitals of the NC E&R, Elia will endeavour to obtain priority telecommunications status from its communication service providers for the use of public communication systems.

However, Elia accepts no liability for the operation of communication channels managed by external parties when the system is in a state of emergency, blackout or restoration.

10 Glossary

ACE: Area Control Error, a signal expressing the difference between a country's actual and scheduled exchanges in real time, adjusted by a proportion of the actual frequency deviation. ACE = ΔP + K Δf, where ΔP is the area imbalance, K is the power/frequency parameter of the control area and Δf is the system frequency deviation.

Active power: The electrical energy, expressed in watts, that can be converted into other forms of energy, e.g. mechanical, thermal or acoustic energy. This value is equal to 3 U I cosine (phi), where U and I are the effective values of the fundamental components of voltage and current and where phi represents the phase difference between the fundamental components of voltage and current.

aFRR: Automatic Frequency Restoration Reserve

AGC: Automatic Generation Controller, controller for restoring the frequency of the LFC area.

AGSOM: Agreement on Grid and System Operation Management. Bilateral agreement between neighbouring TSOs established in accordance with the SAFA. An AGSOM serves as the basis for a high-level reciprocal agreement intended to allow the parties to carry out all necessary grid management tasks and to ensure the operational security of the grid. This agreement covers, among other things, the procedures to be applied in an emergency state.

Amprion: One of Germany's four transmission system operators.

AR: arrêté royal, a Belgian royal decree.

Black start: A generation unit's ability to re-energise an inactive busbar on the grid and provide active power without drawing energy from the grid in order to restart the grid after a collapse.

BMAP: Bidding Market Platform

Bottom-up re-energisation strategy: Strategy where part of a TSO's system can be re-energised without the assistance of other TSOs.

BRP: Balance Responsible Party

BSP: Balancing Service Provider

CA: Cooperation Agreement. Elia has concluded an agreement with every DSO, setting out the cooperation between the two.

Capacity curve: Diagram depicting a PGM's operational capacity (MW-MVAr).

CCP: Centre de Crise Principal, Elia's main crisis unit.

CDSO: Closed Distribution System Operator

CGCCR: Centre Gouvernemental de Coordination et de Crise, Belgium's governmental coordination and emergency centre.

CIGRE: Conseil International des Grands Réseaux Électriques, the International Council on Large Electric Systems.

CIPU: Coordination of Injection of Production Units

Clearing: The automatic or manual interruption of all outgoing feeders in a high-voltage substation.

Control area: Area in which the system operator continuously controls the balance between electricity consumption and generation, taking into account active power exchange between control areas.

CREG: Commission de régulation de l'électricité et du gaz, the Belgian Federal Commission for Electricity and Gas Regulation.

DG Energy: The General Directorate for Energy within the Federal Public Service Economy.

Distribution transformer: A transformer that injects electricity into the distribution system.

DSO: Distribution System Operator. In this document, the term 'DSO' refers to the operator of a public distribution system. For the avoidance of doubt, closed distribution systems connected to the transmission or distribution system must not be interpreted as a DSO sub-category in this document.

DSP: Defence Service Provider, a legal entity having a legal or contractual obligation to provide a service contributing to one or more measures of the System Defence Plan.

DWDM: Dense Wavelength Division Multiplexing, a data communication technology.

EAN: European Article Number, a unique, 18-digit reference number for a generation unit, access point or connection point.

EAS: ENTSO-E Awareness System, application used by all ENTSO-E TSOs to notify one another of the state of their system and to exchange other information.

Electricity system: All equipment, including all interconnected grids, connection facilities and grid user facilities connected to these grids.

EMS: Energy Management System, the management system used for real-time grid monitoring, remote control and security analysis.

Energy coordinator: Operational department of the access responsible party coordinating generation units located in Belgium.

FCR: Frequency Containment Reserve, operational reserve used to contain the frequency within a predetermined range after an incident. Decentralised response of speed controls on individual generators. Activation time: 10 to 30 seconds.

FGC: Federal Grid Code, Royal Decree of 22 April 2019 establishing a federal technical regulation for the management of and access to the electricity transmission system.

FRCE: Frequency Restoration Control Error, the control error for the frequency restoration process, equivalent to the ACE of an LFC area.

Frequency Leader: TSO tasked with managing system frequency in a synchronised region or synchronous area in order to return system frequency to rated levels.

Frequency relay: Relay that issues a command in the event of excessively low frequency (e.g. discharge).

Frequency restoration controller for the LFC area: Process implemented within the Elia EMS, which processes FRCE measurements every 4 seconds and provides automated instructions to the aFRR providers connected via telecommunication connections.

FRR: Frequency Restoration Reserve, operational reserve used to return frequency and system imbalance to normal levels. Centralised control. Automatic or manual activation within 15 minutes.

High priority significant grid user: A significant grid user for whom special conditions apply when it comes to disconnection and re-energisation.

Houseload operation: State of a PGM where a PGM that is disconnected from the transmission system in the event of a blackout can continue to operate, supplying its own in-house load.

HVDC: High-Voltage Direct Current, interconnector transporting energy by means of high-voltage direct current.

Island operation: Independent operation of all or part of a system that is isolated after being disconnected from the interconnected grid, comprising at least one PGM or HVDC network supplying power to this system and controlling the frequency and voltage.

LFC area: Load-Frequency Control area. For Belgium, this corresponds to Elia's control area.

LFDD: Low Frequency Demand Disconnection, also known as automatic load shedding at low frequency.

LFSM-O: Limited Frequency Sensitive Mode - Overfrequency, operating mode used in a PGM or HVDC system where the generation of active power is reduced in response to a change in system frequency above a certain value.

LFSM-U: Limited Frequency Sensitive Mode - Underfrequency, operating mode used in a PGM or HVDC system where the generation of active power is increased in response to a change in system frequency below a certain value.

'Load-Shedding Plan' Ministerial Decree: Ministerial Decree of 3 June 2005 establishing the load-shedding plan for the electricity transmission system and as amended from time to time.

Load-shedding plan: The 'Load-Shedding Plan' Ministerial Decree setting out the load-shedding plan for the electricity transmission system, which comprises the manual demand disconnection procedure and the LFDD system.

mFRR: Manual Frequency Restoration Reserve

Minister of Economy: Federal minister or secretary of state for the economy.

Minister of Energy: Federal minister or secretary of state dealing with energy-related issues.

MOG: Modular Offshore Grid, currently an offshore high-voltage substation to which four wind farms are connected.

Multiple-incident situation: A situation involving multiple incidents. Refers to the physical state of the electricity system that, starting from a reference state and ending upon the elimination of transient phenomena, is caused by the simultaneous loss of a generating unit and another component of the electricity system, such as a grid component or a generating unit.

MV substation: Medium-voltage substation, a substation with a rated voltage below 30 kV.

NC DCC: Network Code on Demand Connection, network code governing the connection of distribution systems and demand facilities. Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a Network Code on Demand Connection (for distribution systems and demand facilities).

NC E&R: Network Code on Emergency and Restoration, network code governing the emergency state and restoration of the grid. Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a network code on electricity emergency and restoration.

NC HVDC: Network Code on High-Voltage Direct Current. Commission Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on requirements for grid connection of high-voltage direct current systems and direct current-connected power park modules.

NC RfG: Network Code on Requirements for Generators, network code setting out the requirements for the connection of electricity generation facilities. Commission Regulation

(EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators.

NCC: Elia's National Control Centre

NEMO: Nominated Electricity Market Operator

NGESO: National Grid Electricity System Operator, the electricity system operator for Great Britain.

NLL: Nemo Link Limited, the company operating the HVDC interconnector between Belgium and the UK.

Non-selective load shedding: Manual or automatic interruption of direct or indirect connections between the transmission system and the systems of other operators within Elia's control area by opening the circuit breakers on the transformers connected to these systems.

NRA: National Regulatory Authority. CREG is the NRA in Belgium.

OGE: On-duty Grid Engineer

PAS: Power Application Software, a part of the EMS used to analyse security in near real time.

PGM: Power Generating Module

PPM: Power Park Module, a unit or group of units that generate electricity, connected to the system either non-synchronously or by means of power electronics and that have a connection point to a transmission, (closed) distribution or HVDC system.

PSD: Parallel Switch Device, device used to synchronise systems in parallel, allowing two asynchronous regions to be resynchronised.

PSOS: Power System Operation and Stability, an entity within the Elia NCC that specialises in analysing electrical systems.

PST: Phase Shifting Transformer

RCC: Regional Control Centre

Reactive power: The value, expressed in var, equal to 3 U I sine (phi), where U and I are the effective values of the fundamental components of the voltage and current and where phi represents the phase difference between the fundamental components of voltage and current.

REE: Red Eléctrica de España, Spanish transmission system operator.

Re-energisation: Action of reconnecting generation and load to supply power to parts of the system that have been disconnected.

Regional regulations:

The Flemish Region:

- Grid Code of 5 May 2015 governing the distribution of electricity in the Flemish Region
- Decree of the Flemish Government of 8 January 2016 approving the Grid Code governing the distribution of electricity in the Flemish Region

The Walloon Region: Decree of the Walloon Government of 26 January 2012 on the amendment of the Grid Code governing the management of and access to the local electricity transmission system in the Walloon Region

The Brussels-Capital Region: Decree of the Government of the Brussels-Capital Region of 23 May 2014 on the Grid Code governing the management of and access to the electricity distribution system in the Brussels-Capital Region

RES: Renewable Energy Source

Restoration Plan: All technical and organisational measures required to return the system to its normal state.

Resynchronisation Leader: TSO tasked with resynchronising two synchronised regions.

Resynchronisation point: Device connecting two synchronised areas, usually a circuit breaker.

Resynchronisation: The act of synchronising and reconnecting two synchronised regions at the resynchronisation point.

RSC: Regional Security Coordinator

RSP: Restoration Service Provider, a legal entity having a legal or contractual obligation to provide a service contributing to one or more measures of the System Restoration Plan.

RTE: French transmission system operator.

RTU: Remote Terminal Unit, control unit that pools a substation's signals and sends them from the substation to the control centre.

SAFA: Synchronous Area Framework Agreement for the Continental Europe regional group.

SCADA: Supervisory Control And Data Acquisition, part of the EMS.

SE: System Engineer, Elia NCC operator responsible for monitoring the system in real time.

Selective load shedding: Manual or automatic interruption of feeders in TSO or DSO substations not classified as feeders for high priority SGUs.

SGU: Significant Grid User, a category of grid users as per NC E&R Article 2(2).

Shortage procedure: Procedure whose legal basis is described in the 'Load-Shedding Plan' Ministerial Decree.

SO: System Operator, Elia NCC operator in charge of monitoring balancing reserves.

SOGL: System Operation Guideline. Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation.

Structural injecting cables: As described in the 'Load-shedding Plan' Ministerial Decree.

SVC: Static VAR Compensator, device used to compensate for reactive power.

Swissgrid: Swiss transmission system operator.

Synchronised region: Part of a synchronous area covered by interconnected TSOs having a common system frequency and which is not synchronised with the rest of the synchronous area.

TenneT NL: Dutch transmission system operator.

Terna: Italian transmission system operator.

Top-down re-energisation strategy: Strategy where the assistance of other TSOs is required to re-energise parts of a TSO's system.

Total load: The total load for the purposes of the LFDD system calculated using the following formula:

TOTAL LOAD = Σ GROSS GENERATION + IMPORTS – EXPORTS – ENERGY STORAGE – HOUSELOAD OPERATION

NB: All values in the formula are used as positive values.

TSO: Transmission System Operator, responsible for operating the high-voltage grid and for the transmission of electricity. A TSO's responsibilities involve providing access to the grid, monitoring flows and ensuring uninterrupted management of the balance between generation and consumption.

TSO-controlled dispatching: A way of operating the transmission system, for example at a time when certain market segments are interrupted and the grid users connected to the TSO adopt the instructions and set points issued by said TSO without undue delay.

Unexpected phenomena: Phenomena that occur when the system is in an emergency state or are caused by an interruption in electricity generation, transmission or demand (such as frequency fluctuations, voltage drops, congestion, etc.) which cannot be compensated quickly or adequately enough by an increase in generation in the relevant part of the control area, by an increase in electricity supply to the relevant part of the control area or by demand-side management.

11 List of measures and implementation deadlines

There is a distinction between those measures that SGUs have to implement following the activation of the Defence Plan as per section 7 and those measures that SGUs have to implement in advance as per the NC E&R. The latter measures are listed below.

11.1 List of measures and implementation deadlines applicable to TSOs and their facilities

#	Measure	Deadline
1	Switch from Alert Elia to Emergency Elia	Date of ministerial approval + 1 year[15]
2	Implement the Emergency Elia, Blackout Elia and Grid Restoration Elia notifications	Date of ministerial approval + 1 year
3	Implement the LFDD system	18 December 2022
4	Upgrade the 'rescue code' systems in the EMS as per this new System Defence Plan	Date of ministerial approval + 1 year

11.2 List of measures and implementation deadlines applicable to identified SGUs and their facilities

#	Measure	Deadline
1	Implement a process ensuring the proper receipt of the various notifications sent by Elia as per section 8. Elia, in consultation with stakeholders, will define the practical arrangements in the coming months.	Date of ministerial approval + 1 year

11.3 List of measures and implementation deadlines applicable to DSOs and their facilities

#	Applicable to	Measure	Deadline
1	All DSOs (connected to the transmission or distribution system)	Implement a process ensuring the proper receipt of the various notifications sent by Elia as per section 8. Elia, in consultation with stakeholders, will define the practical arrangements in the coming months.	Date of ministerial approval + 1 year

[15] This follows the spirit of the NC E&R, which sets the ultimate implementation deadline at one year after the finalisation of the draft System Defence Plan.

12 Related documents

This section provides an overview of the related documents referenced in this System Defence Plan. Some of these documents are only available in-house. Elia does not seek the Minister of Energy's approval for these documents. The competent authorities may ask to consult these documents for information purposes.

12.1 Documents only available in-house

The following documents can in principle only be consulted by Elia employees:

- Cooperation agreements between Elia and DSOs;
- The Elia area imbalance operational procedure;
- The extraordinary procedure for frequency monitoring and countermeasures in the event of major steady state frequency deviations;
- The operational limits for individual grid components;
- The full description of the process based on the shortage procedure;
- CGCCR notification form;
- Technical briefing template in the event of shortages;
- Operational activation of the load-shedding plan in national dispatching centres;
- Operational activation of the load-shedding plan in regional dispatching centres (Dutch version);
- Operational activation of the load-shedding plan in regional dispatching centres (French version);
- Procedure for activation of Emergency Assistance NGESO;
- AGSOM between Elia and TenneT NL;
- AGSOM between Elia and RTE.

12.2 Restricted documents available to external parties

The procedure in the event of electricity shortages

12.3 Documents available to external parties

Current balancing rules:
https://www.elia.be/en/electricity-market-and-system/system-services/keeping-the-balance

Annex 1: List of identified SGUs pursuant to Article 11(4)(c) of the Network Code on Emergency and Restoration (confidential)

Annex 2: Table summarising demand limitation measures (confidential)

Annex 3: List of high-voltage substations covered by the Load-Shedding Plan, power per area and per step (confidential)

Annex 4: Register of activations and ministerial decisions allowing for manual activation in the event of power shortages or unexpected phenomena

Step	Date	Start time	End time	Ministerial decision/comments