System defence plan of ELIA

Summary	This document includes the system defence plan developed by ELIA in accordance with the criteria set forth in Regulation (EU) 2017/2196 and in the Federal Technical Regulations. This document was approved by the Minister of Energy in the Ministerial Decree of January 25th 2024
Version	2.0
Date	25-01-2024
Status	Final version approved by the Minister of Energy

Previous versions

Version	Date	Author	Summary of changes
1.01	16-09-2019	Elia	Adjustments obv advice Creg
1.00	18-12-2018	Elia	Comments CREG, DG Energy of FPS Economy and NCCN References to new FTR 2019 Minor changes stakeholders

Content

1 Introduction 5

2 Legal framework 6

2.1 Approval powers 7

2.2 Legal provisions regarding the load shedding plan 7

2.3 Provisions on defence service providers on a contractual basis 8

2.4 Overview diagram of the legal framework 9

3 Conditions for activating the system defence plan 10

4 List of significant grid users and high priority significant grid users 11

4.1 List of identified significant grid users 11

4.2 High priority significant grid users 12

4.2.1 List of high priority significant grid users for the system defence plan 12

4.2.2 General conditions for disconnecting and reactivating high priority significant grid users 13

5 Classification of system states 15

5.1 Normal state 15

5.2 Alert state 16

5.3 Emergency 16

5.4 Blackout state 18

5.5 Restoration state 18

6 Roles and responsibilities of entities in the context of the system defence plan 19

6.1 Transmission System Operators 19

6.2 Significant grid users 19

6.2.1 Operators of power generation units (PGM) 19

6.2.2 Transmission-connected demand facilities 20

6.2.3 Transmission-connected closed-distribution system operators (CDSOs). 20

6.2.4 Operators of asynchronous energy storage facilities 20

6.3 Public distribution system operators (DSOs) 20

6.4 Balancing Responsible Parties (BRPs) 21

6.5 Balancing service providers (BSPs) 21

7 System defence plan procedures. 22

7.1 Frequency deviation management procedure 22

7.1.1 Criteria for frequency 22

7.1.2 Description and objectives 23

7.1.3 Measures prior to the frequency deviation management procedure 23

7.1.4 Measures of frequency deviation management procedure. 24

7.2 Voltage deviation management procedure 27

7.2.1 Description and objectives 27

7.2.2 Activation criteria 27

7.2.3 Procedure at excessive voltages 27
7.2.4 Procedure when voltages are too low 29
7.3 Power flow management procedure 30
7.3.1 Description and objectives 30
7.3.2 Prior actions 30
7.3.3 Activation criteria 30
7.3.4 Power flow management procedure 30
7.4 Procedure for support of active power 32
7.4.1 Description and objectives 32
7.4.2 Prior actions according to the balancing rules and operational agreement of the LFC block 32
7.4.3 Activation criteria 33
7.4.4 Procedure 33
7.5 Procedure in case of scarcity 35
7.5.1 Description and objectives 35
7.5.2 Communication in case of detection of scarcity 35
7.6 Procedure for manual demand disconnection (confidential) 37
7.7 Inter-TSO support and coordination in the emergency state 37
7.7.1 Voltage deviation management procedure 38
7.7.2 Power flow management procedure 38
7.7.3 Procedure for support of active power 38
7.8 Automatic underfrequency control scheme 39
7.8.1 Description and objectives 39
7.8.2 Limited frequency sensitive mode-underfrequency 39
7.8.3 Automatic switching and decoupling of asynchronous energy storage facilities 40
7.8.4 Automatic low frequency demand disconnection - LFDD plan (confidential) 41
7.8.5 Overview of automatic actions in the event of a system frequency collapse 41
7.9 Automatic overfrequency control scheme 43
7.9.1 Description and objectives 43
7.9.2 Limited frequency sensitive mode for over frequency 43
7.9.3 Automatic behavior of energy storage facilities 44
7.9.4 Automatic behavior of HVDC interconnectors. 44
7.10 Automatic regulation against voltage collapse 45
7.10.1 Description and objectives 45
7.10.2 Activation criteria 45
7.10.3 Procedure 45
8 Information exchange during emergency, blackout or restoration states 46
8.1 Notification 'Emergency ELIA' 46
8.1.1 Description 46
8.1.2 Activation criteria 47
8.2 'Black-out ELIA' notification 47
8.2.1 Blackout notification from ELIA to relevant stakeholders 47
8.2.2 Blackout notification by ELIA to government agencies (confidential) 47
8.3 Notification `Grid restoration ELIA' 47
9 Definitions and abbreviations 48
10 List of measures and implementation deadlines 54

10.1 List of measures and implementation deadlines, to be implemented by the TSO in its facilities 54

10.2 List of measures and implementation deadlines, by implementing SGUs in their facilities 54

10.3 List of measures and implementation deadlines, to be implemented by DSOs in their facilities 55

11 List of related documents 55

11.1 Documents available only internally 55

11.2 Documents available externally with classification restricted distribution 56

11.3 Documents available externally 56

Annex 1: List of designated SGUs according to the NC ER Article 11(4)(c) 57

Appendix 2: Summary table of demand reduction measures. 61

Appendix 3: List of high voltage substations involved in the manual demand disconnection plan. (Confidential) 62

Appendix 4: Register of activations and ministerial decisions authorizing manual activation in the event of electricity shortages and sudden phenomena 62

Annex 5: List of high-voltage substations involved in the 2023 automatic demand disconnection plan. (Confidential) 62

Appendix 6: List of high-voltage substations involved in the automatic demand disconnection plan as envisioned by 2027. (Confidential) 62

Appendix 7: LFDD design note (Confidential) 62

1 Introduction

This document comprises ELIA's system defence plan and describes automatic and manual measures for avoiding a blackout, limiting the spread of faults and stabilizing the electricity system in the event of an emergency, in order to restore a normal or alert state as quickly as possible and with minimal impact on grid users[1] .

This document was prepared by ELIA, on the basis of Articles 11 and 15 to 22 of Regulation (EU) 2017/2196 of the European Commission of November 24, 2017 establishing a grid code for the emergency and restoration of the electricity grid (NC ER) and taking into account other grid codes, the Royal Decree of April 22, 2019 containing a technical regulation for the management of the electricity transmission grid (the FTR), other relevant legislation (public health and safety, nuclear safety, etc.) as well as possible specific local characteristics.

ELIA prepared this system defence plan in consultation with distribution system operators (DSOs), relevant significant grid users (SGUs), CREG, the DG Energy of the FPS Economy and other transmission system operators (TSOs) of the synchronous zone Continental Europe, in accordance with Article 11(1) of the NCER.

References in other legislative and regulatory texts to the Rescue Code are considered to refer to the System defence plan referred to in article 261 , § 1, of the FTR.

Without prejudice to provisions in national or European legislation, the technical and organizational measures for which implementation deadlines are specified in this plan that fall after the date of approval of the system defence plan by the Minister of Energy (the Minister) will not take effect until the corresponding implementation.

In preparing the system defence plan, ELIA ensured that:

- The plan's measures, implemented primarily by individual SGUs, complement rather than contradict each other;
- The measures provide adequate protection against anticipated problems; and
- No more measures are activated than are necessary to address the problem, minimizing the impact on grid users and the duration of the outage and maximizing efficiency.

Article 4 of the NC ER requires ELIA to use market-based mechanisms as much as possible to ensure the safety and stability of the grid.

In accordance with Article 50(3) of the NC ER, the current system defence plan will be reviewed by ELIA at least every five years to assess its effectiveness. ELIA shall consider at least:

a) The development and evolution of his network since initial design;
b) The suitability of new equipment installed in transmission and distribution systems since initial design;
c) The SGUs put into operation since the first draft, their suitability and relevant services offered;
d) The tests conducted and the analysis of incidents in the system in accordance with Article 56(5) of Regulation (EU) 2017/1485, and
e) Operational data collected during normal operation and after failure.

[1] Learn more about the system states in section 5.

According to Article 6(1) of the NC ER, when reviewing the system defence plan, each European TSO will ensure consistency with the corresponding measures in the plans of TSOs within its synchronous zone and in the plans of neighboring TSOs belonging to a different synchronous zone, of at least the following measures:

a) The support and coordination between TSO in the emergency state, in accordance with Article 14 of the NC ER; (see section 7.7 of this document);
b) The frequency management procedures, in accordance with Article 18 of the NC ER (see section 7.1 of this document)7.1
c) The procedure for active power support in accordance with Article 21 of the NC ER; (see section 7.4 of this document) 7.4

In accordance with Article 6(3) of the NC ER , ELIA will provide the necessary documents to Coreso (the regional security coordinator)[2]. Within 3 months of receiving the documents, Coreso will prepare a technical report on the consistency of the measures.

According to Article 4, §4 of the Code of Conduct, the non-confidential version of the system defence plan will be annexed to the relevant connection agreements including, where appropriate, the confidential measures for the connection agreements in question. ELIA has shared the confidential version of the System defence plan only with the competent authorities. Only the titles of the sections considered confidential have been kept.

Table 1 shows highly simplified which defence measures can be taken to bring back the current (including imports), voltage and frequency within the operational safety limits in real time as well as the measures in case of pre-detected (threat of) scarcity. These measures are described further in the document.

			Bij plotse fenomenen in real time						Bij (dreiging tot) schaarste
			Stroom	Spanning		Frequentie		Import	(productie + import) < verbruik
			Te hoog	Te laag	Te hoog	Te laag	Te hoog	Te hoog	in periode tussen D-7 en D-1
MOGELIJKE BESCHERMINGSMAATREGELEN	PGMs HVDC Opslag	Meer MW injectie in het net	x			x		x	x
		Minder MW injectie in het net	x				x		
		Meer Mvar injectie in het net		x					
		Minder Mvar injectie in het net			x				
	Verbruiks-installaties, HVDC, Opslag	Meer MW afname uit het net	x				x		
		Minder MW afname uit het net	x			x		x	x
		Meer Mvar afname uit het net			x				
		Minder Mvar afname uit het net		x					
	Netbeheerder	Uitschakelen verbinding	x	x	x				
		Blokkeren spanningsregeling transformatoren		x					
		Verlaging spanningsreferentie distributietransformatoren met 5%				x		x	x
		Uitschakeling elektrische accumulatieverwarming				x		x	x
		Activering procedure schaarste							x
		Automatisch afschakelen belasting				x			
		Inter-TSB assistentie		x	x	x	x	x	x
		Manueel afschakelen belasting	x	x				x	x

Table 1: Overview of protective measures

2 Legal framework

Article 11(1) of the NC ER requires ELIA to develop a system defence plan in consultation with relevant distribution system operators (DSOs), significant grid users (SGUs), national

[2] At the European level, it was agreed among the TSOs that the implementation of Article 6(3) would happen every 5 years and that the next implementation would be started at the end of 2023.

regulatory authorities (NRA) and neighboring transmission system operators (TSOs) and TSOs of the same synchronous zone.

ELIA prepared the system defence plan in accordance with Articles 11 and 15 to 22 of the NC ER.

In case of incompatibility between the NC ER and a higher law, the higher law prevails.
The System defence plan cannot prejudice the NC ER and the provisions of the FTR.

2.1 Approval powers

According to articles 4(5) and 4(7) of the NC ER, the Belgian TSO must notify the NRA or other entity(ies) defined by the member state of changes to the system defence plan.

According to Article 259 of the FTR, the Minister of Energy, on the proposal of the transmission system operator and after consulting the CREG, approves the proposals referred to in points c), d) and g) of Article 4(2) of the NC ER.

According to Article 261 of the FTR, the transmission system operator submits a proposal of amendments to the system defence plan to the Minister of Energy after consulting the CREG and the DG Energy. According to Article 1 of the Ministerial Decree of October 28, 2022 amending the Ministerial Decree of December 19, 2019, this proposal must be submitted to the Minister of Energy within 4 years of the entry into force of the system defence plan. ELIA therefore submitted an amended proposal of the System defence plan to the Minister of Energy on 6 October 2023.

According to Article 1 of the Ministerial Decree of January 25, 2024 approving the proposal of system defense plan and the proposal of restoration plan in accordance with Articles 261 and 262 of the Royal Decree of April 22, 2019 on technical regulations for the management of the electricity transmission system and access to it, this proposal of system defense plan (version 2.0) is approved.

This System defence plan refers to other related documents in some places. Section 11 contains a list of related documents, some of which are available only internally to ELIA. ELIA does not seek approval from the Minister of Energy on these related documents. These documents are available for inspection at ELIA upon request by the appropriate governmental authorities.

2.2 Legal provisions regarding the load shedding plan

In accordance with Article 261 §4 of the FTR, the Minister of Energy determines the phase-out plan upon proposal by the TSO.
The load shedding plan may, in implementation of Article 261 §4 of the FTR, include the following possible measures:

1) the obligation on the TSO:
   a) to disconnect all or part of the connections;
   b) modifying or interrupting connections with other grids in the control area;
2) the obligation for consumers or certain categories of consumers, throughout the country or certain parts of it, to reduce the electricity they take from the grid within the predetermined limits;
3) the prohibition to use electricity for certain purposes.

According to Article 11(5) of the NC ER, the system protection plan includes a manual demand disconnection procedure and the low-frequency automatic consumption

disconnection scheme. Consequently, the disconnection plan is included as part of the system protection plan.

In accordance with the Ministerial Decree on Shutdown Plan, the shutdown plan can be applied under the procedures below:

- The procedure to protect the power system from **sudden phenomena** that suddenly undermine the integrity of the power system;
- The procedure to protect the electricity system in the event of an **announced scarcity or threat of scarcity** of electricity for a significant, more or less predictable period of time.

Under the disconnection plan, disconnections are carried out either in an automatic manner by the low-frequency automatic consumption disconnection scheme (section 7.8.4) or in a manual manner according to the manual consumption disconnection procedure (section 7.6).

2.3 Provisions on defence service providers on a contractual basis

Some system defence plan measures are based on capabilities that are expected to be provided voluntarily. The NC ER provides in Section 4(4) that ELIA will use these voluntary capabilities through defence service providers, either on a statutory or contractual basis.

ELIA does not consider it useful to introduce defence service providers on a contractual basis, because voluntary participation in defence actions in the form of making reserves available can already be provided through the existing flexibility platforms that, under the rules for suspension and restoration of market activities, continue to operate in a state of emergency.

In case of a continued lack of security of supply for the control area, and after activating all bids for balancing energy and contractual reserves within TSOs, ELIA, after enlisting support from neighboring TSOs, may decide to initiate the active power support procedure, as explained in Section 7.4.

Consequently, ELIA should not acquire any additional contractual defence services.

However, ELIA does not rule out the use of defence service providers on a contractual basis in the future. In that case, general terms and conditions reflecting the purpose of the service will be proposed in accordance with the NC ER.

2.4 Overview diagram of the legal framework

Figure 1 provides a simplified overview of the possible grid events, the applicable defence measures and the applicable legal framework:

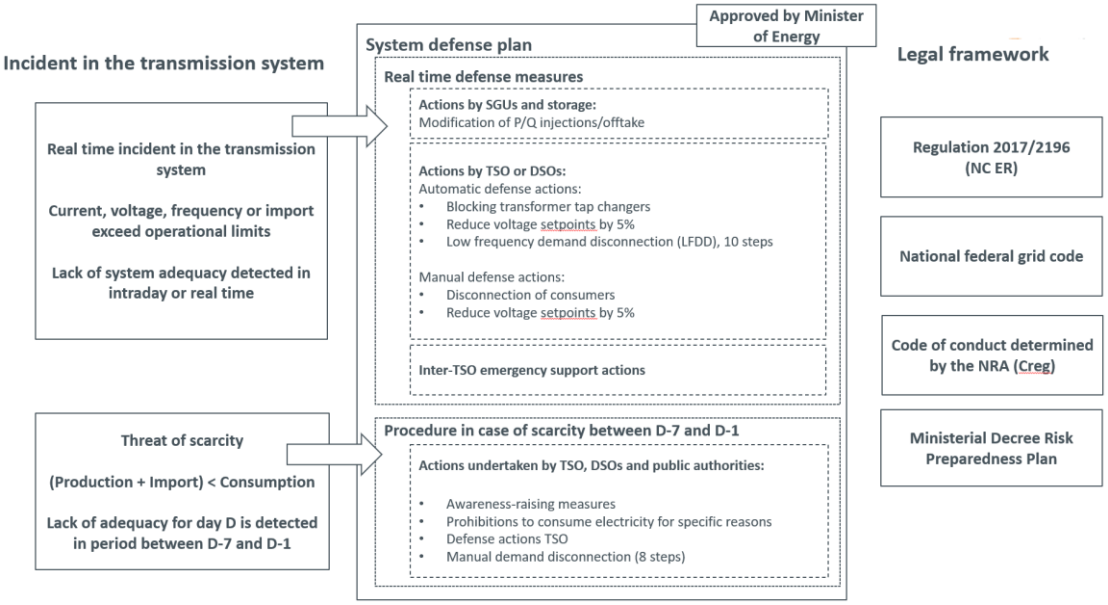


Figure 1: Overview of possible grid events, defence measures and legal framework

3 Conditions for activating the system defence plan

ELIA activates its system defence plan procedures as described in Sections 7.1-7.4 and 7.6 in coordination with the designated DSOs and SGUs.

In addition to automatically activated system defence plan arrangements, ELIA activates a system defence plan procedure when:

- The **system in a state of emergency is in accordance** with paragraph 5.3 and no remedial actions, as listed in Article 22 of the SOGL are available to restore the system to normal condition, or
- The **operational security of the transmission system, based on the** analysis of operational security by ELIA, requires the activation of a measure of the system defence plan, in addition to available remedial actions.

Notwithstanding the system state (as explained in paragraph 5) and where necessary the activation of remedial actions, as mentioned in Article 22 of the SOGL Measures, System defence plan or Restoration Plan, ELIA will take all measures it deems necessary to prevent danger to the safety of personnel or damage to equipment that would result from a situation of which it has been notified.

When ELIA needs to take measures to avoid compromising the safety of staff members or damaging infrastructure, or when ELIA implements system defence plan or restoration plan measures, ELIA will inform CREG and the DG Energy in a timely manner of the actions taken and prepare a report detailing the reasons, implementation and impact of the actions taken.

This report is sent to the CREG, the DG Energy and, if necessary, to relevant stakeholders, as indicated and without prejudice to the provisions in Articles 14(4), 18(4), 20(3) and 22(4) of the NC ER.

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

In accordance with Article 11(4) paragraph (c) of the NC ER, the system defence plan contains a list of the SGUs responsible for applying to their facilities the measures resulting from the binding requirements of the NC RFG, the NC DCC, the NC HVDC or from national legislation, and a list of measures to be applied by those SGUs.

ELIA has identified these capacities of SGUs for direct use in its system defence plan in section 4.1. and added a detailed list in Appendix 1.

Without prejudice to the provisions of Article 4(2) paragraphs (c) and (d) and Article 50(5) of the NC ER, the list of designated SGUs and the list of significant high-priority grid users for the system defence plan shall be communicated by ELIA to the Minister of Energy.

Designated SGUs are a subset of the categories of grid users listed below to which the NC ER applies under Article 2(2) of the NC ER:

a) Existing and new type C and D power generation units in accordance with the criteria of Article 5 of the NC RfG

b) Existing and new Type B power generation units in accordance with the criteria of Article 5 of the NC RFG, if designated as SGUs in accordance with Article 11(4), and Article 23(4) of the NC ER;

c) Existing and new transmission-connected consumer installations;

d) Existing and new transmission-connected closed distribution systems;

e) Providers of redispatch of power generation units or consumer facilities by aggregation and providers of reserve active power in accordance with Title 8 of the SOGL, and

f) Existing and new high-voltage direct current ("HVDC") systems and DC-connected power park modules in accordance with the criteria of Article 4(1), of the NC HVDC.

4.1 List of identified significant grid users

ELIA identified the following system defence plan requirements that are required by law for significant grid users[3] :

User type	**Capacity used in the system defence plan**	**Reference to legal obligation**
Existing and new PGMs with a maximum active power greater than or equal to 25 MW. Emergency generators installed at these PGMs are not included.	Follow an instruction from the TSO regarding the setting value for the exchange of active or reactive power with the grid, taking into account the technical capabilities of the PGM.	Required by FTR Article 261 §2

Table 2: type, capacity and legal provision for designated SGUs

Appendix 1 provides a detailed list of designated SGUs for the System defence plan.

[3] From a legal standpoint, SGU refers to the infrastructure. In order to apply the measures imposed by ELIA under the system defence plan with respect to this infrastructure, ELIA addresses the grid user who signed the connection contract for the corresponding infrastructure.

ELIA wants to use a limited number of resources to efficiently respond to a transmission system emergency. Therefore, instead of a large number of smaller PGMs, ELIA wants to use a limited number of PGMs with a maximum active power greater than or equal to 25 MW.

4.2 High priority significant grid users

4.2.1 List of high priority significant grid users for the system defence plan

The list of high priority significant grid users for the system defence plan includes the following three main categories:

- Category 1: the **priority connections** as specified in Article 261 §6 4 of the FTR.
- Category 2: The **Additional connections** from the list consisting of entities that can be repurposed as a priority for economic, security and public order, or public health reasons.
- Category 3: the **Structural injecting cables**

As for **category 1,** 8 groups of high priority significant grid users for the system defence plan are considered:

1. **Technical auxiliary systems** required for the vital operation of ELIA's grids, public DSOs and CDS operators.

   ELIA's substations whose auxiliary systems are fed via the distribution grid, via a medium-voltage connection or via a grid user's infrastructure, whose power supply may be interrupted by manual demand disconnection. The DSOs have designated the corresponding feeders as priority feedbacks in their management systems.

2. Technical assistance systems **Ampacimon**

   The cables to which telecommunications transmission towers are connected that are essential for the operation of Ampacimon modules. Ampacimon modules are devices fixed to high-voltage lines that continuously calculate the maximum current carrying capacity according to weather conditions and transmit it to the grid operator's control centers. In the absence of this information, the grid operator has to apply lower maximum current carrying capacity, which may result in having to activate an additional step of the manual demand disconnection plan. The DSOs have designated the corresponding feeders as priority feedbacks in their management systems.

3. **Hospitals** referred to in Article 2 of the Coordinated Law of July 10, 2008 on Hospitals and Other Care Facilities.
4. The **management centers of emergency calls** 100, 101 and 112 based on Article 2, first paragraph, 61°, of the Law of June 13, 2005 on electronic communications.
5. The Government Coordination and Crisis Centre referred to by the Royal Decree of 18 April 1988 establishing the Government Coordination and Crisis Centre and the **coordinating committees of governors** referred to in Article 32 of the Royal Decree of May 22, 2019 on emergency planning and management of emergencies at the municipal and provincial level and on the role of mayors and provincial governors in the event of crisis events and situations requiring coordination or management at the national level.

6. The headquarters from which the operation of the **Astrid network** is coordinated. (This list is empty as the grid user in question does not belong to 1 of the steps of the manual demand disconnection plan)
7. **Infrabel** injection points for railroad overhead lines connected to the distribution network. They are protected to prevent trains from having to stop suddenly, which would require a major deployment of emergency services.
8. **Fluxys** plants without a "fixed gas group" connected to the distribution grid. They are protected to prevent gas distribution from being compromised.

The nominative lists of individual high-priority significant grid users for the System Protection Plan are provided in the annexes of the document "List of high-priority significant grid users for the System Protection Plan". In accordance with Article 29 §2 of the FTR, ELIA submits this list to the minister for approval annually before 1 November. The minister pronounces on the submitted list within a period of one month from the day of its receipt.

The DSBs also have the list of high-priority significant grid users for the recovery plan.

Category 2 are **additional connections** from the list determined by the Minister of Economy or the Minister of Energy in consultation with TSOs and relevant DSOs, as defined in Article 261 §6 of the FTR, for which the Ministers have issued the order for restoration.

These are "**sensitive consumers**" such as healthcare centers, water management facilities, juvenile centers, prisons, Seveso companies, psychiatric hospitals, intervention services, etc., which, for specific reasons at the request of the ministers, may not be disconnected or must be re-powered as a priority.

An indicative, non-exhaustive list of sensitive consumers is provided to Synergrid by the FPS Economy by September 1 each year.

The decision as to which entities are effectively prioritized for resupply is taken at the crisis consultation or in the policy cell of the management cell referred to in the Royal Decree of January 31, 2003 establishing the emergency plan for crisis events and situations requiring coordination or management at the national level, as defined in Article 31 §4 of the FTR. The list only acquires an existence character during a crisis at the moment when the Minister asks the system operators to prioritize certain entities on this list.

Outside of a crisis, this indicative list should be considered purely as a tool for grid operators to better prepare themselves to take the necessary actions at the request of the minister during a crisis.

The nominative list of "additional connections" can only be added to the list of high-priority significant grid users for the system defence plan at the time they are designated by ministers during a crisis.

Category 3 are **structurally injecting cables**, which by themselves cannot be considered grid users.
These are cables to which only producers are connected, or cables for which previous counts carried out indicate that the direction of flow at the end of the cable at the level of the secondary rails is injecting for at least 90% of the time on an annual basis, to the extent this information is available to the DSO concerned.

DSOs have designated the structurally injecting cables in their management system so that they are not disconnected or can be fed back with priority.

4.2.2 General conditions for disconnecting and reactivating high priority significant grid users

These general terms and conditions are in accordance with Article 261 §4 of the FTR.

The principles for disconnect and reactivate high priority significant grid users in case of **manual** demand disconnection apply as explained in paragraph **Error! Reference source not found.**

The principles for disconnection and reactivation of high priority significant grid users in case of **automatic** demand disconnection , apply as explained in paragraph 7.8.4.

The conditions for voltage restoration after automatic or manual disconnection are included in the restoration plan and in Section 7.8.5.4: "Resupply of demand after a frequency drop."

In the event of an interruption of the high priori significant ty grid users, ELIA and the operators of other grids will cooperate and use all available resources to restore supply to the high priority significant grid users as quickly as possible.

5 Classification of system states

The SOGL contains harmonized system management rules for TSOs, regional security coordinators (RSCs), DSOs and SGUs. Article 18 of the SOGL specifies the different system states (normal state, alert state, emergency state, blackout state and restoration state). The following sections define these in more detail. The definitions contained in the SOGL take precedence over the description below.

5.1 Normal state

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

- **Voltage and electrical currents** are within established operational safety limits;
    - Voltage range at the connection point between 110 kV and 300 kV: 0.90 pu - 1.118 pu
    - Voltage range at the connection point between 300 kV and 400 kV: 0.90 pu - 1.05 pu
    - Current limits for thermal rating including momentary permissible overloads, taking into account the type of grid elements, their technical limits and environmental conditions (wind, solar radiation, temperature, etc.).
- **The frequency** meets the following criteria:
    - The steady-state frequency deviation is within the standard frequency range equal to +/- 50 mHz, or
    - The absolute value of the steady-state frequency deviation does not exceed the maximum steady-state frequency deviation equal to 200 mHz, and the system frequency limits for the alarm condition are not reached;
- The **active power reserve and the reactive power reserve** are sufficient to deal with failure situations from the list of failure situations established in accordance with Article 33 of the SOGL without exceeding operational safety limits;

  The control area of the relevant TSO is and will remain within the operational safety limits after the implementation of remedial measures following the occurrence of a fallout situation included in the list established in accordance with Article 33 of the SOGL, which consists of the groups of listed below:

  a) Grid elements from the Belgian grid:
     - Individual (interconnection)lines or cables at a nominal voltage of 380 kV-30 kV.
     - Individual generators connected to the transmission grid.
     - Individual main rails at a nominal voltage of 380 kV.
     - Individual interconnections between different main rails at a nominal voltage of 380 kV.
     - Transformers between different transmission grids (e.g. 380kV/150kV, 220kV/70kV, 150kV/36 kV). Transformers to distribution grids are not included in this list.
     - Phase-shifting transformers
     - the HVDC links Nemolink and ALEGrO.
  b) Grid elements in the northern French grid that can have a significant impact on the Belgian grid: lines 380 kV or 220 kV, important generators, rail couplers 380 kV or 220 kV, transformers between 380 kV and 220 kV, rails on 380 kV or 220 kV, the HVDC connections IFA1, IFA2 and Eleclink.
  c) Grid elements in the Dutch grid that may have a significant impact on the Belgian grid: lines 380 kV, major generators, rail couplers 380 kV, the HVDC connections BritNed, NorNed and Cobra.
  d) Grid elements in the German grid that may have a significant impact on the Belgian grid: lines 380 kV, major generators, rail couplers 380 kV.

5.2 Alert state

A transmission system is in the alert state when the following conditions are met:

- **Voltage and electrical currents** are within established operational safety limits (same as in normal condition):
    - Voltage range at the connection point between 110 kV and 300 kV: 0.90 pu - 1.118 pu
    - Voltage range at the connection point between 300 kV and 400 kV: 0.90 pu - 1.05 pu
    - Current limits for thermal rating including momentary permissible overload taking into account the type of grid elements, their technical limitsand environmental conditions (wind, solar radiation, temperature, etc.).

And

- The **reserve capacity of the** TSO decreases by more than 20% for more than 30 minutes, and this decrease in real-time system management cannot be compensated,

Or

- The frequency meets the following criteria:
    - The absolute value of the steady-state frequency drift does not exceed the maximum steady-state frequency drift equal to 200 mHz, and
    - The absolute value of the steady-state frequency deviation is continuously greater than 50 % of the maximum steady-state frequency deviation equal to 200 mHz for a time period longer than the alarm condition activation time equal to 5 minutes, or is continuously greater than 50 % of the standard frequency range equal to +/- 50 mHz for a time period longer than the frequency restoration time equal to 15 minutes,

Or

- At least one failure situation from the list of failure situations established in accordance with Article 33 of the SOGL will result in the TSO's operational safety limits being exceeded, even after remedial measures have been taken.

  Failure situations are classified as follows:
    - Normal outage situations: loss of a 380 kV - 30 kV line or cable, loss of generators, loss of a 380 kV rail coupler, loss of a transformer, loss of a 380 kV rail.
    - Exceptional failure situations: loss of a high voltage pylon (carrying multiple lines). By default, these failure situations are not applied in the operational safety analysis except for predicted wind speeds over 130 km/h.
    - Out-of-category situations: loss of multiple nuclear power units, loss of an entire high-voltage substation. By default, these outage situations are not applied in the operational safety analysis unless there is a clearly identifiable outage risk.

5.3 Emergency

A transmission system is in a state of emergency if at least one of the following conditions is met:

- There is at least one violation of a TSO's established operational safety limits. The established operational safety limits are as follows:
    - Voltage range at the connection point between 110 kV and 300 kV: 0.90 pu - 1.118 pu
    - Voltage range at the connection point between 300 kV and 400 kV: 0.90 pu - 1.05 pu
    - Current limits for thermal rating including momentary permissible overload taking into account the type of grid elements, their technical limits and environmental conditions (wind, solar radiation, temperature, etc.).

  The operational safety limits for the various grid elements can be found in ELIA's operation criteria.
- The frequency does not meet the established criteria for the normal state and for the alert state;
- At least **one measure from the** TSO**'s** system defence plan **has been activated;**
- There is a **breakdown in the operation of tools, resources and facilities** in accordance with Article 24(1) of the SOGL, as a result of which those tools, resources and facilities are unavailable **for more than 30 minutes**.

  The tools, resources and installations referred to in SOGL Article 24 are listed below:

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

Following applications and installations were considered:
- Energy Management System (EMS) with e.g. condition estimator and safety analysis
- The EntsoE Awareness System (EAS).
- ELIA's control centers, including regional and backup control centers
- Data warehouse and LAN connection
- LFC zone frequency restoration controller.
- Manual FRR control system
- Telecommunications systems (data and voice)

(b) Means of switching circuit breakers, coupling circuit breakers, tap changers for transformers and other equipment for managing the elements of the transmission system;

The following systems and installations have been considered, but are not limited to:
- Control center SCADA (main, backup and regional control centers)
- Substation SCADA, for those substations identified as essential to the restoration plan
- Data communication to essential substations
- Data and voice communications to control rooms
- RTU in the substation
- Local data communication in the substation

(c) Means of communicating with control centers of other TSOs and European R CC s;
- For the European RCCs, only voice communicators have been considered
- Between TSOs, voice and data communications were considered, Including the Electronic Highway and EAS

(d) Tools for operational safety analysis, and

This includes the following tools: EMS with e.g. SCADA, state estimator and safety

analysis

(e) Tools and communication tools needed by ELIA for cross-border market activities.

This concerns market tools associated with the EMS, such as the tool for managing nominations, schedules, activation of energy bids, etc.

5.4 Blackout state

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

- **Loss of more than 50% of consumption**[4] within the control zone of the respective TSO;
- Total **absence of voltage within the control zone** of the respective TSO **for at least three minutes**, triggering restoration plans.

5.5 Restoration state

A transmission system is in the restoration state when a TSO has begun activating measures from its restoration plan from the emergency or blackout state.
The restoration state can occur after a blackout or after a system split. This refers to the division of the synchronous zone continental Europe into several asynchronous parts.

[4] Consumption is understood as 'total load'

6 Roles and responsibilities of entities in the context of the system defence plan

The specific role of each of the following entities is critical to the efficient implementation of System defence plan procedures.

- Transmission system operators (TSOs).
- Significant grid users (SGUs).[5]
- Distribution system operators (DSOs).[6]
- Balancing Responsible Parties (BRPs).
- Balancing service providers (BSPs).

The system defence plan describes the strategy and practices used by ELIA and the entities listed above to stabilize the grid in a coordinated manner following an incident.

6.1 Transmission System Operators

ELIA will implement the measures of its system defence plan to be applied to the transmission system. It will maintain the implemented measures.

ELIA is responsible for keeping the procedures of the system defence plan up to date and organizing regular staff training.

When an incident occurs, ELIA will evaluate the situation and contact the parties involved in implementing any of the procedures of the system defence plan.

ELIA will make decisions regarding suspension and restoration of energy markets according to the "Rules for the suspension and restoration of market activities" and the "Specific Rules for Imbalance and Balancing Energy Settlement". These rules must be approved by CREG.

Neighboring TSOs, if requested by ELIA, will provide all possible assistance as long as they themselves are not in the emergency, blackout or restoration state. Article 14(1) of the NC ER not only imposes assistance on neighboring TSOs but also allows ELIA to request support from any TSO in the EU, providing all possible assistance to such TSOs through interconnectors as long as it does not put its transmission system or the interconnected transmission system into the emergency or blackout state.

6.2 Significant grid users

6.2.1 Operators of power generation units (PGM)

Stabilization of the grid after an incident is mainly achieved by restoring the balance between generation and consumption of both active and reactive power. Therefore, it is crucial that ELIA and the PGM operators work well together. As mentioned earlier, ELIA wants to use a limited number of resources to efficiently respond to a transmission system emergency. Therefore, instead of a large number of smaller PGMs, ELIA intends to use a limited number of PGMs with a maximum active capacity greater than or equal to 25 MW. Thus, when this section refers to PGMs, we mean PGMs with a maximum active power greater than or equal to 25 MW.

Operators of PGM with a maximum active power greater than or equal to 25 MW must take all necessary measures to follow ELIA's instructions without delay. These instructions are binding.

[5] See the list of SGUs in section 44.
[6] To avoid misunderstanding, when this document refers to a DSB, it represents a public DSB and not a closed DSB.

Operators of PGM with a maximum active power greater than or equal to 25 MW must designate a contact entity that is available 24h/24h and has sufficient knowledge and authority to provide ELIA with clear information about the capabilities and limitations of the unit concerned and to follow instructions from ELIA. These instructions are binding.

6.2.2 Transmission-connected demand facilities

Transmission-connected demand facilities must appoint a contact entity that is available 24/7 to inform ELIA at its request about the state of the facilities and the possibilities for adjusting the exchange of active and reactive power with the transmission grid.

6.2.3 Transmission-connected closed-distribution system operators (CDSOs).

Transmission-connected CDSOs must appoint a contact entity that is available 24/7 (dispatching). In particular, this contact entity must be able to inform ELIA, at its request, of the state of the closed distribution system and the possibilities for adjusting the amount of active and reactive power exchanged with the transmission grid via the one or more connection points.

In its role as relevant system operator, the transmission-connected CDSO must facilitate the implementation of instructions issued by ELIA by relevant entities connected to its closed distribution system.

6.2.4 Operators of asynchronous energy storage facilities

Asynchronous energy storage facilities contribute greatly to the production-consumption balance of the electric system. Since this system protection plan does not contain specific instructions given manually to operators of asynchronous energy storage facilities, it is crucial that they follow market signals properly.

The technical requirements that asynchronous energy storage facilities must meet for frequency deviations are described in Article 97 of the FTR.

6.3 Public distribution system operators (DSOs)

Each public DSO must follow the procedures of the system defence plan (section 7) at the request of ELIA without delay.

Each public DSO must perform the actions required for voltage restoration of high priority significant grid users after they have been disconnected, according to the cooperation agreement (SOK) between ELIA and the public DSO.

Each public DSO should designate a contact entity available 24h/24h (dispatching). This contact entity will be able to inform ELIA about the state of its installations, this includes:

- Inform ELIA, upon its request, of the state of the distribution system and the possibilities for adjusting the amount of active and reactive power exchanged with the transmission system through the connection point.
- Facilitate the implementation of instructions issued by ELIA to SGUs connected to the distribution system.

6.4 Balancing Responsible Parties (BRPs)

The relevant obligations for BRPs as defined in the "General Conditions BRP" remain in effect as long as market activities are not suspended according to the "Rules for Suspension and Restoration of Market Activities" and "Specific Rules on Imbalance Settlement and Balancing Energy Settlement," published on ELIA's website after approval of CREG.

For the purposes of these Rules, during a period of TSO-controlled dispatching, the BRP is not responsible for balancing its portfolio, as this could lead to a reduction in the efficiency of restoring the transmission system to its normal or alert state. ELIA will notify the BRPs of a market suspension and market restoration according to the communication procedure that is part of the Rules.

When the system is managed in a state of TSO-controlled dispatching, ELIA will send instructions directly to the PGM operators.

When the system is in the restoration state after a system split, the relevant obligations for BRPs, as described in the General Terms and Conditions BRP, in the Code of Conduct or in the FTR, remain in effect.

6.5 Balancing service providers (BSPs)

The relevant obligations for BSPs as defined in the "BSP General Conditions" remain in effect as long as market activities are not suspended according to the "Rules for Suspension and Restoration of Market Activities" and "Specific Rules on Imbalance Settlement and Balancing Energy Settlement," published on ELIA's website after approval of the CREG.

ELIA will notify the BSPs of a market suspension and market restoration according to the communication procedure that is part of these rules.

When the system is managed in a state of TSO-controlled dispatching, ELIA will send instructions directly to the PGM operators.

When the system is in the restoration state after a system split, the relevant obligations for BSPs, as described in the BSP General Conditions, in the Code of Conduct or in the FTR, remain in effect.

7 System defence plan procedures.

In accordance with Article 11(5) of the NC ER, the system defence plan includes at least the following technical and organizational measures:

(a) System protection schemes, which shall include, at a minimum:

(i) Automatic underfrequency control schemes in accordance with Article 15;

(ii) Automatic overfrequency control schemes in accordance with Article 16, and

(iii) Automatic arrangements against voltage collapse in accordance with Article 17;

(b) System defence plan procedures that include, at a minimum:

(i) The frequency deviation management procedure in accordance with Article 18;

(ii) The voltage deviation management procedure in accordance with Article 19;

(iii) The electricity flow management procedure in accordance with Article 20;

(iv) The procedure for asset support in accordance with Article 21, and

(v) The procedure for manual demand disconnection in accordance with Article 22.

In addition to these minimum required procedures, this system defence plan includes in section 7.5 also the procedure in case of scarcity, according to the Risk Preparedness Plan.

7.1 Frequency deviation management procedure

7.1.1 Criteria for frequency

Figure 2 shows the relationship between the criteria for the system states and the magnitude and duration of the frequency anomaly, as applied in the synchronous zone Continental Europe.

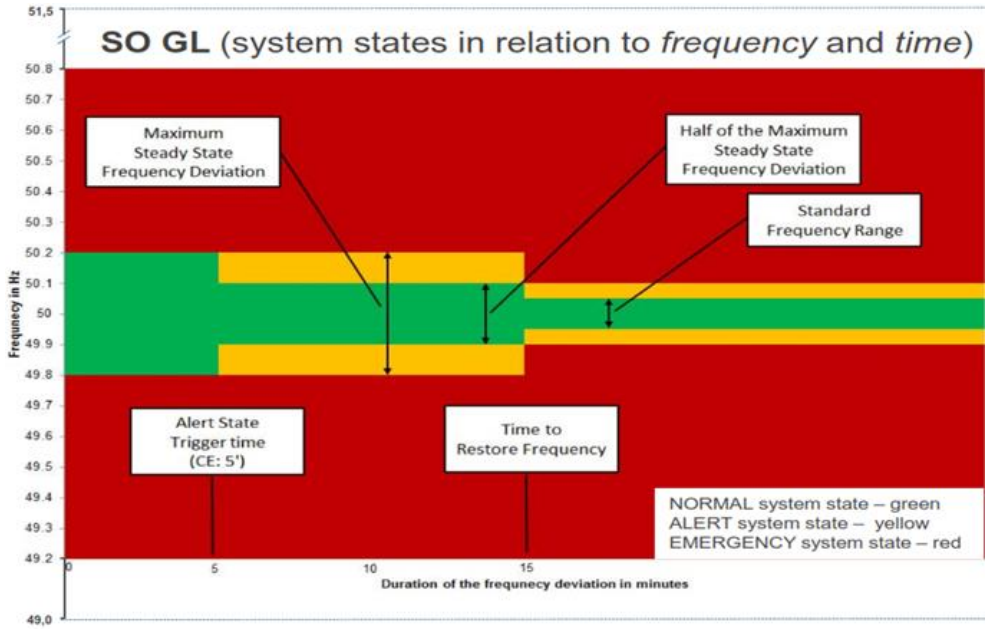


Figure 2: criteria for magnitude and duration of frequency deviation

7.1.2 Description and objectives

The measures of the frequency deviation management procedure of the system defence plan, were developed according to Article 18 of the NC ER.

The objective of the frequency deviation management procedure is to stabilize the frequency after an incident, **before the appointment of a frequency leader**[7] .

The frequency management procedure that is part of the **restoration plan** aims at restoring nominal frequency after a split of the synchronous zone into several synchronous regions or during grid restoration he n provides, among other things, for the interruption and restart of the Picasso and Mari **European balancing platforms in the event** of a system split and for the coordination of **HVDC links** between split asynchronous regions.

7.1.3 Measures prior to the frequency deviation management procedure

The following actions take effect in case of frequency deviations in the range **±200 mHz** around the nominal frequency, in the normal or alert state:

(a) Primary Control or Activation of Frequency Containment Reserves (FCR). This control is done locally on certain generation units, consumption units or HVDC units connecting different synchronous zones. The injected or withdrawn power is quickly adjusted appropriately according to the varying frequency. This "proportional" control results in a permanent frequency deviation from the nominal frequency.

(b) Secondary control or activation of the aFRR (automatic Frequency Restoration Reserves). This refers to the LFC zone frequency restoration controller that is centrally managed by ELIA and aims to reduce to zero both the ACE and the permanent frequency deviation caused by the primary control. This control adjusts every 4 seconds the desired values of the active power of certain generation units, consumption units or HVDC units between different synchronous zones.

If the steady-state frequency is outside the range **49.95 - 50.05 Hz** for more than **15 minutes, or**

If the steady-state frequency is outside the range **49.90 - 50.10 Hz** for more than **5 minutes** ,

happens the activation of the exceptional **frequency monitoring procedure.** This procedure provides for immediate consultation between TSOs of the synchronous zone continental Europe and provides for countermeasures in case of large frequency deviations in steady state.

Phase 1: **Swissgrid** (even months) or **Amprion** (odd months) will **immediately** contact the responsible TSOs **by phone** based on the ACE deviation and confirm the expected actions via email to the responsible TSO.

Phase 2: If there is no noticeable improvement in system frequency, **Swissgrid or Amprion** will **initiate a telephone conference on a larger scale** so that at the latest 20 minutes after violation of the frequency limit of 50 mHz, or at the latest 10 minutes after violation of the frequency limit of 100 mHz, the relevant partners (Swissgrid, Amprion, RTE, REE, Terna) are in contact with each other.

If the responsible TSO(s) has/have declared in Phase 1 that he/she cannot/can not respond to the frequency deviation due to missing or exhausted measures, then the TSOs concerned

[7] The appointment of a frequency leader is described in the frequency management procedure of the restoration plan.

should propose and develop all measures possible according to their own rules (market and security).

7.1.4 Measures of frequency deviation management procedure.

Fast reserve controls are available within a range of +/- 200 mHz around the nominal frequency of usually 50 Hz. Therefore, under the conditions for which the system is designed, it can be assumed to be under control with adequate reserve margins in this range.

If the frequency evolves outside this range, rapid additional action is required, in addition to the reserve arrangement already deployed, to stabilize the energy system equilibrium[8]. The typical intervention time is on the order of milliseconds to stop rapid frequency drops. Therefore, these measures cannot be considered as reserve regulation, but should be seen as pure defence measures.

The measures of the frequency deviation management procedure described below aim to avoid further frequency drop and possible subsequent blackout of the system.

If the steady-state frequency is outside the **49.90 - 50.10 Hz range** for more than **15 minutes** manual activation of the **Emergency ELIA** notification occurs

7.1.4.1 In case of underfrequency

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

- If the frequency remains continuously below 49.80 Hz for more than 30 seconds, the **ELIA Emergency** Notification is automatically sent.
- Coo 's pump storage units operating in pump mode are automatically stopped by a local frequency relay if the frequency remains below 49.80 Hz for 125 ms.
- If the frequency remains below or equal to 49.80 Hz for more than 1 minute, the LFC zone frequency restoration controller automatically switches to **"frozen mode."** This gives the SE (system engineer) of ELIA the opportunity to evaluate the situation and take over manually. This means that the active power reference values for the PGMs participating in aFRR remain unchanged. Until release, the LFC zone frequency restoration controller remains passive and the ACE signal is no longer automatically controlled to a zero value.
- ELIA may manually/automatically override the output signal of the "frozen" control mode of the LFC zone frequency restoration controllers to accelerate system stabilization. To avoid congestion, these measures should be used with caution.
- **Automatic** activation of **LFSM-U**[9]
- **Automatic** response from asynchronous energy storage facilities as described in section 7.8.3
- If the steady-state frequency falls **below 49.70 Hz**, then the following actions are **automatically** activated by ELIA (manual activation is also possible):
    - Sending a request (via a Scada-to-Scada signal) to the DSOs and CDSOs (if relevant) to turn off accumulation heaters and hot water boilers.
    - Reduce the voltage reference value by 5% on automatic voltage control systems of distribution transformers between the ELIA grid and the distribution grid.

[8] Note: According to Article 154(7) of the SOGL, FCR reserves can be deployed within a certain time frame outside the +/- 200 mHz.
[9] As applicable in the NC RFG

- In order to stabilize the frequency and provided that the frequency gradient allows it, ELIA can send a request to start certain PGMs quickly (vb turbojets) or to **change the reference value for the active power** of certain PGMs with a maximum active power greater than or equal to 25 MW, in accordance with the market rules in force at the time and taking into account the impact on zones with congestion.

  Certain PGMs may temporarily generate power above the normal value of the maximum active power. To activate this **additional power,** ELIA should contact the affected PGM by telephone.

- If it is relevant for frequency stabilization, ELIA may **disconnect the following** SGUs directly or indirectly through public DSOs or CDSOs:
  - Transmission-connected demand facilities and transmission-connected closed distribution systems;
  - The HVDC interconnector between Belgium and the UK after real-time consultations with NGESO and NLL.

  SGUs remain disconnected until ELIA issues further instructions.

  When ELIA disconnects an SGU, ELIA, within 30 days of the incident, prepares a report detailing the justification, implementation and effects of this action and submits it to CREG and makes it available to significantly affected system users.

- If the frequency falls **below 49.00 Hz**, automatic demand disconnection is activated as described in section 77.8.4

When the frequency is stabilized, the frequency management procedure of the restoration plan should be applied to restore the normal value of the frequency.

When ELIA disconnects an SGU, ELIA, within 30 days of the incident, prepares and submits to CREG a report detailing the justification, implementation and effects of this action.
Pursuant to Article 13 of the FTR, this report is also sent for information to the DG Energy as well as, where applicable, to the various interested parties without prejudice to the provisions of Articles 14(4), 18(4), 20(3) and 22(4) of the NC ER. The CREG gives its opinion on the appropriateness of the actions taken.

7.1.4.2 In case of overfrequency

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

- If the frequency remains continuously above 50.20 Hz for more than 30 seconds, the **ELIA Emergency** Notification is automatically sent.

  Automatic activation of **LFSM-O** [10]

In accordance with Article 18(4) of the NC ER, if it is relevant for frequency stabilization, ELIA may **disconnect the following** SGUs directly or indirectly through public DSOs or CDSOs:

- PGMs with a maximum active power greater than or equal to 25 MW
- The HVDC interconnector between Belgium and the UK after real-time consultations with NGESO and NLL.

SGUs remain disconnected until ELIA issues further instructions.

[10] As applicable in the NC RFG

When ELIA disconnects an SGU, ELIA, within 30 days of the incident, prepares and submits to CREG a report detailing the justification, implementation and effects of this action.
Pursuant to Article 13 of the FTR, this report is also sent for information to the DG Energy as well as, where applicable, to the various interested parties without prejudice to the provisions of Articles 14(4), 18(4), 20(3) and 22(4) of the NC ER. The CREG gives an opinion on the appropriateness of the actions taken.

7.2 Voltage deviation management procedure

7.2.1 Description and objectives

The voltage deviation management procedure of the system defence plan was developed according to Article 19 of the NC ER.

The objective of the voltage anomaly management procedure is to **restore** the **voltage within normal operating limits** or to support a neighboring TSO that is in a state of emergency at its request.

This procedure will take effect from the day following the approval of the system defence plan.

7.2.2 Activation criteria

The voltage deviation management procedure **can be manually activated by ELIA** when the voltage is not within the operational limits specified in the NC ER:

- 0.9 pu - 1.05 pu for connection points at 400 kV
    - (360 kV - 420 kV) for 400 kV
        - ELIA operational limits: (370kV - 418 kV).
        - Material limit: 420 kV
- 0.9 pu - 1.118 pu for connection points at 150 kV and 220 kV
    - (198 kV - 245 kV) for 220 kV
        - ELIA operational limits: (208 kV - 242 kV).
        - Material limit: 245 kV
    - (135 kV - 168 kV) for 150 kV
        - ELIA operational limits: (143 kV - 165 kV).
        - Material limit: 170 kV

The voltage anomaly management procedure can be activated **in emergency conditions at the request of Tennet NL or RTE**. In such cases, ELIA makes available the largest possible amount of reactive power that does not lead to an emergency or blackout condition of its transmission system. If ELIA is in a state of emergency, it can request voltage support from Tennet NL and RTE.

ELIA can request voltage support from Tennet NL or RTE if ELIA is in a state of emergency or to avoid being in a state of emergency.

7.2.3 Procedure at excessive voltages

ELIA can take the following actions preventively or curatively **in case of excessive voltages** :

- Activation of the **ELIA Emergency** Notification and preparation of a **local analysis** (EMS investigation mode, PSOS support, etc.) of the situation.
- Switch on own shunt reactors, switch off own capacitor batteries;
- In consultation with DSOs or CDSOs, eliminate certain capacitor batteries in distribution networks;
- Disconnecting cable connections, taking into account N-1 safety criteria.

- Request of additional voltage support or reactive power absorption by PGMs with a maximum active power greater than or equal to 25 MW up to the limits provided in the contract for the provision of voltage regulation services; PGMs that typically qualify (without excluding others for this purpose) are:
    - TIHANGE 3: absorption up to a maximum of XXX MVar each as seen from the high voltage side of the boost transformer
    - TIHANGE 1N and 1S: absorption up to a maximum of XXX MVar each as seen from the high voltage side of the boost transformer.
    - COO 1 - 6. absorption up to a maximum of XXX MVar at the terminals of the generators together.
    - DOEL 4: absorption up to a maximum of XXX MVar each as seen from the high voltage side of the boost transformer
- Application to adjust the reactive power exchanged with the grid by the Nemolink HVDC plant connected to the Gezelle substation.
    - Such a request should be submitted by ELIA to NLL by phone or through the ReVolt application, as described in Appendix N of the operational protocol[11] and as indicated in the steps below:
        - ELIA activates the emergency state in EMS (notification "Emergency ON" to the SGUs) and in EAS.
        - ELIA sends a reactive power set point via ReVolt to NLL according to the normal procedure described in the T&C VSP or NLL follows a specific instruction given by ELIA by telephone.
- Adjusting the reactive power exchanged with the grid by the HVDC plant connected to the Lixhe substation (Alegro)
    - Such a request must be made by ELIA by telephone to Amprion
- Creating circulating currents in the grid by setting asymmetric tap positions on the PSTs (phase shifting transformers), in real time after previous coordination with Tennet NL, Amprion and RTE .
    - One can cause loop flows of about 1200 MW starting from Belgium via Zandvliet through the Netherlands (Rilland - Geertruidenberg - Eindhoven - Maasbracht) back to Belgium via Van Eyck
    - Continuous follow-up is needed to ensure N-1 safety.
    - Using the PST for voltage management is a very powerful tool, but it also causes additional heat losses.
    - The conditions for efficient use of this resource are: maximum availability of PSTs, transport axes at the northern border in operation as much as possible, no active restrictions abroad.
- If in Day D-1 during the coordination of PSTs, efforts are made to generate sufficient transport when high voltages are expected, the network can be preemptively made more inductive.
- Application for reactive power support to Tennet NL or RTE to provide additional reactive power capacities.
    - Preemptive shutdown of certain grid elements that generate reactive power can be an effective remedy. For example, Rte could be asked to preemptively

[11] This document is only available internally ELIA and is not submitted for approval

take one of the two lines between Lonny and Mastaing out of service to reduce voltages in the Belgian grid.

7.2.4 Procedure when voltages are too low

ELIA can take the following actions preventively or curatively **when voltages are too low**:

- Activation of the **ELIA Emergency** Notification and preparation of a **local analysis** (EMS investigation mode, PSOS support, etc.) of the situation.
- Switch on own capacitor batteries, switch off own shunt reactors;
- In consultation with public DSOs or CDSOs, enable certain capacitor batteries in distribution networks;
- Application for additional voltage support or reactive power injection by PGMs with maximum active power greater than or equal to 25 MW;
- Application to adjust the reactive power exchanged with the grid by the Nemolink HVDC plant connected to the Gezelle substation, in the same manner as mentioned in §7.2.3.
- Application for adjusting the reactive power exchanged with the grid by the Alegro HVDC plant connected to the Lixhe substation, in the same way as mentioned in §7.2.3.
- Application for reactive power support to Tennet NL or RTE to provide additional reactive power capacities.
- If the actions listed above prove insufficient, ELIA may decide to activate the manual demand disconnection procedure described

7.3 Power flow management procedure

7.3.1 Description and objectives

This procedure was established in accordance with Article 20 of the NC ER. Its objective is to bring **electricity flows back within operational limits**.

7.3.2 Prior actions

The following action should be considered before activating this procedure:

- Counter trading and redispatching, as described in Regulation (EU) 2015/1222 (capacity allocation and congestion management).

7.3.3 Activation criteria

The electricity flow management procedure **can be manually** activated by ELIA's system engineer when real-time electricity flows are outside operational limits.

The operational limits for the various grid elements can be found in ELIA's exploitation criteria.

7.3.4 Power flow management procedure

When this procedure is activated, the following actions can be taken:

- Activation of notification **Emergency ELIA.**
- The following manual actions can be taken directly or indirectly through CDSOs depending on the situation:
    - Starting/stopping designated SGUs
    - Changing the setting values of the voltage at the connection point or the setting values the exchanged active and reactive power of designated SGUs. Instructions can be given directly to the control center of the SGU or through the BRP dispatch.
- If relevant to resolving the overload, ELIA may **disconnect the following** SGUs directly or indirectly through public DSOs or CDSOs:
    - PGMs with a maximum active power greater than or equal to 25 MW
- In order to bring electricity flows on cross-border grid elements, or on elements in the vicinity of a border, within operational limits, ELIA may take the following actions:
    - Neighboring TSOs request to activate specifically localized reserves in their control area.
    - Neighboring TSOs request to adjust tap positions of phase-shifting transformers.
- If the measures listed above are not sufficient, ELIA may also take the following actions:
    - **Manual or automatic opening of a cross-border interconnector** only in consultation with other TSOs.
    - Activation of the **manual demand disconnection procedure** described in section 7.6, in the required zones to resolve the overload. Here the impact

of manual demand disconnection on the grid user(s) should be weighed against the impact of the loss of one or more overloaded grid elements.

SGUs remain disconnected until ELIA issues further instructions.

When ELIA disconnects an SGU, ELIA, within 30 days of the incident, prepares and submits to CREG a report detailing the justification, implementation and effects of this action.
Pursuant to Article 13 of the FTR, this report is also sent for information to the DG Energy as well as, where applicable, to the various interested parties without prejudice to the provisions of Articles 14(4), 18(4), 20(3) and 22(4) of the NC ER. The CREG gives an opinion on the expediency of the actions taken

If SGUs are disconnected directly, **the relevant** DSO**s or CDSOs should be notified**.

7.4 Procedure for support of active power

7.4.1 Description and objectives

In case there is no security of supply for the control area for the day-ahead market or the intraday market, ELIA may request support for the active power in accordance with Article 21 of the NC ER .

In case of absence of security of supply for the control zone in real time, the active power support procedure serves to **compensate for zonal control error** (ACE) when available bids for balancing energy and inter-TSO contracts are insufficient.

7.4.2 Prior actions according to the balancing rules and operational agreement of the LFC block

Before activation of the active power support procedure:

- If ELIA's reserve capacity decreases by more than 20% for more than 30 minutes and there are no resources available to compensate for the reduction in real-time systemoperation , the **Alert state** must be activated in the Entso-E Awareness System (EAS):

$$\left[\frac{\mathrm{FCR}_{target} - \mathrm{FCR}_{actual}}{\mathrm{FCR}_{target}}\right] x\ 100 > 20 \text{ or}$$

$$\left[\frac{FRR_{target} - FRR_{actual}}{FRR_{target}}\right] x\ 100 > 20$$

$$\Big\} \quad t > 30 \text{ min}$$

The target values for sizing FCR and FRR (sum of aFRR and mFRR) for a given time period are compared in real time to the actual available reserves, with reserves already activated in previous time periods considered as available reserves.

Reserves that are not available due to forced or planned unavailability (even if unavailable during contractual replacement time) are considered to be actually unavailable.

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

- nominations identified in the bidding market platform (BMAP) for units with an installed capacity of less than 25 MW;
- nominations on D-1 for units with installed capacity of 25 MW or more and nomination reserve transfer (NRT) via secondary market during intraday.

An overview and alarm are provided in BMAP.

BMAP is still being used for mFRR and FCR at the time of writing. Until the go-live of the European balancing platform MARI, BMAP will remain in use for mFRR. After that, BIPLE will become the new bidding platform for mFRR. (FCR will remain in BMAP). BIPLE is already in use for aFRR since June 2022.

ELIA's Market Engineer activates the Alarm Condition if necessary.

- **Activation of all available reserves for balancing energy**, according to the operational procedure imbalance zone ELIA at the time of absence of security of supply for the control zone. The operational procedure imbalance zone ELIA can be consulted internally at ELIA.

  The operational procedure imbalance zone ELIA displays the current balancing rules which can be consulted on the ELIA website via the following link:

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

- **Activation of balancing alert signal**[12] once all R3 (mFRR) reserves are activated, so BSPs send more energy bids and activate the additional energy bids.

7.4.3 Activation criteria

Based on the operational security of the grid, the active power support procedure can be **manually activated** by ELIA's system engineer **in case of absence of security of supply for the control area** in or near real-time, and prior to a manual consumption disconnect..

7.4.4 Procedure

When activating the active power support procedure, the following actions can be taken in descending order of priority:

- Activation of the notification **Emergency ELIA**
- Activation of **inter-**TSO **emergency support** in accordance with Article 14(1) of the NC ER. Depending on available cross-border capacity and power flows on the grid, ELIA's system engineer decides to request neighboring TSOs, or TSOs connected via interconnectors, to activate reserves in their control area. These arrangements were established with each neighboring TSO in the corresponding AGSOM. As soon as Article 14(1) of the NC ER is invoked, the N-1 reserve rule is lifted in order to have sufficient capacity on the interconnectors, if safety calculations would show that the N-1 incident is manageable, i.e. if there is enough time available for curative actions after the incident would occur to avoid a cascade effect. Care will also be taken to ensure that the lifting of the N-1 reserve rule does not result in an emergency at the assisting TSO.

If inter-TSO emergency support is insufficient, ELIA's system engineer may activate one or more of the following actions based on the operational security of the grid:

- **Manual activation** of the following actions by ELIA's system engineer:
    - Sending a request to distribution system operators for subsequent actions:
        - switching off accumulation heaters and hot water boilers through the SCADA.
        - Telephone request to maximise the active power of generation units with an installed capacity greater than 1 MW or 250 kVA (depending on the DSO) connected to the distribution grid. This action is possible in accordance with Synergrid note C10-11 section D.9.2.
    - Reducing the set point of the automatic voltage control of distribution transformers between the ELIA grid and the distribution grid by 5%, as described in section 7.1.4.1. For most consumption units, active power consumption decreases to some extent when the voltage drops.
    - Pump storage units operating in pump mode will be stopped or disconnected if they were not already stopped by marketmechanisms .
- Activation of the manual demand disconnection procedure described in section 7.6 of this document. This is possible only after optimal assistance is provided by neighboring TSOs or TSOs connected via interconnectors, at maximum capacity

[12] The balancing alert is not part of the system defence plan. It is a signal sent in Normal or Alert condition to request more energy bids from BSPs and to try to avoid the activation of a measure of the SDP. The signal is activated by the system engineer in ELIA's NCC based on the operational security of the grid.

utilization on the interconnectors and after activation of all the actions described above.

7.5 Procedure in case of scarcity

7.5.1 Description and objectives

If, within a period beginning on day D-7 and ending on day D-1 at 19 h, ELIA detects an absence of supply security for the control area (scarcity) for day D, ELIA shall immediately notify the competent authorities and the NCCN and initiate the scarcity procedure.

The **scarcity procedure** contains the details of the process and interactions between ELIA and the competent authorities, according to the Risk Preparedness Plan. The document *The electricity scarcity procedure* [restricted distribution classification] can be consulted internally at ELIA.

In case of (threat of) scarcity, ELIA proposes possible demand reduction measures with the aim of reducing electricity consumption in the Belgian control area, which may include;

- the obligation is imposed on consumers or certain categories of consumers, throughout the country or certain parts of it, to reduce the electricity they take from the grid within predetermined limits;
- the prohibition on using electricity for certain purposes.

The summary table of demand reduction measures was updated, by the DG Energy, after consultation with the Minister of Energy, in 2022 .

The summary table, included under Appendix 2 contains the demand reduction measures that the transmission system operator may recommend, including an evaluation of potential consumption reduction.

The integral process description based on the scarcity procedure, which chronologically describes the tasks for the various functions within ELIA involved in the scarcity process, as well as the interactions with the various external partners, can be consulted internally at ELIA.

If the actions listed above prove insufficient, ELIA may decide to use the manual demand disconnection procedure described in paragraph 7.6 of this document, to activate it.

To avoid manual demand disconnection, ELIA will optimally use the transmission capacity of available transmission elements in real time, including cross-zone lines, while also taking into account reserve margins for mitigating the impact of an unexpected outage of a grid element or PGM, in consultation with neighboring TSOs.

7.5.2 Communication in case of detection of scarcity

If, for any day D within a period beginning on day D-7 and ending on day D- 1 at 19 h, ELIA detects an absence of security of supply for the control area, ELIA must immediately notify the relevant government authorities and the NCCN using a notification form.

After sending the notification, ELIA organizes a technical briefing for the Federal and Regional Ministers of Energy, the Federal Minister of Economy, the Minister of the Interior, the Director General of Energy of the DG Energy and the Director of the NCCN on the detected volume shortage, locations, period and proposed measures.

The DG Energy uses the website Elektriciteitsschaarste | FOD Economie (fgov.be) to publish the scarcity situation for the next 7 days. This uses the following color codes for each day:

- Green: normal
- Orange: risk of scarcity detected
- Red: risk of shutdown detected
- Black: shutdown announced

If ELIA detects an absence of security of supply for the control area for a day D after D- 1 at 19 h, ELIA notifies the NCCN and the Minister of Energy.

7.6 Procedure for manual demand disconnection (confidential)

7.7 Inter-TSO support and coordination in the emergency state

This procedure was established in accordance with Article 14 of the NC ER.

At the request of a TSO in an emergency state, ELIA shall provide via interconnectors all possible assistance to the requesting TSO, provided that it does not put its transmission system or the interconnected transmission systems into an emergency, blackout or restoration state.

Conversely, ELIA may also request support from other TSOs when its own balancing energy reserves are exhausted, as described in Section 7.4.4. Depending on available cross-border capacity and power flows on the grid, ELIA's system engineer decides which neighboring TSO(s) to request to activate reserves in their control area. The neighboring TSO is obliged to activate its reserves to the extent that it is not or would not be in an emergency, blackout or restoration state by applying the requested support measures.

The agreements regarding mutual support in emergency states were established with each neighboring system operator in the corresponding AGSOM[13] .

If ELIA requests support from other TSOs that are not directly linked to the ELIA control area, ELIA must notify the intermediate TSOs and seek their agreement.

When assistance is to be provided via the "Nemolink" HVDC interconnector between the UK and Belgium, it may consist of performing the actions, as indicated in the "Procedure for activation of Emergency Assistance NGESO", which can be consulted internally at ELIA.

When assistance is to be provided through the "ALEGrO" HVDC interconnector between Germany and Belgium, it may consist in performing the actions, as indicated in the AGSOM between Elia and Amprion (Section 3.4.8):

In order to prevent an imminent danger to personnel or the installation, Elia or Amprion have the right to turn off or disconnect or modify the physical power over ALEGrO without prior agreement. The other party must be immediately notified of such action.

ELIA may proceed to manually disconnect a transmission system element with significant cross-border impact, including an interconnector, under the following conditions:

- ELIA is consulting with neighboring TSOs, and
- This action does not put the remaining interconnected transmission system into an emergency or blackout state.

ELIA may **manually disconnect** a transmission system element with a significant cross-border impact, including an interconnector, **without consultation** in exceptional circumstances involving a violation of operational safety limits, in order to avoid jeopardizing the **safety of personnel** or **damaging** the **installation**.

When ELIA disconnects an SGU, within 30 days of the incident ELIA draws up a report detailing the justification, implementation and effects of this action and submits it to the CREG and the reporting TSOs and makes it available to the significantly affected system users. Pursuant to Article 13 of the FTR, this report is also sent for information to the DG Energy as well as, where applicable, to the various interested parties without prejudice to the provisions of Articles 14(4), 18(4), 20(3) and 22(4) of the NC ER. The CREG gives an opinion on the appropriateness of the actions taken.

[13] The AGSOM is updated as soon as there are significant changes in the physical linkages between the TSOs involved or upon changes in other arrangements included in the AGSOM.

7.7.1 Voltage deviation management procedure

According to Article 19 of the NC ER, neighboring TSOs in an emergency state may request ELIA to make available all reactive power capacity without placing ELIA's transmission system in the emergency or blackout state. See section 7.2.3.

7.7.2 Power flow management procedure

In order to bring the electricity flows on cross-border grid elements, or on elements near a border, within operational limits, a TSO may request a neighboring TSO to:

- Specifically localized reserves to be activated in its control zone.
- Adjusting the tap positions of phase-shifting transformers.

See also section 7.3.4.

7.7.3 Procedure for support of active power

According to Article 21 of the NC ER, if other TSOs request support for ELIA's active power, ELIA must:

- Making her free energy bids available;
- Activate the available balancing energy, to provide the corresponding electricity flows to the requesting TSO, and
- Requests for active power support by its balancing service providers and by an SGU affiliated in its LFC zone that does not already provide balancing services to the TSO to provide the corresponding active power support to the requesting TSO.

When the requested active power is activated, the requesting TSO and ELIA can use:

- The available cross-zone capacity in case the activation occurs before the gate-closing time of the cross-zone intraday market and if the supply of the relevant cross-zone capacity is not suspended;
- Additional capacity that may be available as a result of real-time system status, with the requesting and requested TSOs coordinating with other significantly affected TSOs.

When ELIA and the requesting TSO have agreed on the terms for providing support for the active power, the agreed amount of active power and the time for its delivery are fixed, unless the transmission system of ELIA, enters the emergency or blackout state.

7.8 Automatic underfrequency control scheme

7.8.1 Description and objectives

The measures of the automatic under-frequency control scheme, which is part of the system defence plan, were developed according to Article 15 of the NC ER.

The automatic under-frequency control scheme includes:

- The setting of the limited frequency sensitive mode - under frequency in the load frequency control zone (LFC zone) of the TSO, see section 7.8.2 .
- A scheme for automatic switching and decoupling of energy storage facilities see Section 7.8.3.
- An automatic low frequency demand disconnection plan, see section 7.8.4.

7.8.2 Limited frequency sensitive mode-underfrequency

When the system is in an state emergency after a major outage, which has resulted in a large generation shortfall, and all purchased FCR has been utilized, the limited frequency sensitive mode under-frequency (LFSM-U) should be activated. Article 15(2)(c) of the NC RFG specifies that new Type C and D power generation units in accordance with the criteria of Article 5 of the NC RFG, should be equipped with frequency response capability for active power in LFSM-U.
LFSM-U is automatically activated for PGMs when the frequency drops below 49.80 Hz.
When LFSM-U is activated, the LFSM-U response of the PGMs, which provide FCR from the LFSM-U intervention, must be continued from the general FCR activation.

The expected LFSM-U contribution from existing PGMs in Belgium averages 4% power increase per 0.1 Hz frequency drop (droop of 4%) and is highly dependent on the available upward reserves at the generating units.

If the frequency falls below 49.80 Hz, then PGMs will continue to rise their power output, if necessary up to the maximum capacity, as long as no technical restrictions apply for this purpose.

The associated LFSM-U response has the same droop for normal and alert state (target value = 5%; acceptable within the range of 2% to 12%), and in no way does compromise the stability of the PGMs that provide FCR .

ELIA takes account of previously agreed coordinated actions in normal and alert state aimed at restoring frequency.

LFSM-U is automatically activated on the Belgium-UK HVDC interconnector when the frequency in Belgium falls below 49.80 Hz and will lead to a reduction in the flow of active power from Belgium to the UK or an increase in the flow of active power from the UK to Belgium of up to 450 MW according to a statism of 5%.

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

- Automatic freezing of support (response of active power is frozen);
- The original active power reference value resumes after a normal operational ramping rate (100 MW/min).

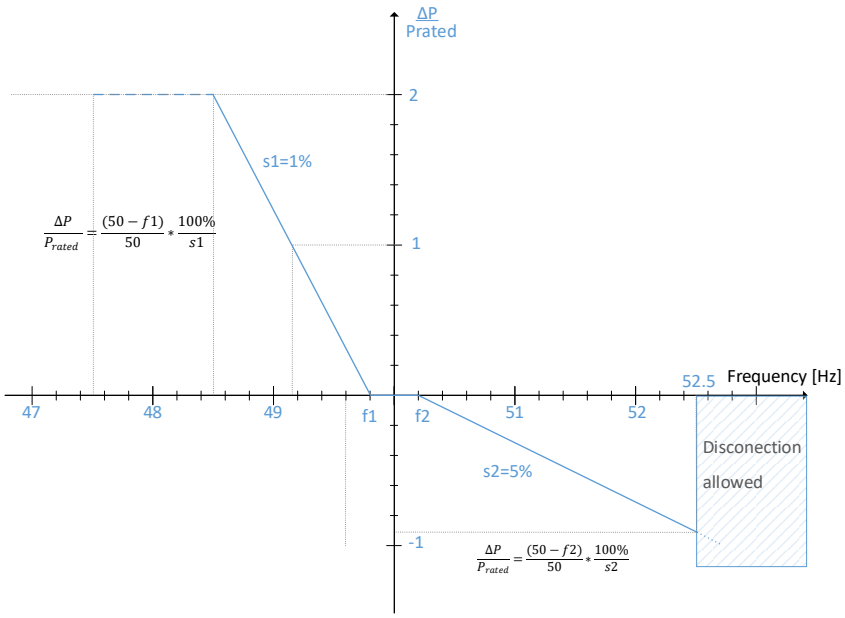
When the frequency gradient allows it, activation of the limited frequency sensitive mode for under-frequency should be done before activation of the low frequency demand disconnection.

No LFSM-U is foreseen on the HVDC interconnector between Germany and Belgium since both ends are part of the same synchronous zone. A power adjustment as a function of frequency would be immediately compensated via parallel AC connections and would not cause an effect on frequency within the synchronous zone.

7.8.3 Automatic switching and decoupling of asynchronous energy storage facilities

According to article 97§2 of the FTR, asynchronous energy storage facilities must contribute to frequency stability in the event of large frequency variations by adjusting their active power as shown in Figure 6 .

Asynchronous energy storage facilities operating in load mode will automatically disconnect at a frequency of 49.0 Hz .
The maximum total disconnection time, taking into account measurement, calculation time of relays, activation actions of auxiliary circuits and opening time of breakers, must be as fast as technically possible. Intentional delays are not allowed.



Parameters	Values
f1	49.8 Hz
f2	50.2 Hz
s1	1%
s2	5%
Control time	As soon as possible and no longer than 15 s
Response time	As soon as technically possible (no intentional delays); specific provisions may apply in accordance with the TSO

Figure 6 : Frequency response for active power of asynchronous energy storage facilities

7.8.4 Automatic low frequency demand disconnection - LFDD plan (confidential)

7.8.5 Overview of automatic actions in the event of a system frequency collapse

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

- From 50.00 Hz to 49.80 Hz:
    - Activation of all available FCR (primary reserves).
- When f = 49.80 Hz:
    - Activation of the ELIA Emergency Notification if the frequency remains less than or equal to 49.80 Hz continuously for more than 30 seconds.
    - Activation of LFSM-U.
    - The LFC zone frequency restoration control (aFRR control) switches to "frozen mode" if the frequency remains less than or equal to 49.80 Hz continuously for more than 1 minute.
    - Asynchronous energy storage facilities automatically adjust their injection/extraction according to the statism setting, as mentioned in section 7.8.3.
    - Pump storage units in COO operating in pump mode are stopped immediately.
- When f = 49.70 Hz
    - Activation of action U-5%, as described in section 7.1.4.1
    - Switching off certain accumulation heaters and hot water boilers
- When f = 49.00 Hz:
    - Automatic disconnection of storage units when still in charge mode
    - Activation of the LFDD plan for automatic demand disconnection at low frequency. The different steps are indicated in Table 5.
- When f = 48.0 0 Hz:
    - The LFDD plan for automatic consumption disconnect was fully activated.
- When f < 48, 0 Hz:
    - PGMs can be disconnected from the grid, which can accelerate frequency collapse.

These actions are summarized in Figure 9.

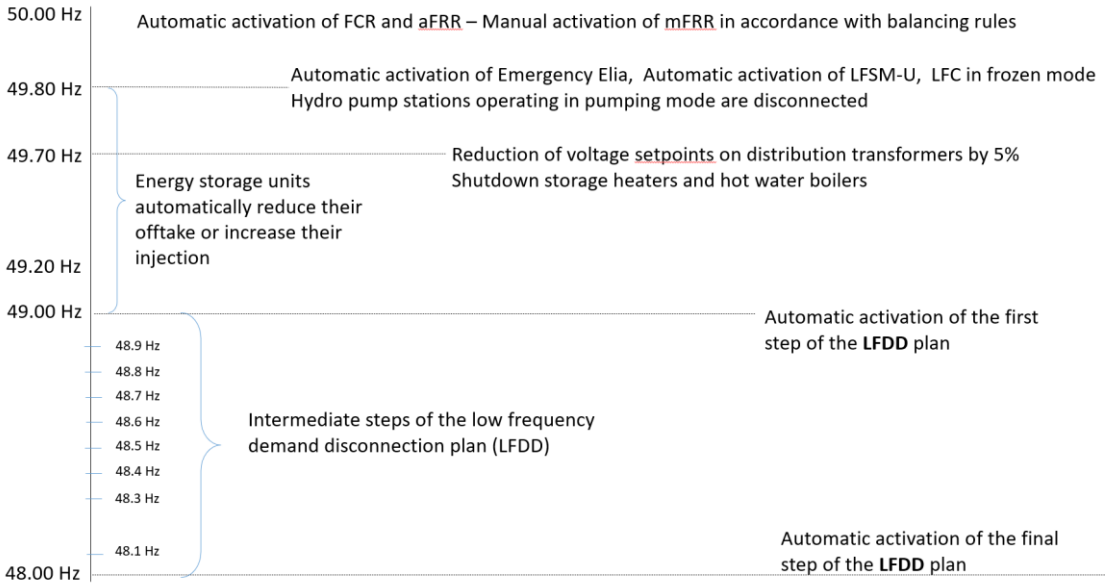


Figure 9: automatic actions in case of a frequency drop

7.9 Automatic overfrequency control scheme

7.9.1 Description and objectives

The measures of the automatic overfrequency control scheme, which is part of the system defence plan, were elaborated according to Article 16 of the NC ER. This scheme aims to avoid overfrequency, where several grid users could disconnect, with a risk of system collapse. The automatic over-frequency control scheme leads to an automatic decrease in the total active power injected into each LFC zone of the synchronous zone Continental Europe.

7.9.2 Limited frequency sensitive mode for over frequency

When the system is in an emergency state after a major failure, which has resulted in a large production surplus, and all FCR has been deployed, the limited frequency sensitive mode for over-frequency (LFSM-O) is activated.

The frequency response capacity for active power of PGMs in LFSM-O is a capacity required for all types of PGMs according to NC RFG, Article 13(2).

LFSM-O is automatically activated for PGMs when the frequency rises above 50.20 Hz.

If the frequency rises above 50.20 Hz and up to the frequency ranges defined in Article 154(6) of the SOGL, then the power output of PGMs decreases further to the minimum capacity, as long as no technical restrictions apply to it.

The associated LFSM-O response has the same droop for normal and alert state (target value = 5%; acceptable within the range of 2% to 12%), and in no way compromises the stability of the PGMs that provide FCR .

The expected LFSM-O contribution from existing PGMs in Belgium averages 4% power decrease per 0.1 Hz frequency increase (statism of 4 %) and is highly dependent on the available downward reserves on the rotating generation units.

When LFSM-O is activated, the LFSM-O response of the PGMs that provide FCR from the LFSM-O intervention is set further from the overall FCR activation.

ELIA shall establish its automatic over-frequency control scheme, taking into account the suitability of the power generation units regarding the limited frequency sensitive mode - over-frequency and of the energy storage facilities in its LFC zone.

The LFSM-O control settings present on the Belgian generation units were found to be sufficient to meet the requirements of paragraphs (a) and (b) of Article 16(2) of the NCER. Therefore, it was not deemed necessary by ELIA to establish a stepwise linear disconnection of generation and/or of HVDC systems in its LFC zone.

ELIA takes into account previously agreed coordinated actions in normal and alert states aimed at restoring frequency.

In accordance with Article 16(2) of the NCER, the TSOs of the Regional Group Continental Europe recommend the following parameter settings for the LFSM-O on PGMs:

The frequency threshold for activation of the LFSM-O:	50.2 Hz
The reduction factor of injection of active power:	5% recommended

7.9.3 Automatic behavior of energy storage facilities

In accordance with article 97§2 of the FTR, asynchronous energy storage facilities must contribute to frequency stability in the event of large frequency variations by adjusting their release of active power as shown in Figure 6 .

When the frequency exceeds 50.20 Hz, energy storage facilities automatically adjust their injection or offtake according to Figure 6 .

7.9.4 Automatic behavior of HVDC interconnectors.

In accordance with article 102 § 5 of the FTR and article 5 of the NC HVDC, LFSM-O is automatically activated on the Belgium-UK HVDC interconnector when the frequency in Belgium rises above 50.20 Hz. This will result in a reduction of the active power from the UK to Belgium of up to XXX MW according to a statism setting of XXX%.

However, increasing active power from Belgium to the UK is not foreseen, as this could give rise to overloading elements within the AC network.

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

- Automatic freezing of support (response of active power is frozen);

The original active power reference value resumes after a normal operational ramping rate (XXX MW/min).

No LFSM-O is foreseen on the HVDC interconnector between Germany and Belgium since both ends are part of the same synchronous zone. A power adjustment as a function of frequency would be immediately compensated via parallel AC connections and would not cause an effect on frequency within the synchronous zone.

7.10 Automatic regulation against voltage collapse

7.10.1 Description and objectives

The automatic regulation against voltage collapse, which is part of the system defence plan, were established according to Article 17 of the NC ER.

Several defence measures for voltage management are present at different places locally in the electricity system and, in addition, are also partly centrally managed by ELIA. However, these schemes are applicable in the normal and alert states and continue to operate without special intervention in the emergency state and do not require any specific activation.

The automatic blocking of tap changers on distribution transformers between the ELIA grid and the distribution grid is an effective means of preventing the voltage in the primary transmission system from falling further, after an incident with a danger of a total voltage collapse, caused by actions of the tap changers intended to maintain voltage in the secondary distribution system.

ELIA implemented an automatic blocking scheme for tap changers with the aim of preventing **a voltage collapse** by **blocking** the **voltage regulation** on distribution transformers between the ELIA grid and the distribution grid.

The tap changers on HS/MS transformers are automatically blocked if the voltage on the primary side falls below 92% of the rated voltage.

In that case, the voltage reference value of the secondary side is automatically reduced by 5%. This limits the flow of reactive power from the primary high-voltage grid to the secondary medium-voltage grid, preventing further voltage drop on the primary side of the grid.

The blocking arrangement is applied locally to transformers between the ELIA grid and the distribution grids. The blocking arrangement is also applied to transformers between grids with a transport function mentioned below:

- transformers between the 150 kV grid and the 36 kV grids in the North-West zone
- transformers between the 150 kV grid and the 70 kV grids (only a few transformers have automatic control activated; most are in manual mode in normal operation)
- transformers between the 380 kV grid and the 110 kV grid in the South-East zone.

In other places, the step switches of the transformers between the grids with a transmission function are manually adjusted in normal operation and to which, consequently, no blocking regulation applies....

The flow direction of reactive power is not taken into account as a blocking criterion.

The maximum delay between threshold detection and blocking is a few milliseconds.

Automatic disconnection of consumption at low voltages is not provided as a defence measure.

7.10.2 Activation criteria

Blocking control is automatically activated when the voltage on the primary side falls below 92% of the rated voltage.

7.10.3 Procedure

The blocking arrangement is **automatically** activated.

8 Information exchange during emergency, blackout or restoration states

The exchange of information during the emergency, blackout or restoration state of the transmission system is determined by article 40 of the NC ER.

'**Emergency ELIA**', '**Blackout ELIA'** and '**Grid Restoration ELIA**' notifications are sent by ELIA to the following grid users and stakeholders:

- Distribution system operators (DSOs).
- Balancing Officers (BRPs).
- Significant grid users (SGUs).
- Regulators and relevant government agencies (CREG, DG Energy and NCCN)
- Balancing service providers (BSPs).
- Restoration service providers (RSPs).
- Appointed electricity market operators (NEMOs).
- Coreso (regional coordination center)
- Other relevant entities

ELIA sends the signals simultaneously through the three following communication paths for which stakeholders can register in advance:

- From Scada to Scada
- Text message to a mobile number
- Email

By receiving the notification 'Emergency ELIA', 'Blackout ELIA' or Grid Restoration ELIA', grid users are warned that they **must be ready to follow ELIA's instructions without delay**.

When the system state returns to the normal or alert state, ELIA will send a notification to indicate that the emergency, blackout or restoration state is no longer in effect.

Entities obtaining the signal via SCADA are asked to acknowledge receipt of both the ON and OFF signals by a human operator.

The sequence of system states with corresponding time is published on Elia's website .

If the corresponding criteria are met, ELIA must notify other TSOs by updating the system state in the Entso-E Awareness System (EAS).

8.1 Notification 'Emergency ELIA'

8.1.1 Description

The notification "Emergency ELIA" aims to inform grid users and relevant stakeholders that the system is in the emergency state **and** that one or more measures of the system defence plan have been activated or may be activated in the near future.

If no system defence plan actions are required, the ELIA Emergency Notification should not be sent[14] .

The SGUs and the operators of an HVDC interconnector , should stop all testing and apply the principle of caution, upon receiving the signal 'Emergency ELIA' .

[14] There is no one-to-one relationship between the activation of the emergency state in the Entso-E Awareness System and the transmission of the 'Emergency ELIA' signal .

8.1.2 Activation criteria

'Emergency ELIA' is **manually** activated by the ELIA National Control Center (NCC) when:

- the system is in an emergency state according to Article 18(3) of the SOGL

  AND

- a system defence plan action may be required.

The 'Emergency ELIA' notification is **automatically** activated when:

- the frequency drops below 49.80 Hz for at least 30 consecutive seconds
- the frequency rises above 50.20 Hz for at least 30 consecutive seconds

8.2 'Black-out ELIA' notification

8.2.1 Blackout notification from ELIA to relevant stakeholders

The 'Blackout ELIA' notification aims to inform grid users and relevant stakeholders that the system is in the blackout state (see paragraph 5.4) .

8.2.2 Blackout notification by ELIA to government agencies (confidential)

8.3 Notification 'Grid restoration ELIA'

The purpose of the 'Grid Restoration ELIA' notification is to inform grid users that the system is in the restore state in accordance with Articles 38(3)(d) and 40(2) of the NC ER.

Further information on the system restoration will be distributed through other channels (ELIA website, Elia Corporate X account)

If the restoration condition was caused by a **system split**, ELIA will:

- at least notify neighboring TSOs of:
  - The extent and boundaries of the synchronized zone(s) to which its control zone belongs;
  - the restrictions on operating the synchronized zone;
  - The maximum duration for and amount of active and reactive power that can be delivered through interconnectors; and
  - any other technical or organizational constraints;

- Notify the frequency leader of its synchronized zone of at least:
  - The constraints to maintaining island operation;
  - The additional load and generation available; and
  - the availability of operating reserves;

9 Definitions and abbreviations

The definitions of the NC ER, the NC SOGL, the NC DCC, the NC RfG and the NC HVDC apply to the system defence plan without being explicitly restated in this paragraph.

ACE: Area Control Error (zonal control error): as defined in Article 3(2)(19) of the NC SOGL

Active power: as defined in Article 2(20) of the NC RFG

DG Energy: the General Directorate of Energy of the Federal Public Service Economy

aFRR: Automatic FRR, FRR that can be activated by an automated control system

AGC = Automatic Generation Controller: controller for frequency restoration of the LFC zone.

AGSOM = Agreement on Grid and System Operation Management: bilateral agreement between neighboring TSOs, drafted in accordance with SAFA, which contains the basis for a high degree of mutual understanding in order to perform all necessary grid operation tasks and maintain the operational security of the power system. This agreement includes, among other things, the agreements on the procedures to be applied in the emergency situation.

ALEGrO = Aachen Liege Electrical Grid Overlay: name of the HVDC interconnection between Belgium and Germany. It is jointly operated by the transmission system operators ELIA and Amprion.

Amprion: one of the four transmission system operators in Germany.

Black Start: the ability of a generating unit to re-energize an inactive main rail in the grid and allow active power to be delivered without taking energy from the grid, for the purpose of restarting the power system after a meltdown.

BMAP = Bidding Market Platform.

Bottom-up restoration strategy: strategy in which part of a TSO's system can be reactivated without assistance from other TSOs;

BRP = Balance Rersponsible Party: a balancing responsible party.

BSP = Balancing Service Provider: a provider of a balancing service.

Capacity curves: diagram showing the operational capabilities of a PGM (MW-MVAr).

CCP = Centre de Crise Principal (main crisis cell): the general crisis cell of ELIA

CDSO = Closed Distribution System Operator.

CIGRE = **Conseil International des Grands Réseaux Électriques** : international council for large electricity networks.

Clearing: automatic or manual interruption of all rooms in a high-voltage substation.

LFC zone frequency restoration controller: a process implemented in ELIA's EMS that processes FRCE measurements every 4 seconds and provides automated instructions to aFRR providers connected via telecommunications connections.

CREG = Commission for the Regulation of Electricity and Gas.

Distribution Transformer: Transformer that injects electricity into the distribution grid.

DSO = distribution system operator: when this document refers to a DSO, it means the operator of a public distribution system. To avoid misunderstanding: transmission

or distribution interconnected closed distribution systems should not be interpreted in this document as a subcategory of a DSO.

DSP = Defense Service Provider: legal entity with a legal or contractual obligation to provide a service that contributes to one or more measures of the System defence plan

DWDM = Dense Wavelength Division Multiplexing: a technology for data communication.

EAN = European Article Number : an 18-digit number used as a unique reference number for a production unit, access point or connection point.

EAS = Entso-E Awareness System: an application used by all TSOs in Entso-E to inform each other of their system state and other information related to TSOs.

Electricity crisis: as referred to in Article 2.9 of the Risk Preparedness Regulation : an existing or imminent situation in which there is a significant shortage of electricity, as identified by Member States and described in their risk preparedness plans, or in which it is not possible to supply customers with electricity.

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

Houseload operation: PGM status where the PGM is disconnected from the transmission system when a blackout occurs and can remain operational by feeding its own auxiliary load.

Island operation: as defined in Article 2(43) of the NC RFG

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

Energy coordinator: Operational service of the access manager that coordinates production located in Belgium.

FCR = Frequency Containment Reserves: as defined in Article 3(2)(6) of the NC SOGL

FRCE = Frequency Restoration Control Error: as defined in NC SOGL Article 3(2)(43).

Frequency relay: Relay that issues a command when frequency is too low (e.g., disconnection).

FRR = Frequency Restoration Reserves: as defined in Article 3(2)(7) of the NC SOGL

FTR = Federal Technical Regulation: royal decree of April 22, 2019 containing technical regulations for the management of the electricity transmission grid

Code of Conduct: The Code of Conduct, adopted by CREG by decision (B) 2409 of October 20, 2022, and as amended from time to time, establishing the conditions for connection and access to the transmission system and the methods for calculating or determining the conditions for the provision of ancillary services and access to cross-border infrastructure, including the procedures for capacity allocation and congestion management;

Synchronized area: The part of a synchronous zone managed by interconnected TSOs with a common system frequency that is not synchronized with the rest of the synchronous zone

Regional regulations:

Flemish Region:

- Technical Regulations for the Distribution of Electricity in the Flemish Region of March 24, 2023 .
- Technical Regulations Local Transmission Network of Electricity Flemish Region of 29 May 2020.

Walloon Region:

- Decree of the Walloon Government approving the technical regulation for the management of electricity distribution networks in the Walloon Region and access thereto dated 27 May 2021.
- Decree of the Walloon Government on the revision of the technical regulation for the management of the local electricity transmission network in the Walloon Region and access to it of January 26, 2012

Brussels Capital Region:

- Order of the Brussels Capital Government establishing the technical regulations for the management of the electricity distribution network in the Brussels Capital Region and access to it of May 23, 2014.
- Order of the Brussels Capital Government approving the technical regulation for the management of the regional electricity transmission network of 13 July 2006.

Restoration plan: as defined in Article 3(9) of the NCER

Resynchronization: as defined in Article 3(9) of the NCER: The synchronization and reconnection of two synchronized areas at the resynchronization point;

Resynchronization leader: as defined in Article 3(12) of the NCER: The TSO designated and responsible for the resynchronization of two synchronized areas;

Resynchronization point: as defined in Article 3(13) of the NCER

HPSGU: High priority significant grid user: significant grid user subject to special conditions regarding disconnection and voltage restoration;

HVDC = High Voltage Direct Current: as defined in Article 2(1) of the NC HVDC

IGCC = International Grid Control Cooperation: European platform for netting imbalances between different TSOs

RD = royal decree.

LFC Zone: Load Frequency Control Zone, as defined in Article 3(2)(12) of the NC SOGL. For Belgium, this is ELIA's control zone.

LFDD = Low Frequency Demand Disconnection: disconnection of consumption at low frequency, also called automatic disconnection at lower frequency.

LFSM-O =Limited Frequency Sensitive Mode - Overfrequency: as defined in Article 2(37) of the NC RFG

LFSM-U =Limited Frequency Sensitive Mode - Underfrequency: as defined in Article 2(38) of the NC RFG.

MARI: European balancing platform for the coordination of mFRR

Market Engineer: operator at ELIA's national control center, responsible for activating balancing energy and monitoring balancing reserves.

mFRR = Manual Frequency Restoration Reserves.

Minister of Economy: the federal minister or secretary of state who has economics under his jurisdiction.

Minister of Energy: the federal minister or secretary of state who has energy under his jurisdiction.

MOG = Modular Offshore Grid: as defined in article 2, 7ter of the Law of April 29, 1999 on the organization of the electricity market.

MV substation: medium voltage substation. A substation with a rated voltage lower than 30 kV**.**

NCC = **National Control Center**: national control center of ELIA.

NCCN = **National Crisis Center / Centre de Crise National:** the national crisis center of home affairs.

NC DCC =Demand Connection Network Code: network code for connection of consumers. European Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a network code for connection of consumers.

NC ER = Network Code Emergency and Restoration: network code for emergency and restoration. European Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a Network Code for Emergency and Restoration of the Electricity Grid.

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

NC RfG = Requirements For Generators Network Code: grid code for requirements for generators. European Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a grid code with requirements for the connection of generators to the grid.

NEMO = Nominated Electricity Market Operator.

NGESO = National Grid Electricity System Operator: the transmission system operator in Britain.

Non-selective disconnection: manual or automatic interruption of direct or indirect connections between the transmission system and networks of other network operators in ELIA's control zone, by opening the breakers of the transformers to these networks.

NLL = Nemo Link Limited. This is the name of the company that operates the HVDC interconnector between Belgium and the United Kingdom.

NRA = National Regulatory Authority: national regulatory authority. In Belgium, CREG assumes the role of NRA.

OGE = On-duty Grid Engineer: grid engineer on duty.

PAS = Power Application Software: This is a component of the EMS used for near real-time safety analysis.

PGM = Power Generating Module: as defined in Article 2(5) of the NC RfG

PICASSO : European balancing platform for the coordination of aFRR

Sudden phenomenon : unexpected event in the electricity system occurring after day D-1, 19h and potentially causing an electricity shortage on day D that cannot be

sufficiently or quickly compensated by an increase in generation in Belgium or an increase in imports or through demand-side management.

PPM = Power Park Module: as defined in Article 2(17) of the NC RFG

Sudden phenomena procedure: procedure whose legal basis is described in Article 7 of the Ministerial Decree on Risk Preparedness Plan and which is described in Chapter 4.1.11.2 of the Risk Preparedness Plan.

Procedure at scarcity: procedure whose legal basis is described in Article 7 of the Ministerial Decree Risk Preparedness plan and described in Chapter 4.1.11.1 of the Risk Preparedness Plan.

PSD = Parallel Switch Device: device used to resynchronize two asynchronous regions.

PSOS = Power System Operation and Stability: This is an entity within ELIA's NCC that specializes in power system analysis.

PST = Phase Shifting Transformer.

RCC = Regional Control Centre: regional control center, referring to a region within Belgium.

RCC = Regional coordinationcenter: regional coordination center, referring to a region within Europe.

Reactive power: synonymous with reactive power.

REE = Red Eléctrica de España :transmission system operator in Spain.

Control zone: the zone within which the market engineer continuously regulates the balance between the consumption and supply of electricity, taking into account the exchanges of active power between control zones.

RES = Renewable Energy Sources: renewable energy sources

Risk preparedness plan: plan referred to in article 6§4 of the FTR and established in annex of the Ministerial Decree Risk Preparedness Plan.

Risk Preparedness Regulation: REGULATION (EU) 2019/941 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of June 5, 2019 on risk preparedness in the electricity sector and repealing Directive 2005/89/EC

RSP = Restoration Service Provider: Restoration service providers, as defined in Article 3(1) of the NCER

RTE: transmission system operator in France.

RTU = Remote Terminal Unit: control unit that bundles and sends signals in a substation between the substation and the control center.

SAFA = Synchronous Area Framework Agreement for the Regional Group Continental Europe. This agreement entered into force on April 14, 2019, after approval by the national regulators in accordance with Article 6(3)(d) of the SOGL.

SCADA = Supervisory Control And Data Acquisition. This is part of the EMS.

SE = System Engineer: systems engineer. Operator at ELIA's national control center responsible for monitoring the grid in real time.

Selective disconnection: manual or automatic interruption of departing cables in TSO or DSO substations not classified as departing cables to significant high priority grid users.

Significant shortage: a blackout for more than 100,000 connections or for more than 100 MW of power, as defined in Article 2(1) of the Ministerial Decree Risk Preparedness Plan.

Multi-incident situation: a situation in which multiple incidents occur. This refers to the physical state of the power system that, starting from a reference state and after the disappearance of the transition phenomenon, occurs due to the simultaneous loss of a generation unit and another component of the power system (this may be a grid element or a generation unit).

SGU = **Significant grid user**.

SOGL: **System Operations Guideline**. European Commission Regulation (EU) 2017/1485 of August 2, 2017 establishing guidelines on electricity transmission system operation.

SOK = Cooperation Agreement: ELIA has entered into an agreement with each DSO describing the cooperation between ELIA and the DSO

Voltage restoration: reactivation of production and load to **activate** the shutdown parts of the system

Structurally injecting cables: a cable to which only generators are connected, or a cable for which previous counts carried out indicate that the direction of flow at the end of the cable at the level of the secondary rails is injecting for at least 90% of the time on an annual basis, insofar as this information is available to the distribution system operator concerned .

SVC = Static VAR Compensator: a device to compensate reactive power

Swissgrid: transmission system operator in Switzerland.

TenneT NL: transmission system operator in the Netherlands.

Terna: transmission system operator in Italy.

Top-down restoration strategy: strategy that requires the assistance of other TSOs to reactivate parts of another TSO's system.

Total load: the total load for the low frequency automatic decoupling consumption plan is defined using the following calculation method:

TOTAL LOAD **=** Σ GROSS PRODUCTION + IMPORTS - EXPORTS - ENERGY STORAGE OPERATING as load + ENERGY STORAGE OPERATING as generator – house load

All values in the formula are used as positive values.

Transmission network : the ELIA network, including the regional/local transmission networks as provided for in the Regional Regulations, unless expressly stated otherwise.

TSO = transmission system operator: as defined at article 2, 8 of the Law of April 29, 1999 on the organization of the electricity market.

TSO-controlled dispatch: a way of operating the transmission grid, for example, during a period when certain market segments are interrupted and when grid users connected to the TSO promptly implement set points provided by the TSO and execute instructions.

Active power: The electrical power, expressed in watts, that can be converted to other forms of power, such as mechanical, thermal, acoustic. Active power is also called the "active power."

10 List of measures and implementation deadlines

A distinction is made between, on the one hand, the measures to be applied by SGUs after the activation of the protection plan, as mentioned paragraph 7 and, on the other hand, the measures that SGUs must implement in advance and that stem from the implementation of the NC ER. The latter measures are listed in the lists below.

10.1 List of measures and implementation deadlines, to be implemented by the TSO in its facilities

#	Measure	Deadline for implementation	Status on 06/10/2023
1	Adjusting Alarm ELIA to Emergency ELIA	Date approval minister + 1 year[1]	Fully implemented
2	Implementation of notification 'Emergency ELIA', 'Blackout ELIA', 'Nether restoration ELIA'	Date approval minister + 1 year	Fully implemented
3	Implementation of the automatic LFDD plan as provided in version 1 of the system defence plan	18/12/2022	Fully implemented
4	Upgrade the 'rescue code plans' in the EMS in accordance with version 1 of the system defence plan	Date approval minister + 1 year	Fully implemented
5	Implementation of the automatic LFDD plan as provided in version 2 of the system defence plan	According to an implementation plan to be determined in more detail between 2024 and 2029	To be implemented
6	Integration of type B production units into the EMS in accordance with version 2 of the system defence plan	Date approval minister + 1 year	To be implemented

10.2 List of measures and implementation deadlines, by implementing SGUs in their facilities

#	Applicable to	Measure	Deadline for implementation	Status on 30/09/2023
1	All SNUs	Implement measures to ensure proper receipt of the various notifications sent by ELIA. The notifications are described in Section 8 of the System defence plan. ELIA will define the concrete practical modalities in consultation with stakeholders in the coming months.	Date approval minister + 1 year	Fully implemented
2	Transmission-connected consumption installations and closed distribution networks	Implementation of an installation for selective consumption disconnection as described in the LFDD design note added in Annex 7.	According to an implementation plan to be determined in more detail between 2024 and 2029	To be implemented

10.3 List of measures and implementation deadlines, to be implemented by DSOs in their facilities

#	Applicable to	Measure	Application term	Status on 30/09/2023
1	All DSOs (connected to the transmission or distribution network)	Implement a system to properly receive the various notifications sent by ELIA. The notifications are described in Section 8 of the System defence plan. ELIA will determine the concrete practical modalities in consultation with stakeholders in the coming months.	Date approval minister + 1 year	Fully implemented
2	All DSOs (connected to the transmission or distribution network)	Implementation of an installation for selective consumption disconnection taking into account the direction of active power on individual departing cables, as far as technically feasible, for substations that are part of the LFDD plan as listed in Annex 5 and Annex 6 in 2027.	According to an implementation plan to be determined in more detail between 2024 and 2029	Still to be implemented
3	All DSOs (connected to the transmission or distribution network)	Implementation of ELIA's instructions on adjusting the active power of generation units in distribution networks	Date approval minister + 1 year	Still to be implemented

11 List of related documents

This section lists related documents referenced in this System defence plan. Some related documents are available only internally ELIA. ELIA does not seek approval from the Minister of Energy on these related documents. These documents are available for review at ELIA upon request by the appropriate governmental authorities.

11.1 Documents available only internally

By default, the documents below can only be accessed by ELIA employees:

- Cooperation agreements between ELIA and the DSOs.
- Operational procedure imbalance zone ELIA
- Exceptional procedure for frequency monitoring and countermeasures in case of large frequency deviations in steady-state.
- The operational limits for the various grid elements
- The integral process description based on the scarcity procedure
- Notification form NCCN
- Template for scarcity technical briefing
- Operational activation of the shutdown plan in national dispatch.
- Operational activation of the shutdown plan in the regional dispatchers (Dutch version).
- Activation opérationnelle du plan de délestage au sein des dispatchings régionaux (French version).
- Procedure for activation of Emergency Assistance NGESO
- AGSOM between ELIA and Tennet NL.

- AGSOM between ELIA and RTE
- AGSOM between ELIA and Amprion

11.2 Documents available externally with classification restricted distribution

The electricity shortage procedure:

11.3 Documents available externally

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

Annex 1: List of designated SGUs according to the NC ER Article 11(4)(c)

The SGUs in the table below refer to the individual assets and the corresponding entity that can be contacted by ELIA. Each SGU that is a PGM has a unique identification number consisting of the PGM's EAN number (this is not the EAN number of the access point listed on ELIA's website).

For the SGU that is an HVDC plant, the unique identification number taken was the Interface Agreement number.

All SGUs in this list belong to the ELIA control zone, which is part of the regional control zone continental Europe.

All SGUs will be informed to enable proper receipt of notifications by ELIA of system states and the interruption and restart of market operations.

SGU unique naming	Unique reference number	Category	CDS	Identification date	Entity tob e contected by ELIA	Address of entity to be contacted by ELIA
Alegro HVDC	Alegro HVDC	HVDC	no	26/09/2023	Alegro	Rue des Taillis 4 4600 Lixhe
AMB Gent WT Storm	541453176017865768	existing PGM with PMax ≥ 25 MW	no	26/09/2023	ArcelorMittal Belgium _ Gent	John Kennedylaan 51 9000 Gent
Zelzate 2 Knippegroen	541453170030939574	existing PGM with PMax ≥ 25 MW	no	26/09/2023	ArcelorMittal Belgium _ Gent	John Kennedylaan 51 9000 Gent
Arlanxeo Zwijndrecht	541453107048964502	existing PGM with PMax ≥ 25 MW	no	26/09/2023	ARLANXEO Belgium _ Zwijndrecht	Canadastraat 21 2070 Zwijndrecht
Zwijndrecht Lanxess GT	541453172994196413	existing PGM with PMax ≥ 25 MW	no	26/09/2023	ARLANXEO Belgium _ Zwijndrecht	Canadastraat 21 2070 Zwijndrecht
Aspiravi Wuustwezel	541453112201488016	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Aspiravi _ Brecht	Bethovenstraat 66 2960 Brecht
Zandvliet Power	541453101893252135	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	BASF Antwerpen _ Antwerpen	Scheldelaan 600 2018 Antwerpen
Oud-Lillo Monsanto	541453158737754829	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Bayer Agriculture _ Antwerpen	Scheldelaan 16 2018 Antwerpen
Belwind Phase 1	541453113723391297	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Belwind _ Zeebrugge (Offshore)	Bligh Bank 1 8380 Zeebrugge
Burgo Ardennes Virton Turbine 4	541453141474868188	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Burgo Ardennes _ Virton	Rue de la Papeterie 1 6760 Virton
Burgo Ardennes Virton Turbine 5	541453160814317544	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Burgo Ardennes _ Virton	Rue de la Papeterie 1 6760 Virton
Thorntonbank - C-Power - Area NE	541453120478004211	existing PGM with PMax ≥ 25 MW	no	26/09/2023	C - Power _ Bredene	Thorntonbank 8450 Bredene
Thorntonbank - C-Power - Area SW	541453150484210252	existing PGM with PMax ≥ 25 MW	no	26/09/2023	C - Power _ Bredene	Thorntonbank 8450 Bredene
Windvision Estinnes WIND	541453124835270646	existing PGM with PMax ≥ 25 MW	no	26/09/2023	CGNEE Belgium Wind Energy Company _ Estinnes	Route de Mons (en façe du n° 763) 7120 Estinnes
Amercoeur 1 R GT	541453152837115528	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Amercoeur	Rue Chauw à Roc 6 6044 Roux
Amercoeur 1 R ST	541453128600716599	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Amercoeur	Rue Chauw à Roc 6 6044 Roux
BEERSE TJ	541453110860830542	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Beerse	Brusselenstraat 6 2340 Beerse
COO 1 T	541453188083940744	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Coo	Route du Lac 1 4983 Trois-Ponts

COO 2 T	541453177100676292	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Coo	Route du Lac 1 4983 Trois-Ponts
COO 3 T	541453146119338279	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Coo	Route du Lac 1 4983 Trois-Ponts
COO 4 T	541453178285831216	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Coo	Route du Lac 1 4983 Trois-Ponts
COO 5 T	541453114882045984	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Coo	Route du Lac 1 4983 Trois-Ponts
COO 6 T	541453199818962818	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Coo	Route du Lac 1 4983 Trois-Ponts
DOEL 1	541453164246726035	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Doel	Haven 1800, Scheldemolenstraat 9130 Doel
DOEL 2	541453141114133591	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Doel	Haven 1800, Scheldemolenstraat 9130 Doel
DOEL 4	541453181034094091	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Doel	Haven 1800, Scheldemolenstraat 9130 Doel
DROGENBOS GT1	541453155745315554	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Drogenbos	De Bruyckerweg 1 1620 Drogenbos
DROGENBOS GT2	541453194308489561	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Drogenbos	De Bruyckerweg 1 1620 Drogenbos
DROGENBOS ST	541453146122324467	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Drogenbos	De Bruyckerweg 1 1620 Drogenbos
HERDERSBRUG GT1	541453112497967486	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Herdersbrug	Pathoekeweg 300 8000 Brugge
HERDERSBRUG GT2	541453144916927818	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Herdersbrug	Pathoekeweg 300 8000 Brugge
HERDERSBRUG ST	541453101361829043	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Herdersbrug	Pathoekeweg 300 8000 Brugge
RODENHUIZE 4	541453198563265809	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Rodenhuize	Rodenhuizekaai 3 9042 Desteldonk
SAINT-GHISLAIN STEG	541453123455840345	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Saint-Ghislain	Rue d'Hautrage 89 7331 Baudour
Schaerbeek Siomab	541453151734393831	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Siomab	Léon Monnoyerkaai 8 1120 Brussel
TIHANGE 1N	541453142219460018	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Tihange	Avenue de l'Industrie 1 4500 Tihange
TIHANGE 1S	541453135949593781	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Tihange	Avenue de l'Industrie 1 4500 Tihange
TIHANGE 3	541453189635938400	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Tihange	Avenue de l'Industrie 1 4500 Tihange
VILVOORDE GT	541453152499264473	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Vilvoorde	JF Willemsstraat 200 1800 Vilvoorde
VILVOORDE ST	541453172454845905	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Electrabel _ Vilvoorde	JF Willemsstraat 200 1800 Vilvoorde
Luminus Villers-le-Bouillet WIND	541453130625684630	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Eolus _ Villers-le-Bouillet	Rue de Waremme 123 4530 Villers-le-Bouillet
Lillo Degussa GT1	541453183539849510	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Evonik Antwerpen _ Antwerpen	Frans Tijsmanstunnel West 2040 Antwerpen
Lillo Degussa GT2	541453185186189414	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Evonik Antwerpen _ Antwerpen	Frans Tijsmanstunnel West 2040 Antwerpen
Scheldelaan Exxonmobil	541453177309381966	existing PGM with PMax ≥ 25 MW	no	26/09/2023	ExxonMobil Petroleum & Chemical _ Antwerpen	Polderdijkweg 2030 Antwerpen
Zeebrugge 2 Fluxys	541453185370707516	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Fluxys LNG _ Terminal Zeebrugge	Henri-Victor Wolvensstraat 3 8380 Zeebrugge

Froidchapelle Wind	541453138974720238	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Green Wind _ Froidchapelle	Chaussée de Beaumont (Lieu dit 'Fonds Martin') 6500 Beaumont
ICO Windpark Zeebrugge	541453116524400267	existing PGM with PMax ≥ 25 MW	no	26/09/2023	ICO Windpark _ Zeebrugge	Margareta Van Oostenrijkstraat 8380 Zeebrugge
Beveren Sleco	541453132244509455	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Indaver _ Doel	Molenweg 1 9130 Doel
BP Chembel Geel PTA3	541453152871643162	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	INEOS Aromatics Belgium _ Geel	Amocolaan 2 2440 Geel
INESCO GT1	541453166811770207	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	INEOS Oxide Utilities _ Zwijndrecht	Nieuwe Weg 1 2070 Zwijndrecht
INESCO GT2	541453131341189140	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	INEOS Oxide Utilities _ Zwijndrecht	Nieuwe Weg 1 2070 Zwijndrecht
INESCO ST	541453144504946474	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	INEOS Oxide Utilities _ Zwijndrecht	Nieuwe Weg 1 2070 Zwijndrecht
Infrabel Avernas Greensky Wind	541453170012420052	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	Infrabel _ Avernas	Lieu dit ""Aux Zabrées"" 4280 Abolens
Jemeppe-sur-Sambre GT1	541453134754645821	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	INOVYN Manufacturing Belgium _ Jemeppe	Rue Solvay 39 5190 Jemeppe-sur-Sambre
Jemeppe-sur-Sambre GT2	541453186572796100	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	INOVYN Manufacturing Belgium _ Jemeppe	Rue Solvay 39 5190 Jemeppe-sur-Sambre
Intradel Herstal	541453128860998155	existing PGM with PMax ≥ 25 MW	no	26/09/2023	INTRADEL _ Herstal	Pré Wigy 4040 Herstal
Incinerateur THUMAIDE (IPALLE)	541453150620096924	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Ipalle _ Thumaide	Hameau de Ribonfosse 9 7971 Thumaide
Oorderen Bayer	541453127862811080	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	LANXESS Performance Materials _ Lillo	Scheldelaan 420 2040 Lillo
ANGLEUR TG 41	541453105149024729	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Angleur	Rue Defêchereux 43 4031 Angleur
ANGLEUR TG 42	541453147978770736	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Angleur	Rue Defêchereux 43 4031 Angleur
ANGLEUR TG31	541453127036684755	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Angleur	Rue Defêchereux 43 4031 Angleur
ANGLEUR TG32	541453137445795539	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Angleur	Rue Defêchereux 43 4031 Angleur
ANGLEUR TGV3	541453114676761625	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Angleur	Rue Defêchereux 43 4031 Angleur
EDF Luminus Ham GT	541453149186128378	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Gent	Ham 68 9000 Gent
HAM31	541453179993838078	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Gent	Ham 68 9000 Gent
HAM32	541453153623163709	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Gent	Ham 68 9000 Gent
RINGVAART STEG	541453165925532572	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Ringvaart	Wondelgemsekaai 9000 Gent
EDF Luminus Seraing GT1	541453162200760842	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Seraing	Rue du Pont du Val 1 4100 Seraing
EDF Luminus Seraing GT2	541453155725234745	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Seraing	Rue du Pont du Val 1 4100 Seraing
SERAING TV	541453142655169964	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Luminus _ Seraing	Rue du Pont du Val 1 4100 Seraing
Nemo Link HVDC	Nemo Link HVDC	HVDC	no	26/09/2023	Nemo Link	Pathoekeweg 300 8000 Brugge Belgium
Nobelwind Offshore Windpark	541453164675671838	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Nobelwind _ Zeebrugge (Offshore)	Bligh Bank 2 8380 Zeebrugge

Norther Offshore WP	541453131548107275	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Norther _ Zeebrugge (Offshore)	Nabij de Bank zonder Naam en ten ZO van de Thorntonbank 8380 Zeebrugge
Northwester 2	541453164871870851	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Northwester 2 _ Zeebrugge (Offshore)	Ten NW van de Bligh Bank 9999 Offshore
Northwind	541453157197213174	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Northwind _ Zeebrugge (Offshore)	Lodewijkbank 8380 Zeebrugge
Kristal _ Solar _ Park	541453118670087231	existing PGM with PMax ≥ 25 MW	yes	26/09/2023	NYRSTAR Belgium _ Balen	Zinkstraat 1 2490 Balen
Rentel Offshore WP	541453123210565544	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Rentel _ Zeebrugge (Offshore)	Ten NW van de Thorntonbank en ten ZO van de Lodewijkbank 9999 Offshore
Lanaken Sappi	541453170948833223	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Sappi Lanaken _ Lanaken	Montaigneweg 2 3620 Lanaken
Mermaid Offshore WP	541453152846416159	existing PGM with PMax ≥ 25 MW	no	26/09/2023	SeaMade _ Zeebrugge (Offshore)	Ten NW van de Lodewijk Bank en ten ZO van de Bligh Bank 9999 Offshore
Seastar Offshore WP	541453121368376005	existing PGM with PMax ≥ 25 MW	no	26/09/2023	SeaMade _ Zeebrugge (Offshore)	Ten NW van de Lodewijk Bank en ten ZO van de Bligh Bank 9999 Offshore
PLATE-TAILLE 1 T	541453181586009260	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Sofico _ Plate-Taille	Rue d'Oupia 5 6440 Boussu-lez-Walcourt
PLATE-TAILLE 2 T	541453138010162114	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Sofico _ Plate-Taille	Rue d'Oupia 5 6440 Boussu-lez-Walcourt
PLATE-TAILLE 3 T	541453156580406421	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Sofico _ Plate-Taille	Rue d'Oupia 5 6440 Boussu-lez-Walcourt
PLATE-TAILLE 4 T	541453165774983167	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Sofico _ Plate-Taille	Rue d'Oupia 5 6440 Boussu-lez-Walcourt
PLATE-TAILLE T	541453182399547109	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Sofico _ Plate-Taille	Rue d'Oupia 5 6440 Boussu-lez-Walcourt
LANGERBRUGGE STORA	541453151336306338	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Stora Enso Langerbrugge _ Gent	Wondelgemkaai 200 9000 Gent
LANGERBRUGGE STORA ST 2	541453109080445766	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Stora Enso Langerbrugge _ Gent	Wondelgemkaai 200 9000 Gent
Aalst Syral GT	541453186071413751	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Tereos Starch & Sweeteners Belgium _ Aalst	Burchtstraat 10 9300 Aalst
Syral Aalst	541453165087956193	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Tereos Starch & Sweeteners Belgium _ Aalst	Burchtstraat 10 9300 Aalst
Marcinelle Energie (Carsid)	541453107850545647	existing PGM with PMax ≥ 25 MW	no	26/09/2023	TotalEnergies - Centrale Electrique March-au-Pont _ Marchienne-au-Pont	Rue de la Providence 150 6030 Marchienne-au-Pont
Wilmarsdonk Total GT1	541453180835902697	existing PGM with PMax ≥ 25 MW	no	26/09/2023	TotalEnergies Refinery Antwerp _ Refinery Antwerp	Scheldelaan 16 2018 Antwerpen
Wilmarsdonk Total GT2	541453106660324336	existing PGM with PMax ≥ 25 MW	no	26/09/2023	TotalEnergies Refinery Antwerp _ Refinery Antwerp	Scheldelaan 16 2018 Antwerpen
Wilmarsdonk Total GT3	541453120611619944	existing PGM with PMax ≥ 25 MW	no	26/09/2023	TotalEnergies Refinery Antwerp _ Refinery Antwerp	Scheldelaan 16 2018 Antwerpen
T-power Beringen	541453182359129192	existing PGM with PMax ≥ 25 MW	no	26/09/2023	Vynova Belgium _ Tessenderlo	Stationsstraat 94 3980 Tessenderlo

Appendix 2: Summary table of demand reduction measures.

The table below provides a list of electricity demand reduction measures and was compiled by DG Energy in 2022.

For each measure, an estimate of the demand reduction measure is given in MW and per hour if applied for all of Belgium. The table below gives an example of a weekday in winter. The DG Energy has an IT application to calculate the effect of these measures at other times as well.

Verplichte maatregelen	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Elektrische huishoudtoestellen niet gebruiken (wasmachine, droogkas, afwasmachine, strijkijzer, stofzuiger, wellness apparatuur, elektrische kooktoestellen, waterketel, TV, multimedia…)	- 211	- 160	- 104	- 49	- 49	- 49	- 56	- 144	- 284	- 349	- 394	- 419	- 450	- 454	- 457	- 426	- 438	- 483	- 617	- 628	- 625	- 440	- 365	- 262
Verlichting en apparaten in waakstand uitzetten	- 60	- 60	- 60	- 60	- 60	- 60	- 125	- 125	- 60	- 60	- 60	- 60	- 60	- 60	- 60	- 60	- 60	- 125	- 125	- 125	- 125	- 125	- 125	- 60
Elektrische auto's (Hybride + volledige) niet laden	- 10	- 8	- 6	- 4	- 4	- 2	- 4	- 6	- 8	- 10	- 12	- 12	- 12	- 12	- 6	- 6	- 10	- 12	- 14	- 14	- 14	- 14	- 14	- 12
Sanitair warm water: niet elektrisch verwarmen	- 20	- 20	- 20	- 20	- 20	- 20	- 125	- 175	- 225	- 225	- 225	- 175	- 138	- 100	- 50	- 50	- 88	- 125	- 175	- 175	- 125	- 75	- 20	- 20
Bij elektrische verwarming, temperatuur verlagen tot max 18°C	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400	- 400
Verlaging industriele productie met 50%	- 650	- 613	- 600	- 575	- 588	- 638	- 775	- 775	- 775	- 775	- 775	- 775	- 775	- 775	- 775	- 775	- 763	- 763	- 750	- 738	- 725	- 738	- 725	- 713
Telewerk verplicht (+ burelen energetisch afschakelen)	-	-	-	-	-	-	-	- 29	- 59	- 88	- 117	- 117	- 117	- 117	- 117	- 117	- 117	- 88	- 59	- 29	-	-	-	-
Niet essentiele winkels sluiten	-	-	-	-	-	-	-	- 31	- 61	- 92	- 92	- 92	- 92	- 92	- 92	- 92	- 92	- 92	- 92	- 61	- 31	-	-	-
Verlichting parkings + reclame verlichting doven	- 30	- 30	- 30	- 30	- 30	- 30	- 64	- 64	- 30	- 30	- 30	- 30	- 30	- 30	- 30	- 30	- 30	- 64	- 64	- 64	- 64	- 64	- 64	- 30
Geen treinverkeer (goederen + personen + intenationaal)	- 100	- 100	- 100	- 100	- 100	- 200	- 300	- 300	- 300	- 300	- 300	- 300	- 300	- 300	- 300	- 300	- 300	- 300	- 300	- 300	- 300	- 200	- 100	- 100
TOTAAL	**-1.481**	**-1.390**	**-1.320**	**-1.238**	**-1.250**	**-1.398**	**-1.849**	**-2.048**	**-2.201**	**-2.328**	**-2.405**	**-2.380**	**-2.373**	**-2.339**	**-2.287**	**-2.256**	**-2.297**	**-2.451**	**-2.595**	**-2.533**	**-2.408**	**-2.055**	**-1.813**	**-1.597**

Appendix 3: List of high voltage substations involved in the manual demand disconnection plan. (Confidential)

Appendix 4: Register of activations and ministerial decisions authorizing manual activation in the event of electricity shortages and sudden phenomena

Step	**Date**	**Hour start**	**Hour end**	**Ministerial decision / comment**

Annex 5: List of high-voltage substations involved in the 2023 automatic demand disconnection plan. (Confidential)

Appendix 6: List of high-voltage substations involved in the automatic demand disconnection plan as envisioned by 2027. (Confidential)

Appendix 7: LFDD design note (Confidential)