NC DCC REQUIREMENTS OF GENERAL APPLICATION

Following Art. 6(4) of the NC DCC

22 August 2019 – Submitted for approval

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INTRODUCTION

Article 6(4) of the NC DCC [1] states that the relevant system operator or the TSO submits a proposal for requirements of general application (or the methodology used to calculate or establish them), for approval by the competent entity, within two years of entry into force of the NC DCC, i.e. 7 September 2018. A similar requirement is included in the two other connection Network Codes, namely in Art. 7(4) of the NC RfG [2] and in Art. 5(4) of the NC HVDC [3]. The most stringent deadline for Elia, herein, is 17 May 2018, which is two years after the NC RfG entered into force as first connection Network Code.

The aim of this document is to synthetize the technical proposal of Elia, as relevant system operator or relevant TSO, regarding the Belgian implementation of the non-exhaustive requirements stated in the NC DCC. This document is the final version of the proposal for requirements of general application (hereafter named as 'general requirements', in accordance with Art. 6(4) of the NC DCC.

For the requirements related to the interface between the Elia Network and (closed) distribution systems, the DSOs and CDSO's were largely involved in developing the TSO proposal. However, these requirements have to be considered as an Elia proposal (as relevant TSO), whether their connection is located at federal or regional level. As a result, it should be aimed for to have one unique set of these requirements.

For the requirements related to demand facility providing demand response services, the proposal is mainly focusing on requirements set by Elia, as (relevant) TSO or relevant system operator but the public DSOs were largely involved in developing the TSO proposal and in defining their own implementation proposals (for demand facility providing demand response services connected to the distribution system). Therefore, part of these requirements are also set by the public DSOs, as relevant system operator.

To facilitate the implementation of the NC DCC requirements, Elia and the public DSOs have aligned as much as possible to increase the coherency and legal readability and to avoid as much as possible discrimination between Elia Network- or distribution-connected demand facilities providing demand response services to system operators, in terms of technical requirements.

On 17 May 2018, Elia submitted the general requirements proposals for NC DCC, but also for NC RfG and NC HVDC to the competent authorities together with the proposal of the amended Federal Grid Code [4] and the formal proposal on maximum capacity thresholds of type B, C and D Power Generating Modules. Elia organized beforehand a public consultation for all deliverables from 15 March 2018 up to and including 16 April 2018 for the Federal Grid Code, and 23 April 2018 for the general requirements. The public consultation on the maximum capacity thresholds B, C and D, took place from 19 May till 20 June 2017. This approach is in line with the vision of the Belgian Federal Administration (FOD/SPF Energy) [5] In the Regions the regulators approved the proposed thresholds for type B, C and D power generating modules.

This document represents the final result of Elia taken after discussions with the stakeholders in each of the relevant topics. During the last months, this document was gradually completed and presented to stakeholders, especially during the Federal Grid Code workshops, until all non-exhaustive general requirements were included.

The document follows the same article order as in the NC DCC: the proposal is organized per technical topic and per demand connection category.

The scope of this document contains especially, but is not limited to, the implementation proposal of the non-exhaustive general requirements in the NC DCC. To increase its readability, this document might also contain NC exhaustive requirements, implementation proposals of non-exhaustive requirements of the other connection NC, or other specific national/regional requirements for information purposes only, but certainly does not cover all of them.

With respect to the complete list of non-exhaustive requirements to be proposed as general requirements, Elia is taking as reference the ENTSO-E implementation guidance document (IGD) on 'Parameter of Non-exhaustive requirements' [6]. This document does not only mention the parameters to be defined per topic, but also which article of each connection NC should be considered as non-exhaustive and who should be the relevant system operator to define an implementation proposal. The TSO and DSOs are to be considered as 'relevant system operator', depending on the requirement.

In case the IGD would be modified, if relevant, possible future adaptations can be taken into consideration following consultation with the relevant stakeholders.

In this document, the Elia Network is defined as the electricity network on which Elia holds ownership rights or at least a utilization or operation right, and for which Elia is designated as system operator. Despite the fact that Elia also operates the transmission network at voltage levels above 70kV, the term Elia Network, for the purposes of this document, also includes the local transmission networks, and the regional transmission network and "Plaatselijk Vervoernet" all at 70kV and lower for which Elia is designated as system operator.

For any complaint against the relevant system operator regarding the requirements within this proposal, we refer to art. 6(8) of the NC DCC. The party having a complaint may introduce its complaint to the relevant regulatory authority.

SCOPE OF APPLICATION

As mentioned in article 3 of the NC DCC, the connection requirements set out in the NC DCC apply to:

a) New Elia Network-connected demand facilities;

b) New Elia Network-connected distribution facilities;

c) New distribution systems, including new closed distribution systems (CDS);

d) New demand units, used by a demand facility or a CDS to provide demand response services to relevant system operators and relevant TSOs.

These categories do not include storage devices except for any pumping module that only provides pumping mode (art. 5(1) and 5(2) of the NC DCC).

We refer to articles 3 and 4 of the NC DCC for more information on the application of general requirements to existing facilities and systems, to demand facilities and closed distribution systems with more than one demand unit.

GENERAL REQUIREMENTS

1. Connection of Elia Network-connected demand facilities, Elia Network-connected distribution facilities and Elia Network-connected distribution systems

1.1. General Frequency Requirements [Art. 12]

1.1.1. Frequency requirements [Art. 12 – 1]

The frequency withstand capability is defined in accordance with NC DCC Annex I and presented in the table below:

Frequency Range	Duration
47,5 Hz – 48,5 Hz	**30 minutes**
48,5 Hz – 49,0 Hz	**30 minutes**
49,0 Hz – 51,0 Hz	**Unlimited**
51,0 Hz – 51,5 Hz	**30 minutes**

Table 1 Minimum time periods to be capable of operating on different frequencies, deviating from a nominal value without disconnecting from the network.

For frequency range between 48.5Hz and 49.0Hz, Elia Network-connected demand facilities, Elia Network-connected distribution facilities and Elia Network-connected distribution systems shall be capable to remain connected to the Elia Network and to operate for a minimum period of 30 minutes. This is the recommended value for all the Continental

European Synchronous Area (CE SA) as per Connection Network Code Work Group (also the case for RFG NC).

1.1.2. Extended frequency range [Art. 12 – 2]

The agreement on wider frequency ranges, longer times for operation is a site specific requirement that shall be agreed upon between the relevant system operator or TSO and the owner of an Elia Network-connected demand facility or DSOs considering the system needs, their technically feasible frequency range and relative withstanding duration beyond the ones defined in paragraph 1.1.1.

1.2. General voltage requirements [Art. 13]

1.2.1. Automatic voltage disconnection [Art. 13 – 6]

There is no general need for automatic disconnection at specific voltages except for some individual connection projects. The terms and settings for automatic disconnection shall be agreed between the TSO and the owner of an Elia Network-connected demand facility or the DSO and will be included in the connection contracts and/or collaboration agreements

1.2.2. Voltage requirements for Elia Network-connected (closed) distribution systems in case of a voltage level at the connection/interconnection point below 110kV [Art. 13 – 7]

The voltage level at the connection/interconnection point to the Elia Network of (closed) distribution systems can be lower than 110kV in Belgium. More specifically, (closed) distribution systems can be connected at voltage levels of 70kV, 36kV, 30kV and lower.

For these voltage levels, following requirements are defined at the point of connection to the Elia Network:

Voltage range	Duration
0,90 pu – 1,118 pu	Unlimited

The following voltage base values are to be considered:

- As defined in the collaboration agreement between Elia and the distribution system owners for every specific point of connection/interconnection to the Elia Network for following voltage levels:
    - 5 kV
    - 6 kV
    - 10 kV
    - 11 kV
    - 12 kV
    - 15 kV

- 26 kV
- 30 kV

- 36 kV
- 70 kV

It has to be noticed that the requirement on the upper value of the voltage range does not replace the material voltage withstand capability which is required through the applicable Regional and Federal Grid Codes.

1.3. Short-Circuit requirements [Art. 14]

1.3.1. Short-circuit withstand capability [Art. 14 – 1]

The maximum short-circuit current at the point of connection/interconnection to the Elia Network that an Elia Network-connected demand facility or (closed) distribution system shall be capable of withstanding is specified in the table hereunder for each voltage level[1].

Spanningsniveau (kV)	Um Apparatuur (kV)	LIWV Uw (kV)	Idynamisch (kA)	Vermogen-schakelaars	Andere apparatuur in de hoogspanningsvelden		Verbinding in ondergrondse kabel / luchtlijn	
				Isc (kA)	I thermisch		I thermisch (3φ en 1φ)	
					Duur	(kA)	Duur	(kA)
380	420	1425	160 of 125 (*)	63 ou 50 (*)	>= 1 s	63 of 50 (*)	0,6 s	50
220	245	1050	125 of 100(*)	50 ou 40 (*)	>= 1 s	50 ou 40 (*)	0.6 s	40
150	170	750	125 of 100 (*)	50 ou 40 (*)	>= 1 s	50 ou 40 (*)	0.6 s	40
110	123	550	100	40	>= 1 s	40	0.6 s	Kabels: 40 Lijn: 40 of 31,5 (*)
70	82.5	380	100 of 80 of 50 (*)	40 of 31.5 of 20 (*)	>= 1 s	40 of 31.5 of 20 (*)	0.6 s	Kabels: 25 Lijn: 25 of 20(*)
36	40.5 (42)	200 ou ≥ 170 (*)	100 of 80(*)	40 of 31.5 (*)	>= 1.2 s	40 of 31.5 (*)	3φ: 1.2 s 1φ: 1,2 s	3φ: 31,5 1φ: 4
30	36	170	100 of 80 (*)	40 of 31.5 (*)	>= 1.2 s	40 of 31.5 (*)		
26	30	145	80 of 63 (*)	31.5 of 25 (*)	>= 2 s (1)	31.5 of 25 (*)		
15	17.5	95	63	25	>= 2 s (1)	25	3φ:2 s 1φ: 3,3 s	3φ: 25 1φ: 4
11-12	17.5	95	63	25	>= 2 s (1)	25		
10	12	75	63	25	>= 2 s (1)	25		
6	7.2	60	63	25	>= 2 s (1)	25		

(*): volgens de beslissing van de netbeheerder

(1): corresponderend met de uitschakeltijd van de reservebeveiliging

1.3.2. Communication of a change in maximum short-circuit current [Art. 14 – 3 , 14 – 5, 14 – 8, 14 – 9]

These articles are related to a specific situation/event. These articles present requirements that will be particularized for the cases indicated there.

[1] The French version of this table is available in the Federal Grid Code [4]

In general no changes in short-circuit withstand capability are expected as they will defined in a non-site specific manner more precisely depending on the voltage level as indicated in paragraph 1.3.1.

1.4. Reactive Power Requirements [Art. 15]

1.4.1. Reactive power exchange between the Elia Network and Elia Network-connected demand facilities [Art. 15 – 1 (a)]

A technical capability must be present in the Elia Network-connected demand facilities to be able to keep the reactive power exchange at the connection point, between the following limits:

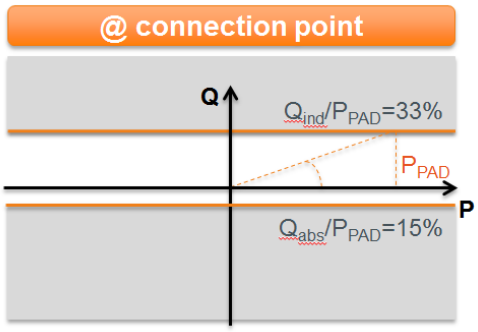
- For the import of reactive power (consumption), the limit is fixed to 33% of the maximum import or export capacity of the connected demand facility,
- For the export of reactive power (production), the limit is fixed to 15% of the maximum import or export capacity of the connected demand facility.

The TSO can grant exceptions for a specific connection point, if the technical or financial system advantages of the exception demonstrated before such an exception is granted. Therefore, the owner of an Elia Network-connected demand facility must address a motivated request to the TSO. The TSO will analyse analyzes the reasons cited. In case the TSO considers that the reasons given for the exception do not contain sufficient evidence, are not justified, are not linked to technical or economic reasons or are contrary to the regulation, it will provide a motivated justification to the owner of the Elia Network-connected demand facility. In accordance with the applicable regulation, the owner of the Elia Network-connected demand facility may appeal the TSO's decision to the concerned regulatory authority.

The Power Put At Disposal (PPAD) is fixed for the import and export of power from or to the Elia Network. These values are fixed in the connection contract. The above-mentioned 'maximum import or export capacity' concerns the maximum of both PPAD values.

These requirements ensure that a sufficient amount of reactive power sources will be present in the Elia Network-connected demand facility but do not specify anything about their usage (in operations).

So, without prejudice to other operational rules, these capabilities have to be demonstrated during the connection process for a limited number of predefined reference scenarios but do not exclude operation with reactive power exchanges outside the above-mentioned limits.



1.4.2. Reactive power exchange between the Elia Network and Elia Network-connected (closed) distribution systems [Art. 15 -1 (b), Art. 15 – 1 (c)]

The Elia Network or the (closed) distribution systems contain power transformers that transform voltage levels of 30kV and higher to voltage levels below 30kV.

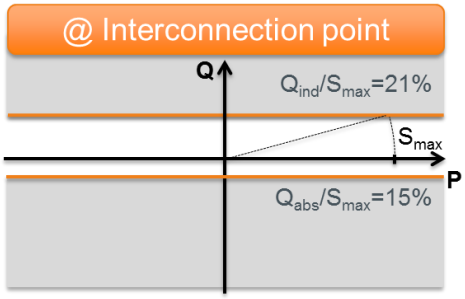
As the reactive losses in power transformers are not negligible (~12%[2] of the active power flow), the requirements on reactive power exchange between the Elia Network and (closed) distribution systems need to take this aspect into account.

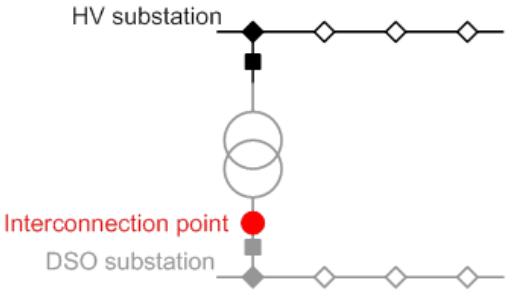
The import of reactive power (consumption) typically occurs at moments of high active power consumption. This also means that the reactive power losses in the power transformers are high in those situations. The export of reactive power typically occurs at moments of low active power exchange between the Elia Network and (closed) distribution system. Reactive power losses in the distribution power transformers are negligible in those situations.

A technical capability must be present in the connected (closed) distribution system (including capabilities of production unit connected to the (closed) distribution system) to be able to keep the reactive power exchange at the connection/interconnection point, between the following limits:

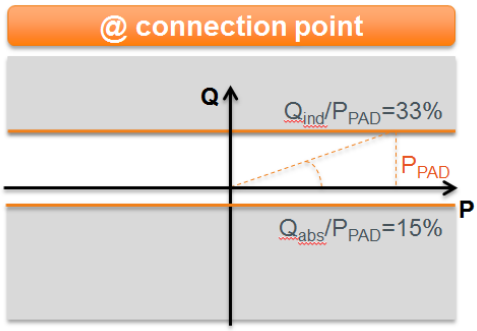
- For the import of reactive power (consumption) the limit is fixed to
    - 33% of the maximum import or export capacity of the connected (closed) distribution system if the voltage level at the connection/interconnection point of the (closed) distribution system is equal or higher than 30kV.
    - 21% of the maximum import or export capacity of the connected (closed) distribution system if the voltage level at the connection/interconnection point of the (closed) distribution system is lower than 30kV.
- For the export of reactive power (production) the limit is fixed to 15% of the maximum import or export capacity of the connected (closed) distribution system in both cases (not dependent of the voltage level at the connection/interconnection point).

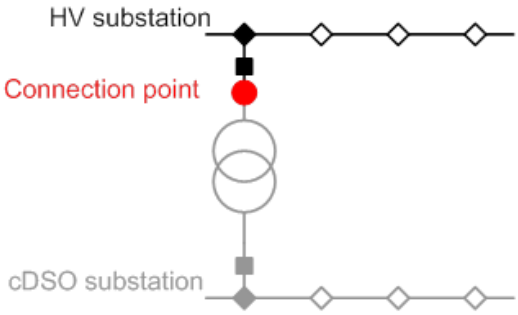
[2] The short-circuit voltage of distribution power transformers is 12% in average.





Typical representation of a TSO-DSO interconnection





Typical representation of TSO-CDSO connection

The maximum import or export capacity is equal to:

- the Power Put At Disposal (PPAD) in case of an Elia Network-connected closed distribution system. The PPAD is fixed for the import and export of power from or to the Elia Network. These values are fixed in the connection contract. The above mentioned 'maximum import or export capacity' concerns the maximum of both PPAD values;
- the Power Put At Disposal (PPAD) in case of Elia Network-connected distribution system (closed distribution system excluded) with a voltage level at the interconnection point equal or higher than 30kV. The PPAD is fixed for the import and export of power from or to the Elia Network. These values are fixed in the collaboration agreement. The above mentioned 'maximum import or export capacity' concerns the maximum of both PPAD values;
- the minimal available exchange capacity at the interconnection point when taking into account the contingencies on grid elements (N-1), i.e. $S_{nom, N-1}$ in case of distribution system (closed distribution system excluded) with a voltage level at the interconnection point lower than 30kV.

Exceptions can be allowed for a specific interconnection point or a set of connection points, if technical or financial benefits are demonstrated through a joint analysis between Elia and the owner of an Elia Network-connected (closed) distribution system as mentioned in [Art. 15 – 1 (c)].

In this perspective, in case of difficulty to reach the above mentioned requirements with the available assets within the (closed) distribution system (including capabilities of production unit connected to the (closed) distribution system) for a given (or a set of) interconnection point(s), a joint analysis between Elia and the owner of an Elia Network-connected (closed) distribution system will be conducted before an investment should be done. The goal of this joint analysis is to guarantee that the above-mentioned limits are reached (either for each

separate interconnection point or for a set of interconnection points of the (closed) distribution grid using the interconnection of the (distribution) grid) and to guarantee thatthe potential investment satisfies the overall technical and economical optimum.

Those investments meeting this technical and economical optimum shall nevertheless also consider reactive power sources (including capabilities of production unit connected to the (closed) distribution system) within the Elia Network-connected (closed) distribution system.

These requirements do not specify anything about the usage (in operations) of the reactive power sources that are present in the Elia Network-connected (closed) distribution system

So, without prejudice to other operational rules, these capabilities have to be demonstrated during the connection process for a limited number of predefined reference scenarios but do not exclude operation with reactive power exchanges outside the above-mentioned limits.

1.4.3. Reactive power exchange between the Elia Network and Elia Network-connected (closed) distribution systems at low active power flow [Art. 15 – 2]

According to the Art 15.2 of NC DCC, the relevant TSO may require that Elia Network-connected distribution systems have the capability at the connection/interconnection point to not export reactive power (at reference 1 pu voltage) at an active power flow of less than 25 % of the maximum import capability.

After analysis, Elia confirms that this requirement reflects a need for the global Belgium zone to be able to manage the reactive power flows and operate the system with the same quality of service in the future as it is nowadays, taking into account the expected evolution of energy mix in Belgium.

In this context, a technical capability must be present in the Elia Network-connected (closed) distribution system (including capabilities of production unit connected to the (closed) distribution system) to be able to not export reactive power (at reference 1 pu voltage) at the connection/interconnection point at an active power flow of less than 25% of the maximum import capacity.

The maximum import or export capacity is equal to:

- the Power Put At Disposal (PPAD) in case of an Elia Network-connected closed distribution system. The PPAD is fixed for the import and export of power from or to the Elia Network. These values are fixed in the connection contract. The above mentioned ‘maximum import or export capacity’ concerns the maximum of both PPAD values;
- the Power Put At Disposal (PPAD) in case of Elia Network-distribution system (closed distribution system excluded) with a voltage level at the connection/interconnection point equal or higher than 30kV.
- the minimal available exchange capacity at the connection point when taking into account the contingencies on grid elements (N-1), i.e. $S_{nom, N-1}$ in case of distribution system (closed distribution system excluded) with a voltage level at the connection/interconnection point lower than 30kV.

In case of difficulty to reach the above-mentioned requirement with the available assets within the (closed) distribution system (including capabilities of production unit connected to the (closed) distribution system) for a given (or a set of) connection/interconnection point(s), a joint analysis between Elia and the owner of an Elia Network-connected (closed) distribution

system will be conducted before an investment should be done. The goal of this joint analysis is:

1. to verify whether the above-mentioned requirement is justified (according to art 15.2 of the DCC NC) either for each separate connection/interconnection point or for a set of connection/interconnection points of the distribution grid;
2. then (if this requirement is confirmed), to guarantee the capability to reach the above-mentioned limits (either for each separate connection/interconnection point or for a set of connection/interconnection points of the (closed) distribution grid using the interconnection of the (distribution) grid) ;
3. to guarantee that, if an investment has to be done, it is the overall technical and economical optimum. This implies that these investments shall be done at the most appropriate grid segment by the relevant System Operator, and it responds to the needs of the system at the lowest overall societal costs on a long-term basis.

Note that, accorded to art 15.2 of the DCC NC, if this requirement is not justified based on the joint analysis (see point 1 above), Elia and the operator of an Elia Network-connected distribution system will agree in the collaboration agreement on alternative requirements according to the outcomes of a joint analysis and based on the overall technical and economical optimum.

Those investments meeting this technical and economical optimum shall nevertheless also consider reactive power sources (including capabilities of production unit connected to the (closed) distribution system) within the Elia Network-connected (closed) distribution system.

These requirements do not specify anything about the usage (in operations) of the reactive power sources that are present in the Elia Network-connected (closed) distribution system.

So, without prejudice to other operational rules, these capabilities have to be demonstrated during the connection process for a limited number of predefined reference scenarios but do not exclude operation with reactive power exchanges outside the above-mentioned limits.

1.4.4. Metrics to express the reactive power capability ranges [Art. 15 – 1 (d)]

All limits are expressed as a percentage of the maximum import or export capacity. The power factor is not used.

1.5. Protection requirements [Art. 16]

1.5.1. Devices and settings required to protect the Elia Network [Art. 16 – 1]

The protection schemes and settings relevant for the Elia Network-connected demand facility or the Elia Network-connected(closed) distribution system are to be determined and agreed site specific by Elia and the owner of the Elia Network-connected demand facility or operator of the Elia Network-connected (closed) distribution system, and will be included in the connection contracts and/or collaboration agreements.

1.6. Control requirements [Art. 17]

1.6.1. Schemes and settings of different control devices [Art. 17 – 1]

The RTSO and the owner of an Elia Network-connected demand facility or the operator of an Elia Network-connected (closed) distribution system shall agree on the schemes and settings of the different control devices relevant for system security of the Elia Network-connected demand facility or the Elia Network-connected distribution system, and include them in the connection contracts and/or collaboration agreements

1.7. Information exchange [Art. 18]

1.7.1. Specifications of information exchange equipment [Art. 18 – 1, 18 – 2, 18 – 3]

For real-time information exchange between Elia Network-connected demand facilities and the RTSO, or between Elia Network-connected (closed) distribution systems[3] and the RTSO, the RTSO applies the TASE 2 (IEC 60870-6) and IEC104 IEC 60870-5-104 Transmission Protocol standards. These standards support time stamping. As standards can change over time Elia will make them publically on its website.

It is important to implement these protocols on a private transmission path (not through the public internet) for reliability and cybersecurity reasons. Regarding voice communication, the requirements concerning backup power supply and equipment redundancy are defined by Art. 41 – 1 of Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a Network Code on electricity emergency and restoration.

1.8. Demand disconnection and demand reconnection [Art. 19]

1.8.1. Low Frequency Demand Disconnection [Art. 19 – 1 (a), Art. 19 – 1 (b), Art. 19 – 1 (c)]

Elia as RTSO will require operators of an Elia Network-connected distribution system to provide automatic low frequency demand disconnection capabilities. The Elia Network contains the power transformers that transform voltage levels of 30kV and higher to voltage levels below 30kV. Therefore, this requirement will only apply to a very limited number of cases.

Currently, the low frequency triggers will disconnect all the power transformers at the interconnection point (non-selective), resulting in a disconnection of the complete demand and production at the interconnection point. This is why the automatic frequency disconnection is currently not implemented in every case. In the near future an automatic demand disconnection in stages (selective) could be required. The settings of these

[3] The requirement is applicable to the information exchanges on the interconnection point or connection point with respectively the distribution or closed distribution system, and does not concern grid users connected to (closed) distribution grids

automatisms will be communicated at the design phase of the connection, during the connection process.

Elia does not currently require owners of Elia Network-connected demand facilities and operators of Elia Network-connected closed distribution systems to provide automatic low frequency demand disconnection capabilities.

As mentioned in [8] the reliability, dependability and speed of a Low Frequency Demand Disconnection scheme are key to secure a power system in case of major disturbances. Such a scheme typically covers several actions:

- The operating time of the under-frequency relays (measurement, individual relay logic and relays combination logic);
- The time of tele protections in case of a transfer trip (in case the underfrequency load shedding relay has to trip a remote load);
- The interface relays (in case the underfrequency load shedding relay and the circuit breaker to trip belong to different entities);
- The time of operation of the circuit breaker.

The operating time of 150ms specified in [Art. 19 – 1(c)] should be interpreted as a maximum boundary for the frequency relay operating time. The specifications of the compliance testing of the frequency relay will be defined by Elia in accordance with article 37 of the NC DCC.

1.8.2. Low Voltage Demand Disconnection [Art. 19 – 2 (a), Art. 19 – 2(b)]

Elia as TSO will not require to the operators of an Elia Network-connected (closed) distribution system and owners of Elia Network-connected demand facilities to provide low voltage disconnection capabilities.

1.8.3. Blocking of on load tap changers [Art. 19 – 3 (a), Art. 19 – 3 (b)]

Elia requires automatic on load tap changer block on transformers that supply distribution systems. The specifications of this automatism will be communicated to Elia before being installed, for example at the design phase of the connection process. The Elia Network contains power transformers that transform voltage levels of 30kV and higher to voltage levels below 30kV. As a consequence the on load tap changer blocking will be installed by the TSO in many cases.

These requirements do not apply to Elia Network-connected closed distribution facilities.

1.8.4. Reconnection [Art. 19 – 4 (a), Art. 19 – 4 (b), Art. 19 – 4 (c)]

In general, the RTSO does not allow automatic reconnection, as a manual reconnection after clearance of the control center of Elia is preferred. In specific cases, Elia could allow automatic reconnection. The latter will be fixed in connection contracts for Elia Network-

connected demand facilities and closed distribution systems, and TSO-DSO agreements for Elia Network-connected distribution systems.

The settings of synchronisation devices are site specific and to be agreed with owner of an Elia Network-connected demand facility or the operator of an Elia Network-connected (closed) distribution system.

In case of remote disconnection of a Elia Network-connected demand facility or (closed) distribution facility due to scarcity, Elia will require to complete the disconnection within 10 minutes. This value will however be confirmed during the design phase of the connection, during the connection process.

1.9. Power quality [Art. 20]

The level of allowed distortion or fluctuation of the supply voltage on the network at the connection/interconnection point of an Elia Network-connected demand facility or an Elia Network-connected (closed) distribution system will not alter from what is stated in the applicable Regional and Federal Grid Codes.

1.10. Simulation models [Art. 21]

1.10.1. Models or equivalent information showing the behavior in steady and dynamic states [Art. 21 – 2, 21 – 3]

Elia will not require the specific simulation models mentioned in the NC DCC showing the behavior of the Elia Network-connected demand facilities and Elia Network-connected (closed) distribution systems in steady and dynamic states.

Elia will however require specific data of Elia Network-connected demand facilities and Elia Network-connected closed distribution systems as defined during the connection process. The required data concerning transmission-connected distribution systems are defined by the TSO-DSO collaboration agreement.

1.10.2. Recordings to compare with model [Art. 21 – 5]

Elia will not require the specific recordings of the Elia Network-connected demand facilities and Elia Network-connected (closed) distribution systems as mentioned in the NC DCC, in order to compare the response of the model with these recordings.

2. Connection of demand units used by a demand facility or a closed distribution system to provide demand response services to system operators

As stated in Art. 3 and Art. 4 – 1 of the NC DCC, the requirements for demand units providing demand response services are only applicable on new demand units. Hence, existing demand units that want to offer demand response services, are out of scope.

2.1. Demand units providing active power control, reactive power control and transmission constraint management [Art. 28]

2.1.1. Definition of a extended frequency range [Art. 28 – 2 (a)]

The frequency requirements defined in section 1.1. are also applicable to demand units with demand response active power control, demand response reactive power control, or demand response transmission constraint management, or demand response system frequency control, either individually or, where it is not part of an Elia Network-connected demand facility, collectively as part of demand aggregation through a third party.

2.1.2. Definition of voltage range if connected at a voltage below 110kV [Art. 28 – 2 (c)]

The normal operational voltage range at the connection point at a voltage below 110kV across which a demand unit delivering demand response system frequency control shall be capable of operating, corresponds to the one defined in paragraph 1.2.3.

2.1.3. Time period to modify power consumption [Art. 28 – 2 (f)]

The time period within which a demand unit delivering demand response needs to adjust its power consumption depends on the type of offered demand response service. These time periods are defined in the terms and conditions (T&C) of these services. As they tend to evolve in time, fixed values cannot be given.

2.1.4. Notification of changes in demand response capacity [28 – 2 (i)]

The notification of a change in demand response capacity shall be carried out as per the contractual provisions of the terms and conditions (T&C) of this service.

2.1.5. Technical specifications to enable transfer of information [Art. 28 – 2 (e), 28 – 2 (l)]

For active or reactive power control and transmission constraint management services, the technical communication requirements are defined as per the prevailing contractual provisions for ancillary services (MVAR, aFRR, mFRR services) or prevailing contractual provisions between the distribution system operator and the flexibility service provider.

2.1.6. Definition of the ROCOF maximum value [Art. 28 – 2 (k)]

The requirement for Rate of Change of Frequency (RoCoF) withstanding capability is aligned with the requirements for generators (RfG Article 13.1.(b)) which is defined in coordination with TSOs in the European Continental Synchronous area. The current applicable ENTSO-e Implementation Guidance Document (IGD) proposes a profile taking 2.0 Hz/s for a duration of 500ms as the minimum RoCoF to be withstood as per the Figure 1.

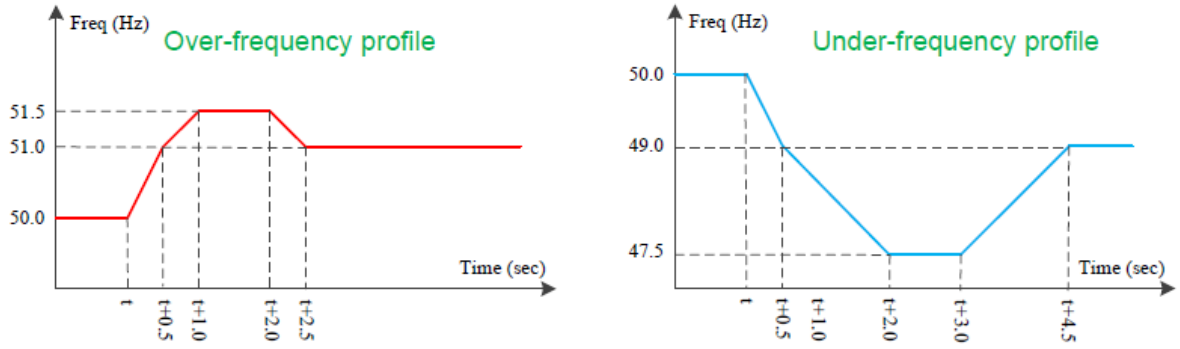


Figure 1 Overfrequency and underfrequency withstanding capabilities

2.2. Demand units with demand response system frequency control [Art. 29]

All frequency related technical requirements are coordinated with TSOs in the European Continental Synchronous area. The implementation of the Article 29 of the DCC NC is covering only the technical capabilities of LFSM-U and LFSM-O emergency functions whenever identified necessary and required by Elia. With respect to Frequency Containment (FCR) service, the relevant technical requirements are defined by the general framework for FCR Service.

2.2.1. Definition of an extended frequency range [Art. 29 – 2 (a)]

This requirement is defined according to Art. 29 - 2(a) of NC DCC. The frequency ranges and extended range, defined in section 1, are also applicable to demand units with demand response active power control, demand response reactive power control, demand response transmission constraint management, or demand response system frequency control, either individually or, where it is not part of an Elia Network-connected demand facility, collectively as part of demand aggregation through a third party.

2.2.2. Definition of voltage range if connected at a voltage below 110kV [Art. 29 – 2 (c)]

The normal operational voltage range at the connection point at a voltage below 110kV across which a demand unit delivering demand response system frequency control shall be capable of operating, corresponds to the one defined in paragraph 1.2.3.

2.2.3. Definition of allowed frequency dead band [Art. 29 – 2 (d)]

The requirement is aligned with ENTSO-E IGD prescribing the allowed maximum frequency dead band for LFSM-U and LFSM-O emergency system frequency control as +-200 mHz for the Continental Europe synchronous area. Therefore resulting in under-frequency threshold of 49.8 Hz and over-frequency threshold of 50.2 Hz.

2.2.4. Maximum frequency deviation to respond [Art. 29 – 2 (e)]

The current draft requirement is aligned with ENTSO-E IGD recommending the maximum frequency deviation to respond for LFSM-U and LFSM-O emergency system frequency control respectively as – 49 Hz and 51.5 Hz for the Continental Europe synchronous area.

2.2.5. Definition of the rapid detection and response to frequency system changes [Art. 29 – 2 (g)]

The requirement proposes that the parameters for the rapid detection and response in case of LFSM-U and LFSM-O are defined as followed:

- Linear proportional response: this shall be achieved following a DR SFC droop: $S_{DR\ SFC} = (\frac{\Delta f}{fn})/(\frac{-\Delta P_{DR}}{Pref})$. The equivalent droop of an aggregated response over several units should be adjustable to achieve an overall droop between 2% and 12%.

2.3. Demand units with demand response very fast active power control [Art. 30]

There are no minimum requirements for inertia contribution. This will not be considered necessary as of today within the synchronous area.

ACRONYMS

aFRR	Automatic Frequency Restoration Reserve
CDSO	Closed Distribution System Operator
DCC	Demand Connection Code
DSO	Distribution System Operator
FCR	Frequency Containment Reserve
HVDC	Network Code on High Voltage Direct Current
IGD	ENTSOE-E Implementation Guidance Document
LFSM	Limited Frequency Sensitive Mode
mFRR	Manual Frequency Restoration Reserve
NC	Network Code
PPAD	Power Put At Disposal
RfG	Requirement for Grid connection of generators
RoCoF	Rate of Change of Frequency
RTSO	Relevant Transmission System Operator
TSO	Transmission System Operator

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