

**Requirements of general application resulting from  
Commission Regulation (EU) 2016/1388 of 17 August  
2016 establishing a network code on demand  
connection (NC DC)**

PSE S.A.

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## Introduction

These requirements of general application resulting from Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a network code on demand connection (hereinafter: Requirements) constitute a document containing substantive resolutions concerning the technical requirements resulting from NC DC<sup>1</sup> and subject to approval by the competent regulatory authority, which PSE S.A. has been obliged to prepare on the basis of NC DC and Article 9ga (1) of the Energy Law<sup>2</sup>. In line with NC DC, the requirements of general application are to be developed by the system operator within whose territory the connection location is situated, i.e. TSO or DSO, as well as the designated transmission system operator. The Republic of Poland has taken advantage of the possibility of transferring the obligation to establish the requirements of general application from relevant system operators to PSE S.A. as the transmission system operator referred to in Article 6(9) of NC DC. The Requirements developed by PSE S.A. were subject to the process of consultations with DSOs and market participants.

If not indicated otherwise, articles in this document refer to articles of NC DC.

**The table below presents abbreviations used in this *Proposal* that have not been directly defined in NC DC. The remaining abbreviations and terms used in the *Proposal* are consistent with the definitions laid down in NC DC.**

NC DC	Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a network code on demand connection
Relevant system operator	the relevant system operator to whose network demand is connected
TSO	Transmission System Operator
DSO	Distribution System Operator
Automatic LFDD	Automatic low frequency demand disconnection scheme

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<sup>1</sup> Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a network code on demand connection, OJ EU, 18.8.2016 L223/10 (NC DC).

<sup>2</sup> Act of 10 April 1997 – Energy Law (Journal of Laws of 2018, item 755, as amended)

## **Requirements of general application**

### **Article 12(1) - Time period for operation**

Transmission-connected demand facility, transmission-connected distribution facility or distribution system shall be capable of remaining connected to the network and operating at the following frequencies and in the following minimum time periods:

Frequency range	Operating time
47.5 Hz - 48.5 Hz	30 minutes
48.5 Hz - 49.0 Hz	30 minutes

### **Article 13(1) - Voltage ranges and time periods for operation**

Transmission-connected demand facility, transmission-connected distribution facility or transmission-connected distribution system shall be capable of remaining connected to the network and operating at the following voltage ranges and in the following minimum time periods:

- for networks with rated voltage from 110 kV to 300 kV

Voltage range	Operating time
1.118 pu - 1.15 pu	60 minutes

- for networks with rated voltage from 300 kV to 400 kV

Voltage range	Operating time
1.05 pu - 1.10 pu	60 minutes

### **Article 14(4) – Threshold for the maximum short-circuit current after an unplanned event**

The specified threshold value should meet the following conditions:

- i. it should not be lower than the maximum short-circuit current specified by the TSO in accordance with Article 14(1) of NC DC that the affected transmission-connected demand facility or the transmission-connected distribution system shall be capable of withstanding;
- ii. it should not be higher than the maximum short-circuit current that the affected transmission-connected demand facility or the transmission-connected distribution system shall be capable of withstanding.

### **Article 14(6) – Threshold for the maximum short-circuit current before a planned event**

The specified threshold value should meet the following conditions:

- i. it should not be lower than the maximum short-circuit current specified by the TSO in accordance with Article 14(1) of NC DC that the affected transmission-connected demand facility or the transmission-connected distribution system shall be capable of withstanding;
- ii. it should not be higher than the maximum short-circuit current that the affected transmission-connected demand facility or the transmission-connected distribution system shall be capable of withstanding.

### **Article 15(1)(a) - Requirements for demand facilities**

The actual reactive power range for importing and exporting reactive power shall not be wider than:

- i. 40 % (i.e. 0.928 power factor  $\cos\phi$ , which corresponds to power factor  $\tan\phi=0.4$ ) of the larger of the maximum import capability or maximum export capability during reactive power import (consumption), provided that in a normal state of network operation average 15-minute values of reactive power consumption shall not exceed 40% (i.e. 0.928 power factor  $\cos\phi$ , which corresponds to power factor  $\tan\phi=0.4$ ) of active power imported from the transmission network; and
- ii. 0 % (i.e. 1 power factor  $\cos\phi$ , which corresponds to power factor  $\tan\phi=0$ ) of the larger of the maximum import capability or maximum export capability during reactive power export (production);

### **Article 15(1)(b) - Requirements for distribution systems**

The actual reactive power range for importing and exporting reactive power shall not be wider than:

- 1) Where connection of the distribution system takes place in an EHV/110kV transformer bay:
  - i. 40% (i.e. 0.928 power factor  $\cos\phi$ , which corresponds to power factor  $\tan\phi=0.4$ ) of the larger of the maximum import capability or maximum export capability during reactive power import (consumption); and
  - ii. 0% (i.e. 1.0 power factor  $\cos\phi$  of the larger of the maximum import capability or maximum export capability during reactive power export (production);
- 2) Where connection of the distribution system takes place in a TSO-owned 110kV switchgear bay:
  - i. 40% (i.e. 0.928 power factor  $\cos\phi$ , which corresponds to power factor  $\tan\phi=0.4$ ) of the larger of the maximum import capability or maximum export capability during reactive power import (consumption); and
  - ii. 40% (i.e. 0,928 power factor  $\cos\phi$ , which corresponds to power factor  $\tan\phi=0.4$ ) of the larger of the maximum import capability or maximum export capability during reactive power export (production).

### **Article 15(1)(d) - Metric other than power factor**

In order to set out equivalent reactive power capability ranges, power factor  $\text{tg}\varphi$  shall also be used, calculated as the ratio of reactive power to active power.

### **Article 15(2) - Capability to not export reactive power**

No requirement is made for transmission-connected distribution systems to have the capability at the connection 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

### **Article 15(4) - Reactive power management**

The condition for the distribution system operator to request the TSO to consider its system for reactive power management is the fulfilment by the distribution system operator of the requirement of Article 15(1) and (2) of Commission Regulation 2016/1388 and documents resulting from that Regulation.

### **Article 18(1) - Information exchange, demand facilities**

Transmission-connected demand facilities shall be equipped with telecommunication devices that allow data to be exchanged according to the protocols set out in the standards:

- a) PN-EN 60870-6. Telecontrol equipment and systems -- Part 6. Telecontrol protocols compatible with ISO standards and ITU-T recommendations (with regard to the ICCP/TASE.2 protocol); or
- b) PN-EN 60870-5-104. Telecontrol equipment and systems -- Part 5-104: Transmission protocols -- Network access for PN-EN 60870-5-101 using standard transport profiles;

with the specified timestamping, in order to exchange information between the TSO and the transmission-connected demand facility.

### **Article 18(2) - Information exchange, distribution systems**

The transmission-connected distribution system shall be equipped with telecommunication devices that allow data to be exchanged according to the protocols set out in the PN-EN 60870-6 standard. Telecontrol equipment and systems – Part 6. Telecontrol protocols compatible with ISO standards and ITU-T recommendations (with regard to the ICCP/TASE.2 protocol) with the specified timestamping, in order to exchange information between the TSO and the transmission-connected distribution system.

### **Article 18(3) - Information exchange, distribution systems**

Data acquisition from a demand facility is performed with the use of the protocols specified in the standard:

- a) PN-EN 60870-6. Telecontrol equipment and systems -- Part 6. Telecontrol protocols compatible with ISO standards and ITU-T recommendations (with regard to the ICCP/TASE.2 protocol); or
- b) PN-EN 60870-5-104. Telecontrol equipment and systems -- Part 5-104: Transmission

protocols -- Network access for IEC 60870-5-101 using standard transport profiles.

Information and data exchange with the DSO's SCADA systems is performed with the use of the protocol set out in PN-EN 60870-6. Telecontrol equipment and systems -- Part 6. Telecontrol protocols compatible with ISO standards and ITU-T recommendations (with regard to the ICCP/TASE.2 protocol).

The minimum scope of data provided to the system operator in case of transmission-connected demand facilities includes:

- i. active and reactive power at the connection point,
- ii. the minimum and maximum power range to be curtailed,
- iii. states of circuit breakers and disconnectors in the power consumption circuit,
- iv. voltage at the connection point,
- v. frequency value at the connection point.

The minimum scope of data provided to the system operator in the case of a transmission-connected distribution system includes:

- i. state of all circuit breakers and disconnectors in 110kV substations,
- ii. active and reactive power in 110kV substation line bays,
- iii. active and reactive power in 110 kV substation transformer bays,
- iv. frequency value in 110 kV substations,
- v. tap positions of transformers connected to the transmission system;
- vi. voltage on busbars in 110 kV substations,
- vii. reactive power in the 110 kV substation reactor and capacitor bay,
- viii. the best available data on aggregated generation for 110 kV/MV transformers per primary energy source in the DSO area,
- ix. the best available data on aggregated demand for 110kV/MV transformers in the DSO area.

### **Article 19(1)(a) - Low frequency demand disconnection, provision of capability and disconnection trigger**

Each transmission-connected demand facility owner shall provide capabilities that enable automatic low frequency disconnection of a specified proportion of their demand. Both for transmission-connected distribution system operators and transmission-connected demand facility owners, disconnection trigger based on a combination of low frequency and rate-of-change-of-frequency is not specified.

### **Article 19(1)(c) - Low frequency demand disconnection, relay parameters**

Low frequency demand disconnection capabilities shall enable operation from 0.5 pu reference voltage.

Operating time is defined as the response time of the device performing automatic LFDD (total



time of device operation) in order to deliver the control signal to a circuit breaker, circuit breaker control signal distribution and circuit breaker operation time.

### **Article 19(2)(a) - Low voltage demand disconnection functional capabilities of distribution facilities**

No low voltage demand disconnection functional capabilities is required for the transmission-connected distribution facilities.

### **Article 19(2)(b) - Low voltage demand disconnection functional capabilities of demand facilities**

No low voltage demand disconnection functional capabilities is required for the transmission-connected demand facilities.

### **Article 19(2)(c) - Implementation of tap changer blocking**

- Responsible party: TSO

Transformers connected to the closed network through which consumers' equipment, facilities and networks are fed shall be equipped with on load tap control with the tap changer blocking capability.

### **Article 19(2)(d) - Equipment for tap changer blocking**

Equipment for on load tap changer blocking shall be installed in coordination with the relevant TSO.

### **Article 19(3)(a) - Automatic/manual OLTC blocking**

The transformer at the transmission-connected distribution facility shall be capable of automatic or manual on load tap changer blocking. Blocking shall be possible locally or remotely from the control room. The tap changer shall allow blocking to be effected at the current position or a position set in response to an instruction within a time of not more than 60 minutes from the giving of the instruction. The recommended time shall not exceed 30 minutes.

### **Article 19(4)(a) - Demand reconnection conditions**

No capability of automatic reconnection after disconnection is used. Manual reconnection, following disconnection, is possible only at the TSO's instruction. The reconnection instruction is issued on the basis the current assessment of the system state and operational security.

### **Article 20 - Power quality**

Unless the TSO decides otherwise, the following requirements shall be met for the operator's network operating without disruptions, at the connection point of demand facilities or

distribution facilities:

1. in each week, 95% of the set of 10-minute average RMS values of supply voltage (applicable also in a disturbed state of the demand network operation) shall fall within the following deviation range:
  - a.  $\pm 10\%$  of rated voltage for a network with rated voltage of 110 kV and 220 kV,
  - b.  $+5\%$  /  $-10\%$  of rated voltage for a network with rated voltage of 400 kV;
2. for 95% of time each week, the long-term flicker indicator Plt caused by supply voltage fluctuations shall not be greater than 0.8;
3. during each week, 95% of the set of 10-minute average RMS values of the negative sequence of symmetrical component of supply voltage shall fall within the 0% to 1% range of the positive sequence component value;
4. demand facilities and transmission-connected distribution systems shall not cause the presence of higher voltage harmonics with values exceeding the limits referred to in PN-EN 50160 Voltage characteristics of electricity supplied by public distribution systems.

Connection of equipment, facilities and networks, as well as the modernisation of already connected equipment, facilities and networks shall not cause the acceptable limits of electricity quality parameters to be exceeded at points of network connection of other entities or reduce the electricity supply reliability level.

### **Article 21(2) - Required simulation models and equivalent information**

Except the cases referred to in Article 21(2) of NC DC, the transmission-connected demand facility owner or transmission-connected distribution facility owner shall also provide updated simulation models or equivalent information in the case of any changes to facilities impacting the behaviour of the facility in steady and dynamic states.

### **Article 21(3) - Format of simulation models and equivalent information**

Simulation models or equivalent information showing the behaviour of the transmission-connected demand facility, or the transmission-connected distribution system, or both, in steady and dynamic states, shall, unless the TSO has decided otherwise, be consistent with the CGMES 2.4.15 (Common Grid Model Exchange Specification) standard or its newer version.

### **Article 21(5) - Requirements for the performance of recordings**

The device(s) being a disturbance recorder shall perform the following functions:

1. recording fast disturbances;
2. recording system (slow-changing) disturbances.

Recordings in a bay corresponding to the connection point or in bays feeding a part of a demand facility shall include at least the following parameters:

1. record analogue signals in each bay: 3 voltages and 3 phase currents as well as 3U0

voltage and 310 current.

2. record frequency;
3. record main protection activation signals, all tripping operation signals of protection or automation schemes, all teleprotection signals (transmission and reception), start signals from auto-reclosing and automatic transfer switch systems;
4. record slow-changing profiles, record entries in the Comtrade format.

The recording trigger thresholds shall be as follows:

1. for voltages (effective voltage levels):
  - a. for of 400 kV or higher voltage networks:  $U < 0.90$  pu or  $U > 1.05$  pu;
  - b. for 220 kV and 110 kV networks:  $U < 0.90$  pu or  $U > 1.118$  pu;
2. for frequency:
  - a.  $f < 49.9$  Hz or  $f > 50.2$  Hz.

### **Article 28. Specific provisions for demand units with demand response active power control, reactive power control and transmission constraint management**

Specific requirements under Article 28(2)(c), (e), (f), (h), (i), (k), (l) of NC DC shall be specified as part of a future update of requirements of general application.

### **Article 29. Specific provisions for demand units with demand response system frequency control**

Specific requirements under Article 29(2)(c), (d), (e), (g) of NC DC shall be specified as part of a future update of requirements of general application.