

SONI and NIE Networks' proposal for the general application of technical requirements in accordance with Articles 12 – 21 and Articles 27 - 30 of the Commission Regulation (EU) 2016/1388 establishing a Network Code on Demand Connection

18 September 2018



Disclaimer

'SONI Ltd as the Transmission System Operator (TSO) for Northern Ireland makes no warranties or representations of any kind with respect to the information contained in this document. We accept no liability for any loss or damage arising from the use of this document or any reliance on the information it contains. The use of information contained within this proposal paper for any form of decision making is done so at the user's sole risk'.

'NIE Networks Ltd as the Distribution Network Operator (DNO) for Northern Ireland makes no warranties or representations of any kind with respect to the information contained in this document. We accept no liability for any loss or damage arising from the use of this document or any reliance on the information it contains. The use of information contained within this proposal paper for any form of decision making is done so at the user's sole risk'.

Table of Contents

1. Introduction	4
1.1. Associated documents	5
1.2. Definitions and Interpretations.....	5
1.3. Structure of this document	5
2. Scope	6
3. Background	7
3.1. Principles underpinning the Proposals	7
3.2. Overview of Demand Connection Types	9
4. Consultation Update	11
4.1. Summary of submissions:	11
5. Proposals	12
5.1 Frequency Theme	13
5.2 Voltage Theme.....	15
5.3 Demand Response Control	32
5.4 System Restoration Theme.....	51
5.5 Instrumentation, Simulation and Control Theme.....	61
6. Conclusion	67

1. Introduction

On the 7th September 2016, the Commission Regulation (EU) 2016/1388 establishing a network code on requirements for demand connection (hereafter referred to as '[DCC](#)') entered into force.

The scope of this document is to seek approval from the National Regulatory Authority on SONI and NIE Networks' proposal for the general application of technical requirements in accordance with Articles 12 – 21 and Articles 27 – 30 of the Commission Regulation (EU) 2016/1388 establishing a network code on requirements for Demand Connections.

This proposal document is produced jointly by SONI Ltd in its role as the Transmission System Operator in Northern Ireland (hereafter referred to as 'TSO') and by NIE Networks in their role as the Distribution Network Operator in Northern Ireland (hereafter referred to as 'DSO').

References in this document to the Relevant System Operator (hereafter referred to as 'RSO') mean the operator of the system to which the user is connected to, i.e. TSO or DSO.

The requirements of the DCC apply from three years after its publication in the Official Journal of the EU (OJEU) as per Article 59. The requirements of the DCC do not apply to existing demand units, distribution systems or closed distribution systems. A demand unit, distribution system or closed distribution system is defined in Article 4 as existing if:

- It is already connected to either the transmission or distribution network in Northern Ireland by two years after entry into force of the DCC (7th September 2018); or
- The demand facility owner has concluded a final and binding contract for the purchase of the demand plant by two years after entry into force of the DCC (7th September 2018).

Under Article 6(4), the RSO or TSO is required to submit a proposal for requirements of general application for approval by the Utilities Regulator (UR) within two years of entry into force of this regulation, i.e. 7th September 2018. The National Regulator then has six months to approve the proposal. It is not a requirement of the DCC to consult upon all of the requirements of general application prior to the submission to the Utility Regulator. The TSO and DSO issued a Consultation Document in the interest of transparency and to ensure that the TSO and DSO have the best information available to them to submit an appropriate set of recommendations to the Utility Regulator for the proposal of requirements of general application.

The TSO and DSO are submitting all of our proposals for the general application of the non-mandatory requirements and non-exhaustive parameters in accordance with those set out in Title II Article 12 – 21 and Articles 27 - 30 of the DCC.

EirGrid plc in its role as the Transmission System Operator in Ireland and by ESB Networks in its role as the Distribution System Operator in Ireland are submitting an equivalent proposal document to the Commission for Regulation of Utilities (CRU).

1.1. Associated documents

The TSO and DSO strongly recommend that all readers review the [DCC Network Code](#).

All references to Article in this document refer to Articles set out in the DCC unless otherwise specified.

1.2. Definitions and Interpretations

For the purposes of this proposal document, terms used in this document shall have the meaning of the definitions included in Article 2 of DCC.

In this proposal document, unless the context requires otherwise:

- a) the singular indicates the plural and vice versa;
- b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this proposal; and
- c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.
- d) Site Specific:

The term “Site Specific” is used in the parameter proposal tables in section 4, it is intended to specify these parameters, taking consideration of the following:

- The appropriate system security studies;
- Consultation with the necessary users, e.g. demand facility owners, distribution system owners.

1.3. Structure of this document

Sections 2 & 3 ‘Scope’ and ‘Background’ provide important information that guide the reader through the DCC concepts and the principles underpinning this proposal document.

Section 4 provides a consultation update, where detail on submissions, changes and derogations are reported.

Section 5 sets out the proposals that are being discussed in this proposal document. It details the proposal, justification and applicability of parameter or requirement as appropriate.

In this document, we have grouped parameters by technical theme, with a number of sub-themes discussed under each theme. Within each theme, we go into detail on which parameter or requirement applies to each demand connection type. The themes are:

1. Frequency
2. Voltage
3. Demand Response Control
4. System Restoration
5. Protection & Instrumentation

A conclusion is provided in Section 6.

2. Scope

The scope of this document is to seek approval from the National Regulatory Authority on SONI and NIE Networks' proposal for the general application of technical requirements in accordance with Articles 12 -21 and Articles 27 – 30 of the Commission Regulation (EU) 2016/1388 establishing a network code on requirements for Demand Connections. Our proposal include:

- making non-mandatory requirements mandatory;
- parameter selection for the non-exhaustive parameters; and
- non-exhaustive parameters for demand units which are providing certain system services, for example Demand Response Control.

Note this document does not seek approval of the mandatory requirements or exhaustive parameters. These have been set by the Commission and cannot be changed. Further information on some of the background to these decisions is available online at:

- [DCC Public Consultation](#)
- [DCC Implementation Guideline](#)

In some cases, exhaustive requirements are described in this document to provide context for relevant discussion point and this will be clearly indicated.

3. Background

The DCC applies across the European Union. The DCC recognises that the requirements of power systems in different synchronous areas can be different due to the differing sizes. For this reason, the DCC provides that some of the requirements for general application are to be specified at national level, i.e. by the TSO, DSO or RSO of the member state, rather than at EU level.

To give effect to this concept the DCC contains requirements that are commonly described as either mandatory or non-mandatory and also requirements that are commonly described as exhaustive or non-exhaustive:

- A mandatory requirement must be applied by the TSO/DSO/RSO as appropriate
- A non-mandatory requirement is one which the TSO/DSO/RSO as appropriate may choose to apply
- An exhaustive parameter has a specified value or range in the DCC which the TSO/DSO/RSO as appropriate must apply
- A non-exhaustive parameter is one for which either:
 - The DCC provides a range from which the TSO/DSO/RSO as appropriate must select the applicable value for their region; or
 - The DCC does not specify a value and the TSO/DSO/RSO as appropriate must select the applicable value for their region.

As mandatory and exhaustive parameters are not at the discretion of the TSO/DSO/RSO as appropriate to modify they do not form part of this proposal document.

3.1. Principles underpinning the Proposals

Some of the requirements for general application exist in Northern Ireland today in the Grid and/or Distribution Codes. The assumptions for selecting the non-mandatory requirements and non-exhaustive parameters are set out below.

Non-Mandatory Requirement Selection

In the majority of cases the following assumptions are made:

- where the requirement provided in the DCC is an existing requirement in Northern Ireland, the requirement is made mandatory nationally under the DCC;
- where the requirement provided in the DCC is not an existing requirement in Northern Ireland, the requirement is not made mandatory nationally under the DCC.

Non-Exhaustive Parameter Selection

There are two examples of non-exhaustive parameter selection under DCC;

1. DCC requests that the TSO/DSO/RSO selects the value from within a range or
2. DCC does not specify a range and requests that the TSO/DSO/RSO specify a value.

In the majority of cases the following assumptions are made:

- where the range for a non-exhaustive parameter provided in the DCC includes the existing value applied in Northern Ireland, the existing value is proposed.
- where the range for a non-exhaustive parameter provided in the DCC does not include the existing value applied in Northern Ireland then the value proposed represents the minimum amount of change possible.
- where the DCC does not provide a value for a non-exhaustive parameter but requests that the RSO defines the value and it is an existing parameter in Northern Ireland, the existing value is proposed.
- where the DCC does not provide a value for a non-exhaustive parameter but requests that the RSO defines the value and it is not an existing parameter in Northern Ireland, a justification is given.

3.2. Overview of Demand Connection Types

There are a number of different demand connection types allowed for within the DCC. These include the following:

- Transmission-connected distribution systems (TCDS)
- Transmission-connected demand facilities (TCDF)
- Closed distribution systems (CDS)
- Transmission-connected distribution facility (TC distribution facility)
- Distribution-connected demand facility (DCDF)

In addition to these demand connection types, the DCC code also refers to the following:

- Demand facility (DF)
- Demand unit (DU)

For ease of reading, the following abbreviations for each of the demand connection types are used throughout the document:

Transmission-connected distribution systems	TCDS
Transmission-connected distribution systems owner	TCDSO
Transmission-connected demand facilities	TCDF
Closed distribution systems	CDS
Closed distribution systems owner	CDSO
Transmission-connected distribution facility	TC distribution facility
Distribution-connected demand facility	DCDF
Demand facility	DF
Demand facility owner	DFO
Demand unit	DU

Table 1 – Abbreviations

Figure 1 below shows how each of these DCC connection types relate to one another. Please note that figure 1 is intended for illustrative purposes only and do not override the definitions in the DCC.

4. Consultation Update

SONI and NIE Networks held a consultation on our proposal for the general application of technical requirements in accordance with Articles 12 – 21 and Articles 27 – 30 of the DCC. This consultation opened on the 6th of July for a period of six weeks until the 10th of August 2018.

4.1. Summary of submissions:

There were no submissions received in relation to this DCC consultation paper.

5. Proposals

This section covers the proposals for the non-exhaustive parameter selection and non-mandatory requirement selection.

The document is laid out by theme, and in some cases further broken down into subthemes for clarity. The five main themes are:

- 5.1 Frequency
- 5.2 Voltage
- 5.3 Demand Response Control
- 5.4 System Restoration
- 5.5 Protection & Instrumentation

Each section includes the article number and the topic being discussed. A brief description of the requirement is provided alongside a table of the items being proposed. The tables contain:

- a description of the parameter or requirement;
- the DCC allowable range or an indication that a parameter needs to be specified by the RSO;
- the proposal for the parameter or requirement;
- the DCC Article reference;
- a list of the demand connection types that this applies to; and
- a justification code.

Justification Codes

The justification codes identify which of the three categories the proposed parameters falls into. For category 1 further rationale is only provided where it is felt it is required to aid understanding. If a proposal falls into category 2 or 3, an explanation is provided.

1. "In line with existing"
The proposed parameter is in line with the existing Grid or Distribution Code requirements.
2. "As close as possible to the existing"
The existing Grid or Distribution Code requirements do not fit within the allowable DCC range. In this case the proposed parameter is as close to the existing Grid or Distribution Code requirements as is allowable under DCC.
3. "New or Different"
The requirement either does not exist in our Grid and Distribution Codes today and a rationale for the selection is provided. In some cases we have the requirement today but we are proposing a different value and a rationale is provided for this choice.
4. "N/A"

Please note that in some tables we have also shown mandatory and/or exhaustive parameters to provide context to the non-exhaustive or non-mandatory parameter. These items are in greyed out cells and are not subject to consultation as we do not have the right to change them.

5.1 Frequency Theme

The only non-exhaustive frequency parameter to be covered under this proposal is frequency ranges as detailed 4.1.1 below.

5.1.1. Frequency Ranges

Article 12.1

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facilities;
- Transmission-connected distribution facilities; and
- Distribution systems.

Requirement:

Transmission-connected demand facilities, transmission-connected distribution facilities and distribution systems shall be capable of remaining connected to the network and operating at the frequency ranges and time periods specified in the table below.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Frequency Ranges	47,5 Hz-48,5 Hz for 90 minutes	Mandatory	12.1	TCDF, TC distribution facilities, and TCDS	N/A
Frequency Ranges	48,5 Hz-49,0 Hz for a time to be specified by each TSO, but not less than 90 minutes	90 Minutes	12.1	TCDF, TC distribution facilities, and TCDS	2
Frequency Ranges	49,0 Hz-51,0 Hz for an unlimited time	Mandatory	12.1	TCDF, TC distribution facilities, and TCDS	N/A
Frequency Ranges	51,0 Hz-51,5 Hz for 90 minutes	Mandatory	12.1	TCDF, TC distribution facilities, and TCDS	N/A

Table 2 – Frequency Ranges

Justification:

The DCC states that the operation time in the frequency range of 48.5 – 49.0 Hz shall be specified by the TSO but not less than 90 minutes. The current Grid Code requirement in this frequency range is 60 minutes. The proposed parameter of 90 minutes is the closest allowable to the current Grid Code requirement.

Please note the Grid Code also requires demand side units to remain connected to the network as follows:

- between 47- 47.5 Hz for 20 seconds
- and between 51.5 - 52 Hz for 60 minutes

These requirements will remain in the Grid Code in addition to the DCC requirements in the table above.

It is proposed that under Article 12.2, which states “The transmission-connected demand facility owner or the DSO may agree with the relevant TSO on wider frequency ranges or longer minimum times for operation. If wider frequency ranges or longer minimum times for operation are technically feasible, the consent of the transmission-connected demand facility owner or DSO shall not be unreasonably withheld.”, to apply the existing Grid Code requirements within the ranges of 47.0 - 47.5 Hz and 51.5 - 52.0 Hz to all TCDF, TC distribution facilities, and TCDS.

5.2 Voltage Theme

The non-exhaustive and non-mandatory voltage / fault ride through parameters cover a number of different requirements. The following sub-themes are discussed in the next sections:

- General voltage requirements
- Short-circuit requirements
- Reactive power requirements
- Power quality

5.2.1 General Voltage Ranges

5.2.1.1 Voltage ranges

Article 13.1 and 13.2

Mandatory Exhaustive Parameter Selection

Applies to:

- Transmission-connected demand facilities
- Transmission-connected distribution facilities
- Distribution systems

Requirement

Article 13.1 : Transmission- connected demand facilities, transmission-connected distribution facilities and transmission connected distribution systems shall be capable of remaining connected to the the network and operating at the voltage rranges and time periods in Annex II.

Article 13.2: Equipment of distribution systems connected at the same voltage of the connection point to the transmission system shall be capable of remaining connected to the network and operating at the voltage ranges and time periods specified in Annex II.

Proposal

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Voltage ranges	0.90 pu - 1.118 pu for unlimited time between 110 kV to 300 kV	0.90 pu - 1.118 pu for unlimited time between 110 kV to 300 kV	13.1	TCDF, TC distribution facilities, and TCDS	N/A
	0.9 pu to 1.05 pu for unlimited time for voltages between 300 kV and 400 kV	0.9 pu to 1.05 pu for unlimited time for voltages between 300 kV and 400 kV		TCDF, TC distribution facilities, and TCDS	N/A
Voltage ranges	0.90 pu - 1.118 pu for unlimited time between 110 kV to 300 kV	0.90 pu - 1.118 pu for unlimited time between 110 kV to 300 kV	13.2	TCDF, TC distribution facilities, and TCDS	N/A
	0.9 pu to 1.05 pu for unlimited time for voltages between 300 kV and 400 kV	0.9 pu to 1.05 pu for unlimited time for voltages between 300 kV and 400 kV		TCDF, TC distribution facilities, and TCDS	N/A

Table 3: Voltage ranges and time periods

Justification:

In Northern Ireland the distribution system is connected to the transmission system at 33 kV. The TSO has operational control and planning responsibility up to the 33 kV terminals of the 110/33 kV transformers.

However the Articles 13.1 and 13.2 refer to connection points from 110 kV upwards. Therefore Article 13.1 and 13.2 have no current applications in Northern Ireland. It is assumed this may apply to future directly connected customers rather than the DSO distribution system.

For the voltage level 110kV, The Electricity Safety, Quality and Continuity Regulations (ESQCR) in Northern Ireland, 2012, establish statutory voltage limits of 0.9 to 1.1 pu. The Transmission System Planning and Security Standards (TSPSS) applies a ranges of 0.9 pu to 1.091 pu.

The limit of 1.118 pu from the Network Code would require equipment to be capable of operating at a voltage level of 123 kV. Whilst this does align with the standard voltage level for procurement of 110 kV plant it is outside that set by the Statutory Rule, the TSSPS and the OSS.

For 275 kV connections the standard equipment is rated at 300 kV. The TSSPS sets an upper limit in planning timescales 289 kV, i.e. 1.051 pu. The SONI Operating Security Standard (OSS) allows this to be relaxed to 302.5 kV, i.e. 1.1 pu in operational timescales following a secured event. This is not expected to exceed 15 minutes. However the range implying up to 1.118 pu in unlimited timescales implies a constant voltage of up to 307.45 kV. This may require developers to procure plant with a higher rating

If a connection is being taken forward to which this may become as issue, in line with the principles behind the Network Code of efficiency and non-discrimination, SONI will engage with the Utility Regulator regarding a derogation from this requirement to allow standard equipment to be procured.

In addition we will engage with the European Commission to change the voltage range for the DCC in the long term as part of the Network Code review process.

5.2.1.2 Automatic disconnection due to voltage level

Article 13.6

Non-mandatory non-exhaustive Parameter Selection

Applies to:

- Transmission-connected demand facilities
- Transmission-connected distribution facilities
- Distribution systems

Requirement

If required by the relevant TSO, a transmission-connected demand facility, a transmission-connected distribution facility, or a transmission-connected distribution system shall be capable of automatic disconnection at specified voltages. The terms and settings for automatic disconnection shall be agreed between the relevant TSO and the transmission-connected demand facility owner or the DSO.

Proposal: Automatic Disconnection Due to Voltage Level

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Minimum Voltage below which Module will automatic disconnect	Specified by the TSO	Site specific	13.6	TCDF, TC distribution facilities, and TCDS	1
Maximum Voltage above which Module will automatic disconnect	Specified by the TSO	Site specific	13.6	TCDF, TC distribution facilities, and TCDS	1

Table 4: Automatic Disconnection Due to Voltage Level

Justification: Automatic Disconnection Due to Voltage Level

The TSO may require TCDF, TC distribution facilities, and TCDS to install an automatic disconnection scheme due to voltage level, where the TSO can reasonably show that it is prudent or necessary to do so.

5.2.1.3 Distribution systems connected to the transmission system

Article 13.7

Mandatory non-Exhaustive Parameter Selection

Applies to:

- Transmission-connected Distribution systems (with connection point voltage of less 110 kV).

Requirement:

With regard to transmission-connected distribution systems with a voltage below 110 kV at the connection point, the relevant TSO shall specify the voltage range at the connection point that the distribution systems connected to that transmission system shall be designed to withstand. DSOs shall design the capability of their equipment, connected at the same voltage as the voltage of the connection point to the transmission system, to comply with this voltage range.

Proposal: Voltage range at the connection point for transmission-connected distribution systems

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Voltage range	Specified by the TSO	0.94 pu to 1.06pu	13.7	TCDS (with connection point voltage of less 110 kV).	1

Table 5: Voltage Ranges below 110 kV

Justification:

The ESQCR sets upper and lower limits on connection to customers at plus and minus 6% of nominal. Therefore the TSO has proposed aligned parameters.

5.2.2 Short-Circuit Requirements

5.2.2.1 Maximum short-circuit current at the connection point

Article 14.1

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facility
- Transmission-connected distribution system

Requirement:

Based on the rated short-circuit withstand capability of its transmission network elements, the relevant TSO shall specify the maximum short-circuit current at the connection point that the transmission-connected demand facility or the transmission-connected distribution system shall be capable of withstanding.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Maximum Short circuit current	Not specified	110 kV 40 kA 275 kV 50 kA 400 kV 50 kA	14.1		1

Table 6: Maximum Short-circuit current

Justification:

The above are based on standard procurement switchgear ratings. The rating of 40 kA at 110kV is required due to the fact that this switchgear will often be de-rated due to high X/R ratios.

5.2.2.2 Threshold for TSO Report Obligation for Change in Maximum Short-Circuit Current after Unplanned Event

Article 14.3:

Mandatory Non-Exhaustive Parameter Selection

Applies to:

- Transmission-connected demand facility
- Transmission-connected distribution system

Requirement:

After an unplanned event, the relevant TSO shall inform the affected transmission-connected demand facility owner or the affected transmission-connected distribution system operator as soon as possible and no later than one week after the unplanned event, of the changes above a threshold for the maximum short-circuit current that the affected transmission-connected demand facility or the affected transmission-connected distribution system shall be able to withstand from the relevant TSO's network in accordance with section 55.2.2.1.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
threshold for the maximum short-circuit current	Not specified	Specified by TCDF or TCDS	14.3	TCDF, TCDS	3

Table 7: Threshold of the maximum short circuit current inducing an information from the TSO for an unplanned event.

Justification:

The threshold set shall either be specified by the TCDF owner for its facility or by the TCDS operator for its network.

5.2.2.3 Threshold for TSO Report Obligation for Change in Maximum Short-Circuit Current before Planned Event

Article 14.5

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facility
- Transmission-connected distribution system

Requirement:

Before a planned event, the relevant TSO shall inform the affected transmission-connected demand facility owner or the affected transmission-connected distribution system operator, as soon as possible and no later than one week before the planned event, of the changes above a threshold for the maximum short-circuit current that the affected transmission-connected demand facility or the affected transmission-connected distribution system shall be able to withstand from the relevant TSO's network, in accordance with section 5.2.2.1.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Threshold of the maximum short circuit current inducing an information from the TSO in case of a change above this threshold	Not specified	Specified by TCDF or TCDS	14.5	TCDF, TCDS	3

Table 8: Threshold of the maximum short circuit current inducing information from the TSO for a planned event.

Justification:

The threshold set shall either be specified by the TCDF owner for its facility or by the TCDS operator for its network.

5.2.2.4 Threshold for Customer Report Obligation for Change in Maximum Short-Circuit Current Contribution after Unplanned Event

Article 14.8:

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-Connected Demand Facility
- Transmission-Connected Distribution System

Requirement:

After an unplanned event, the transmission-connected demand facility owner or the transmission-connected distribution system operator shall inform the relevant TSO, as soon as possible and no later than one week after the unplanned event, of the changes in short-circuit contribution above the threshold set by the relevant TSO.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Threshold of the maximum short circuit current inducing an information from the TCDF or TCDS in case of a change above this threshold	Not specified	0.5kA	14.8	TCDF, TCDS	3

Table 9: Threshold of the maximum short circuit current inducing information from the TCDF or TCDS after an unplanned event.

Justification:

The transmission system is planned with a safety margin of 5% of equipment ratings. The change of short circuit current contribution of 0.5 kA results in a relative increase of short circuit current of maximum 1.6% of the equipment rating, in which case a security margin of at least 3.4% could be maintained.

5.2.2.5 Threshold for Customer Report Obligation for Change in Maximum Short-Circuit Current Contribution before Planned Event

Article 14.9

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facility
- Transmission-connected distribution system

Requirement:

Before a planned event, the transmission-connected demand facility owner or the transmission-connected distribution system operator shall inform the relevant TSO, as soon as possible and no later than one week before the planned event, of the changes in short-circuit contribution above the threshold set by the relevant TSO.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
threshold for the short-circuit contribution	Not specified	0.5kA	14.9	TCDF, TCDS	3

Table 10: Threshold of maximum short circuit current inducing an information from the TSO before a planned event.

Justification:

The transmission system is planned with a safety margin of 5% of equipment ratings. The change of short circuit current contribution of 0.5 kA results in a relative increase of short circuit current of maximum 1.6% of the equipment rating, in which case a security margin of at least 3.4% could be maintained.

5.2.3 Reactive Power Requirements

5.2.3.1 Reactive Power Capability for Transmission-Connected Demand Facilities

Article 15.1 (a)

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facilities

Requirement:

Transmission-Connected Demand Facilities shall be capable of maintaining their steady-state operation at the connection point within a reactive power range specified by the TSO, according to the following condition:

- a) the actual reactive power range specified by the TSO for importing and exporting reactive power shall not be wider than 48 percent of the larger of the maximum import capacity or maximum export capacity, following named P_{max} , (0.9 power factor import or export of active power), except in situations where either technical or financial system benefits are demonstrated, for Transmission-Connected Demand Facilities, by the transmission-connected demand facility owner and accepted by the TSO.

Proposal:

Parameter	Requirement in DCC	Proposal	Article Number	Type Applicability	Justification Code
Definition of the actual reactive power range for DF <u>without</u> onsite generation	consumption: $Q_{min}/P_{max} = -0.48$	consumption: $Q_{min}/P_{MIC} = -0.48$	15.1 (a)	TCDF	2
	production: $Q_{max}/P_{max} = 0.48$	production: $Q_{max}/P_{MIC} = 0.0$	15.1 (a)	TCDF	2
of the actual reactive power range for DF <u>with</u> onsite generation	consumption: $Q_{min}/P_{max} = -0.48$	consumption: $Q_{min}/\max\{P_{MEC}, P_{MIC}\} = -0.48$	15.1 (a)	TCDF	3
	production: $Q_{max}/P_{max} = 0.48$	production: $Q_{max}/P_{max,MEC} = 0.48$	15.1 (a)	TCDF	3

Table 11: Reactive power capability for transmission-connected demand facilities

Justification

The maximum reactive power range of TCDF is determined by the maximum import capacity (P_{MIC}) or maximum export capacity (P_{MEC}).

The reactive power range of TCDF without onsite generation shall be within the range of 0 to $0.48 [Q_{max}/P_{MIC}]$ as per current Grid Code.

The maximum reactive power range of TCDF with onsite generation is determined on the reactive consumptions side by the larger of the maximum import capacity (P_{MIC}) or maximum export capacity (P_{MEC}). Whereas the reactive production is determined by onsite generation only and derives from the maximum export capacity (P_{MEC}). Consequently the reactive power range shall be within the range of $-0.48 [Q_{min}/\max\{P_{MEC}, P_{MIC}\}]$ to $0.48 [Q_{max}/P_{MEC}]$.

5.2.3.2 Reactive Power Capability for Transmission-Connected Distribution Systems

Article 15.1(b)

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected distribution systems

Requirement:

Transmission-Connected Distribution Systems shall be capable of maintaining their steady-state operation at their connection point within a reactive power range specified by the TSO, according to the following condition:

- b) the actual reactive power range specified by the TSO for importing and exporting reactive power shall not be wider than
- 48 percent of the larger of the maximum import capability or maximum export capability, following named P_{max} , during reactive power import (consumption); and
 - 48 percent of the larger of the maximum import capability or maximum export capability, following named P_{max} , during reactive power export (production);

except in situation where either technical or financial systems benefits are proven by the TSO and the transmission-connected distribution system operator through joint analysis.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Reactive Power Range (import)	Q_{min}/P_{max} (consumption) = -0.48pu	consumption: $Q_{min}/\max\{P_{MEC}, P_{MIC}\}$ = -0.48	15.1 (b)	TCDF	3
Reactive Power Range (export)	Q_{max}/P_{max} (production) = 0.48pu	production: $Q_{max}/P_{MEC} = 0.48$	15.1 (b)	TCDF	3

Table 12: Reactive Power Capability

Justification

It is proposed to specify the widest range available from the DCC at this stage. However in the event of the TSO observing reactive power flows across an interface that are the cause of non-compliance with planning standards, the TSO shall instigate joint studies with the the transmission-connected distribution system operator.

5.2.3.3 Alternative Metrics to Set Out the Equivalent Reactive Range

Article 15.1 (d)

Non-mandatory being made mandatory

Applies to:

- Transmission-connected demand facilities
- Transmission-connected distribution facilities
- Transmission-connected distribution systems

Requirement:

The TSO may establish the use of metrics other than power factor in order to set out equivalent reactive power capability ranges;

Proposal

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Metrics to Express Reactive Power Capability	Not specified	In addition to the power factor, all limits are also expressed as the ratio of Q/P_{max} (with P_{max} as either maximum import capacity or maximum export capacity)	15.1.d	TSO	3

Table 13: Metrics to express reactive power capability

Justification:

As per current Grid Code, the metric of power factor will be maintained. In addition to align with the Requirements for Grid Connection of Generators ((EU) 2016/631), the limits are also expressed as the ratio of reactive power to maximum export/import capacity.

5.2.3.4 Reactive Power Requirements below 25% of Maximum Import Capability

Article 15.2

Non-mandatory being made mandatory

Applies to:

- Transmission-connected distribution systems

Requirement

The TSO may require that Transmission-Connected Distribution Systems 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.

Where applicable, Member States may require the TSO to justify its request through a joint analysis with the transmission-connected distribution system operator. If this requirement is not justified based on the joint analysis, the TSO and the transmission-connected distribution system operator shall agree on necessary requirements according to the outcomes of a joint analysis.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
No reactive power export when at an active power flow of below 25% of maximum import capability	TSO have the right to specify	TSO have the right to specify	15.2	TCDS	3

Table 14: No reactive power outout when at active power flow of below 25% of MIC

Justification:

A previous Cost-Benefit-Analysis¹ has shown that the implementation of distributed reactive support could be more cost-efficient. Hence, the TSO are invoking the right to specify that the TCDS shall have the capability to avoid reactive power export at the connection point at 25% of P_{MIC} .

However consistent with the requirement SONI will engage with the TCDS as appropriate.

¹https://www.entsoe.eu/fileadmin/user_upload/library/consultations/Network_Code_DCC/120405-DCC_Call_for_Stakeholder_Input.pdf

5.2.3.5 Active Control of the Exchange of Reactive Power at the Connection Point of a Transmission-Connected Distribution System

Article 15.3 and 15.4

Non-mandatory being made mandatory

Applies to:

- Transmission-connected distribution systems

Requirement:

Article 15.3:

Without prejudice article 15.1 (b) (section 5.2.3.2), the TSO may require the transmission-connected distribution system to actively control the exchange of reactive power at the connection point for the benefit of the entire system. the TSO and the transmission-connected distribution system operator shall agree on a method to carry out this control, to ensure the justified level of security of supply for both parties. The justification shall include a roadmap in which the steps and the timeline for fulfilling the requirement are specified.

Article 15.4:

In accordance with Article 15.3, the transmission-connected distribution system operator may require the TSO to consider its transmission-connected distribution system for reactive power management.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
active control of the exchange of reactive power at the connection point	TSO have the right to specify	Right to specify	15.3	TCDS	3
Reactive Power management	TCDS operator to request	site-specific	15.4	TCDS	3

Table 15: Active Control of the exchange of reactive power at the connection point

Justification:

The TSO proposal is to retain the right to specify the requirements for the TCDS to actively control the exchange of reactive power at the connection point, taking into consideration that the specific requirements will be coordinated with the TCDS.

5.2.4 Power Quality

5.2.4.1 Power Quality

Article 20

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facility owners
- Transmission-connected distribution system operators

Requirement:

Transmission-connected demand facility owners and transmission-connected distribution system operators shall ensure that their connection to the network does not result in a determined level of distortion or fluctuation of the supply voltage on the network, at the connection point. The level of distortion shall not exceed that allocated to them by the relevant TSO. TSOs shall coordinate their power quality requirements with the requirements of adjacent TSOs.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Level of voltage distortion or fluctuation of the supply voltage at the connection point	Should not exceed level of distortion allocated by the relevant TSO	ENA G5/4-1 (Harmonics) ENA P28 (Voltage fluctuation)	20	TCDF, TCDSO	1

Table 16: Level of voltage distortion or fluctuation of supply voltage

Justification:

The Grid Code references the License Standards, also known as TSSPS. For harmonics and voltage fluctuation these are based on Electricity Networks Association Engineering Recommendation G5-4/1 and P28. These standards are aligned with the DSO standards. However it is possible that the DSO and TSO will move the G5/5 and P28 Issue 2 in the future. ER G5/5 is due to be consulted on in Great Britain. Any move to new standards would be subject to revision of the TSSPS and subject to consultation in Northern Ireland. The above standards are broadly similar to the standards applied by the TSO in Ireland.

5.3 Demand Response Control

The non-exhaustive and non-mandatory demand response and frequency control parameters cover a number of different requirements. The following sub-themes are discussed in the next sections:

- Demand Response Active Power Control, Reactive Power Control and Transmission Constraint Management,
- Frequency Control, and
- Demand Response very fast active power control.

5.3.1 Provisions for Demand Units with Demand response active Power Control, Reactive Power Control and Transmission Constraint Management

5.3.1.1 Demand response active power, reactive power control and transmission constraint management

Article 28.2 (a)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering active power control, reactive power control and transmission constraint management

Requirement:

Demand Units with demand response active power control, demand response reactive power control, or demand response transmission constraint management shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

(a) be capable of operating across the frequency ranges specified in Article 12.1 and the extended range specified in Article 12.2 of the DCC;

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Be capable of operating across frequency ranges and extended frequency ranges	Articles 12.1 and 12.2 (Annex 1)	See 4.1.1 Frequency ranges Articles 12.1 and 12.2	28.2 (a)	DU offering DR (demand response)	N/A

Table 17: Capability to operate across frequency ranges and extended frequency ranges

Justification:

It is proposed to align the frequency requirements with those specified in Article 12.1 which are applicable to the following:

- Transmission-connected demand facilities;
- Transmission-connected distribution facilities;
- Distribution system; and
- Demand units who provide demand response active power, reactive power control and transmission constraint management.

5.3.1.2 Demand response active power, reactive power control and transmission constraint management

Article 28.2(b)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering active power control, reactive power control and transmission constraint management

Requirement:

Demand units with demand response active power control, demand response reactive power control, or demand response transmission constraint management shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

- (b) be capable of operating across the voltage ranges specified in Article 13 if connected at a voltage level at or above 110 kV;

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Be capable of operating across voltage ranges	Articles13	See 4.2.1 Voltage ranges Article 13	28.2 (b)	DU offering DR	N/A

Table 18: Capability to operate across voltage ranges

Justification:

It is proposed to align the voltage requirements with those specified in Article 13 which are applicable to the following:

- Transmission-connected demand facilities;
- Transmission-connected distribution facilities;
- Distribution systems; and
- Demand units who provide demand response active power, reactive power control and transmission constraint management.

5.3.1.3 Demand response active power, reactive power control and transmission constraint management

Article 28.2(c)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering active power control, reactive power control and transmission constraint management

Requirement:

Demand units with demand response active power control, demand response reactive power control, or demand response transmission constraint management shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

- (c) be capable of operating across the normal operational voltage range of the system at the connection point, specified by the relevant system operator, if connected at a voltage level below 110 kV. This range shall take into account existing standards and shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9.1;

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Capability to operate across normal voltage range at the connection point specified by the RSO	Not specified	0.94pu to 1.06pu. LV connected : 0.94pu to 1.1pu.	28.2(c)	DU offering DR	1

Table 19: Capability to operate across normal voltage range

Justification:

The above proposal is in line with the ESQCR (Northern Ireland) 2012.

5.3.1.4 Demand response active power, reactive power control and transmission constraint management

Article 28.2(e) and (l)

Non-exhaustive parameter selection

Applies to:

- Demand units (DU) offering active power control, reactive power control and transmission constraint management

Requirement:

Demand units with demand response active power control, demand response reactive power control, or demand response transmission constraint management shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

- (e) be equipped to receive instructions, directly or indirectly through a third party, from the relevant system operator or the TSO to modify their demand and to transfer the necessary information. The relevant system operator shall make publicly available the technical specifications approved to enable this transfer of information. For demand units connected at a voltage level below 110 kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);
- (l) where modification to the power consumption is specified via frequency or voltage control, or both, and via pre-alert signal sent by the relevant system operator or the relevant TSO, be equipped to receive, directly or indirectly through a third party, the instructions from the relevant system operator or the relevant TSO, to measure the frequency or voltage value, or both, to command the demand trip and to transfer the information. The relevant system operator shall specify and publish the technical specifications approved to enable this transfer of information. For demand units connected at a voltage level below 110 kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1).

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Technical specification for the exchange of information	Not specified	<p>TSO will make public all technical specifications to enable the transfer of information available for transmission - connected demand units</p> <p>DSO will public make all technical specifications to enable the transfer of information available for Distribution-connected demand units</p>	28.2(e) and (l)	DUs	3

Table 20: Demand response active power control, demand response reactive power control, or demand response transmission constraint management

Justification:

TSO:

The detailed requirements for the specification of information exchange for Demand Units (DU) offering active power control, reactive power control and transmission constraint management will be determined as part of the implementation phase of the Demand Connection Code. Once determined, the specification will be made publically available.

DSO:

The detailed requirements for the specification of information exchange for Demand Units (DU) offering active power control, reactive power control and distribution constraint management will be determined as part of the implementation phase of the DCC. Once determined, the specification will be made publically available.

5.3.1.5 Demand response active power, reactive power control and transmission constraint management

Article 28.2(f) and (j)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering active power control, reactive power control and transmission constraint management

Requirement:

Demand units with demand response active power control, demand response reactive power control, or demand response transmission constraint management shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

- (f) be capable of adjusting its power consumption within a time period specified by the relevant system operator or the relevant TSO. For demand units connected at a voltage level below 110 kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);
- (j) where the relevant system operator or the relevant TSO, directly or indirectly through a third party, command the modification of the power consumption, enable the modification of a part of its demand in response to an instruction by the relevant system operator or the relevant TSO, within the limits agreed with the demand facility owner or the CDSO and according to the demand unit settings;

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Definition of the period to adjust power consumption within agreed limits.	Not specified	Be capable of adjusting power consumption within a time period specified and within the limits agreed with the DFO or CDSO. To be agreed on a site specific basis.	28.2(f) and (j)	DUs	3

Table 21: The period to adjust power consumption within agreed limits.

Justification:

The adjustment of power consumption by the demand units is dependent on a number of factors, including but not limited to:

- the type of processes carried out by the demand unit;
- the site configuration.

As such, the time taken to adjust the power consumption will vary between demand unit to demand unit, as such the period to adjust power consumption within an agreed limits will need to be agreed on a case-by-case basis.

5.3.1.6 Demand response active power, reactive power control and transmission constraint management

Article 28.2(i)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering active power control, reactive power control and transmission constraint management

Requirement:

Demand units with demand response active power control, demand response reactive power control, or demand response transmission constraint management shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

- notify the relevant system operator or relevant TSO of the modification of demand response capacity. The relevant system operator or relevant TSO shall specify the modalities of the notification;

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Definition of the modalities of notification in case of a modification of the DR capability	Not specified	RSO or TSO shall specify the modalities of the notification of modifications of demand response capacity	28.2(i)	DUs	3

Table 22: Modalities of notification in case of a modification of the DR capability

Justification:

TSO:

The definition of the modalities of notification in case of a modification of DR capability for DU offering active power control, reactive power control and transmission constraint management will be determined as part of the implementation phase of the DCC.

Once determined, the definition of the modalities of notification in case of a modification of the DR capability will be made publically available.

DSO:

The detailed requirements for the specification of information exchange for DU offering active power control, reactive power control and distribution constraint management will be determined as part of the implementation phase of the DCC. Once determined, the specification will be made publically available.

5.3.1.7 Demand response active power, reactive power control and transmission constraint management

Article 28.2 (k)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering active power control, reactive power control and transmission constraint management

Requirement:

Demand units with demand response active power control, demand response reactive power control, or demand response transmission constraint management shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

- (k) have the withstand capability to not disconnect from the system due to the rate-of-change-of-frequency up to a value specified by the relevant TSO. With regard to this withstand capability, the value of rate-of-change-of-frequency shall be calculated over a 500 ms time frame. For demand units connected at a voltage level below 110 kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Definition of maximum RoCoF	Not specified	1 Hz/s over 500 ms	28.2(k)	DUs	1

Table 23: Definition of maximum RoCoF

Justification:

The proposal is to maintain the 'agreed in principle' Grid Code standard for RoCoF (df/dt) of 1 Hz/s over a 500 ms rolling window.

5.3.2 Specific Provisions for Demand Units with Frequency Control

5.3.2.1 Frequency Control

Article 29.2 (a)

Non-exhaustive parameter selection

Applies to:

- Demand Units (DU) offering Demand Response (DR) System Frequency Control

Requirement:

Demand units with demand response system frequency control shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

- (a) be capable of operating across the frequency ranges specified in Article 12(1) and the extended range specified in Article 12(2);

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Be capable of operating across frequency ranges and extended frequency ranges	Articles 12.1 and 12.2 (Annex 1)	See 4.1.1 Frequency ranges Articles 12.1 and 12.2	29.2 (a)	DU offering DR	N/A

Table 24: Capability to operate across frequency ranges and extended frequency ranges

Justification:

It is proposed to align the frequency requirements with those specified in Article 12.1 which are applicable to the following:

- Transmission-connected demand facilities;
- Transmission-connected distribution facilities;
- Distribution systems; and
- Demand units who provide Demand Response (DR) System Frequency Control.

5.3.2.2 Frequency Control

Article 29.2 (b)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering Demand Response (DR) System Frequency Control

Requirement:

Demand units with demand response system frequency control shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

(b) be capable of operating across the voltage ranges specified in Article 13 if connected at a voltage level at or above 110 kV;

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Be capable of operating across voltage ranges	Articles13	See 4.2.1 Voltage ranges Article 13	29.2 (b)	DU offering DR	N/A

Table 25: Capability to operate across voltage ranges

Justification:

It is proposed to align the voltage requirements with those specified in Article 13 which are applicable to the following:

- Transmission-connected demand facilities;
- Transmission-connected distribution facilities;
- Distribution systems; and
- Demand units who provide Demand Response (DR) System Frequency Control.

5.3.2.3 Frequency Control

Article 29.2 (c)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering Demand Response (DR) System Frequency Control

Requirement:

Demand units with demand response system frequency control shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

(c) be capable of operating across the normal operational voltage range of the system at the connection point, specified by the relevant system operator, if connected at a voltage level below 110 kV. This range shall take into account existing standards, and shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Capability to operate across normal voltage range at the connection point specified by the RSO	Not specified	HV Connected: 0.94pu to 1.06pu. LV connected : 0.94pu to 1.1pu.	29.2(c)	DU offering DR	1

Table 26: Capability to operate across normal voltage range at the connection point specified by the RSO

Justification:

The proposal is in line with the ESQCR (Northern Ireland) 2012.

5.3.2.4 Frequency Control

Article 29.2 (d)

Non-exhaustive parameter selection

Applies to:

- Demand Units (DU) offering Demand Response (DR) System Frequency Control

Requirement:

Demand units with demand response system frequency control shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

(d) be equipped with a control system that is insensitive within a dead band around the nominal system frequency of 50,00 Hz, of a width to be specified by the TSO in consultation with the TSOs in the synchronous area. For demand units connected at a voltage level below 110 kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Define the insensitive dead band around the nominal system frequency	Not Specified	49.5Hz – 50.2Hz	29.2 (d)	DU offering DR	3

Table 27: Insensitivity dead band around the nominal system frequency

Justification:

The demand response system frequency control should only be activated during a frequency event.

Under the SDC3.6.1 of the SONI Grid Code, if the NI system frequency reaches 50.2 Hz, each generator is required to respond and take action in order to contribute to contain and correcting the high system frequency. Hence, the upper limit for the insensitive dead has been selected as 50.2 Hz to align with this existing requirement.

The lower limit of the insensitive dead band of 49.5 Hz has been proposed as this value aligns with the existing definition of a Frequency Transient under the current version of the SONI Grid Code.

5.3.2.5 Frequency Control

Article 29.2 (e)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering Demand Response (DR) System Frequency Control

Requirement:

Demand units with demand response system frequency control shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

(e) be capable of, upon return to frequency within the dead band specified in paragraph 2(d), initiating a random time delay of up to 5 minutes before resuming normal operation. The maximum frequency deviation from nominal value of 50,00 Hz to respond to shall be specified by the TSO in coordination with the TSOs in the synchronous area. For demand units connected at a voltage level below 110 kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1). The demand shall be increased or decreased for a system frequency above or below the dead band of nominal (50,00 Hz) respectively;

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Define the maximum frequency deviation from which to respond	Not Specified	Under Frequency maximum frequency deviation – 48.9Hz Over Frequency maximum frequency deviation – 51.1Hz	29.2(e)	DU offering DR	3

Table 28: The maximum frequency deviation from which to respond.

Justification:

The full provision of Demand Response (DR) System Frequency Control should be exhausted in advance of:

- any involuntary load shedding in the case of an under-frequency event, or
- any generation shedding in the case of an over-frequency event.

In the case of an under-frequency event, involuntary load shedding commences when the system frequency drops to 48.9 Hz. Hence, it is proposed to set the under-frequency maximum deviation to 48.9 Hz.

Similarly, in the case of an over-frequency event, the shedding of generation commences when the system frequency reaches 51.1 Hz. Hence it is proposed to set the over-frequency maximum deviation to 51.1 Hz.

5.3.2.6 Frequency Control

Article 29.2(g)

Non- exhaustive parameter selection

Applies to:

- Demand Units (DU) offering Demand Response (DR) System Frequency Control

Requirement:

Demand units with demand response system frequency control shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:

(g) be able to detect a change in system frequency of 0,01 Hz, in order to give overall linear proportional system response, with regard to the demand response system frequency control's sensitivity and accuracy of the frequency measurement and the consequent modification of the demand. The demand unit shall be capable of a rapid detection and response to changes in system frequency, to be specified by the TSO in coordination with the TSOs in the synchronous area. An offset in the steady-state measurement of frequency shall be acceptable up to 0,05 Hz.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Specify rapid detection and response requirements	Not Specified	<p>Rapid detection and response constitutes an initial time delay of active power response of 0 seconds</p> <p>There should be no delays other than those inherent in the design of the DRSFC system</p>	29.2 (g)	DU offering DR	3

Table 29: Rapid detection and response requirements

Justification:

It is essential that in the event of a frequency event, either under- or over-frequency, Demand Response (DR) System Frequency Control is provided as quickly as possible in order to restore the system frequency. To that end, the initial time delay of active power response should be 0 seconds, other than those delays that are inherent in the design of the demand response system frequency control system itself.

5.3.3 Specific Provisions for Demand Units with Demand Response Very Fast Active Power Control

5.3.3.1 Demand units with demand response very fast active power control

Article 30.2

Non-exhaustive parameter

Applies to:

- Demand facility owners or CDSO on contract to deliver demand response very fast active power control.

Requirement:

If the agreement referred to in paragraph 1 takes place, the contract referred to in paragraph 1 shall specify:

- (a) a change of active power related to a measure such as the rate-of-change-of-frequency for that portion of its demand;
- (b) the operating principle of this control system and the associated performance parameters;
- (c) the response time for very fast active power control, which shall not be longer than 2 seconds.
- (d) the response time for very fast active power control, which shall not be greater than 2 seconds.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Provision of Demand response very fast active power control	N/A	To be agreed on an individual contract basis	30.1	DFO, CDSO	1
Change of active power	Not specified	To be agreed on an individual contract basis	30.2(a)	DFO, CDSO	1
Operating principle of control	Not specified	To be agreed on an individual contract basis	30.2(b)	DFO, CDSO	1
Respond time	Less than 2 sec	2 seconds or less	30.2(c)	DFO, CDSO	1

Table 30: Demand response very fast active power control

Justification:

Under DS3, a transmission-connection demand facility owner or a closed distribution system owner can contract to provide very fast active power response as a system service.

The details of the very fast active power response, including the change of active power and operating principle of control, are agreed between the TSO and the demand facility owner or a closed distribution system owner and documented in the subsequent system services contract.

The proposal is to continue to this individual contractual based specification going forward, as it allows the maximum flexibility for the contracting of Demand Response Very Fast Active Power Control.

5.4 System Restoration Theme

The non-exhaustive and non-mandatory System Restoration parameters are detailed below.

It is important to note that there is a separate Emergency Restoration Code, which contains further requirements in relation to the System Restoration and System Defense requirements.

5.4.1 Low Frequency Demand Disconnection Scheme

Article 19.1(a):

Non- mandatory non-exhaustive parameter selection

Applies to:

- Transmission–connected demand facilities
- Transmission-connected distribution systems

Requirement:

All transmission-connected demand facilities and transmission-connected distribution systems shall fulfil the following requirements related to low frequency demand disconnection functional capabilities:

- each transmission-connected distribution system operator and, where specified by the TSO, transmission-connected demand facility owner, shall provide capabilities that enable automatic 'low frequency' disconnection of a specified proportion of their demand. the TSO may specify a disconnection trigger based on a combination of low frequency and rate-of-change-of-frequency;

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Definition of the capabilities of the low frequency demand disconnection scheme	Not specified	49.5 – 47.0 Hz	19.1(a)	TCDF, TCDS	2
Specification of the proportion of demand	Not specified	For TCDF, up to 100 % of the demand For TCDS, the proportion of demand agreed between the TSO and DSO.	19.1(a)	TCDF, TCDS	2
Use of combination of frequency and RoCoF thresholds for low frequency demand disconnection	Not specified	Not invoking	19.1(a)	TCDF, TCDS	N/A

Table 31: Low frequency demand disconnection scheme

Justification:

Article 19.1(a) - Definition of the capabilities of the low frequency demand disconnection scheme

The frequency control capabilities for demand units, as specified under Article 29.2, must be exhausted prior to the activation of the low frequency demand disconnection scheme. Under 29.2 the frequency control capabilities will be exhausted when the frequency drops to 48.9 Hz.

As such, the activation of the low frequency demand disconnection scheme for transmission-connected demand facility and transmission-connected distribution systems will be activated for frequency of 48.9 Hz or lower. The frequency at which a given transmission-connected demand facility and transmission-connected distribution system will be disconnected under the low frequency demand disconnection scheme will be agreed between the TSO and transmission-connected demand facility owner or transmission-connected distribution system owner.

Please note that the proposed parameter 49.5 – 47.0 Hz is a wider capability range than low frequency demand disconnection scheme settings currently in use.

Article 19.1(a) - Specification of the proportion of demand

The proportion of demand to be disconnected is highly dependent on a number of factors, including but not limited to:

- The site configuration;
- Critical loads, for example high priority customers or demand units on the transmission-connected distribution systems, e.g. major infrastructure.

Such factors will need to be taken into consideration when determining the proportion of demand to be disconnected.

Prior to the implementation of the low frequency demand disconnection scheme, the proportion of demand to be disconnected will be agreed between the TSO and transmission-connected demand facility owner and transmission-connected distribution system owner, taking all the relevant factors into consideration.

Please note that where necessary a multi stage low frequency demand disconnection scheme may be required. As above, the details of any multi stage low frequency demand disconnection scheme will need to be agreed between the TSO and the relevant transmission-connected demand facility owner and transmission-connected distribution system owner, prior to its implementation.

Article 19.1(a) - Use of combination of frequency and RoCoF thresholds for low frequency demand disconnection

The proposal is to not to invoke the right to specify the use of the combination of frequency and RoCoF thresholds for low frequency demand disconnection at this time.

5.4.2 Article 19.2: Low Voltage Demand Disconnection Scheme

Article 19.2

Non-mandatory non-exhaustive parameter selection

Applies to:

- Transmission –connected demand facilities
- Transmission-connected distribution systems

Requirement:

With regard to low voltage demand disconnection functional capabilities, the following requirements shall apply:

- a. The TSO may specify, in coordination with the transmission-connected distribution system operators, low voltage demand disconnection functional capabilities for the transmission-connected distribution facilities;
- b. The TSO may specify, in coordination with the transmission-connected demand facility owners, low voltage demand disconnection functional capabilities for the transmission-connected demand facilities;
- c. based on the TSO's assessment concerning system security, the implementation of on load tap changer blocking and low voltage demand disconnection shall be binding for the transmission-connected distribution system operators;
- d. if the TSO decides to implement a low voltage demand disconnection functional capability, the equipment for both on load tap changer blocking and low voltage demand disconnection shall be installed in coordination with the relevant TSO;
- e. the method for low voltage demand disconnection shall be implemented by relay or control room initiation;
- f. the low voltage demand disconnection functional capabilities shall have the following features:
 - i. the low voltage demand disconnection functional capability shall monitor the voltage by measuring all three phases;
 - ii. blocking of the relays' operation shall be based on direction of either active power or reactive power flow.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Definition of the capabilities of the low voltage demand disconnection scheme	Not Specified	Site Specific	19.2(a)	TCDS, TC distribution facilities	1
Definition of the capabilities of the low voltage demand disconnection scheme	Not Specified	Site Specific	19.2(b)	TCDF TCDF	1
On-load tapping changing blocking and Low Voltage demand disconnection (LVDD)	Right to specify or not specify	Right to specify	19.2(c) and (d)	TCDS	3

Table 32: Low voltage demand disconnection scheme

Justification:

Article 19.2(a) - Definition of the capabilities of the low voltage demand disconnection scheme

The low voltage demand disconnection scheme is currently used as a mechanism for disconnection of the transformers in the event that the transmission assets have become islanded. This also includes the trip in the event of low voltage at the connection point.

The TSO will maintain the right to specify the low voltage demand disconnection functional capabilities on a case by case basis in order to ensure a system voltage within the normal operating voltage range.

Article 19.2(b) - Definition of the capabilities of the low voltage demand disconnection scheme

The low voltage demand disconnection scheme is currently used as a mechanism for disconnection of the transformers in the event that the transmission assets have become islanded. This also includes the trip in the event of low voltage at the connection point.

The TSO will maintain the right to specify the low voltage demand disconnection functional capabilities on a case by case basis in order to ensure a system voltage within the normal operating voltage range.

Article 19.2 (c) and (d) - On-load tapping changing blocking and Low Voltage demand disconnection (LVDD)

The proposal is to invoke the right to specify the requirement for on-load tapping changing blocking and low voltage demand disconnection, but to advise on a case-by-case basis, as necessary, taking into consideration the specific requirements will be dependent on plant design and compatibility requirements.

If required, all necessary details would be made available in due time for plant design, which is intended to mean during the connection offer phase.

Please note that the on-load tapping blocking is not currently in use on the transmission system in Northern Ireland but may be required in the future if identified by the relevant system security studies.

5.4.3 Definition of automatic on load tap changer blocking scheme

Article 19.3

Non-mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facilities
- Transmission-connected distribution systems

Requirement:

With regard to blocking of on load tap changers, the following requirements shall apply:

- a. if required by the relevant TSO, the transformer at the transmission-connected distribution facility shall be capable of automatic or manual on load tap changer blocking;
- b. The TSO shall specify the automatic on load tap changer blocking functional capability.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Definition of the automatic on load tap changer blocking scheme	Right to specify or not specify	Right to specify	19.3(b)	TC Distribution Facility	3

Table 33: Automatic on load tap changer blocking scheme

Justification:

Article 19.3 (b) - Definition of the automatic on load tap changer blocking scheme

The proposal is to invoke the right to specify the requirement for on-load tap changing blocking and low voltage demand disconnection, but to advise on a case-by-case basis, as necessary, taking into consideration that the specific requirements will be dependent on plant design and compatibility requirements.

If required, all necessary details will be made available in due time for plant design, which is intended to mean during the connection offer phase.

Please note that the on-load tapping blocking is not currently in use on the transmission system in Northern Ireland but may be required in the future if identified by the relevant system security studies.

5.4.4 Conditions for reconnection post disconnection

Article 19.4

Mandatory non-exhaustive parameter selection (19.4 (a) and (b))

Non – mandatory non-exhaustive parameter selection (19.4 (c))

Applies to:

- Transmission-connected demand facilities
- Transmission-connected distribution systems

Requirement:

All transmission-connected demand facilities and transmission-connected distribution systems shall fulfil the following requirements related to disconnection or reconnection of a transmission-connected demand facility or a transmission-connected distribution system:

- a. with regard to the capability of reconnection after a disconnection, the TSO shall specify the conditions under which a transmission-connected demand facility or a transmission-connected distribution system is entitled to reconnect to the transmission system. Installation of automatic reconnection systems shall be subject to prior authorisation by the relevant TSO; 18.8.2016 L 223/25 Official Journal of the European Union EN
- b. with regard to reconnection of a transmission-connected demand facility or a transmission-connected distribution system, the transmission-connected demand facility or the transmission-connected distribution system shall be capable of synchronisation for frequencies within the ranges set out in Article 12. the TSO and the transmission-connected demand facility owner or the transmission-connected distribution system operator shall agree on the settings of synchronisation devices prior to connection of the transmission-connected demand facility or the transmission-connected distribution system, including voltage, frequency, phase angle range and deviation of voltage and frequency;
- c. a transmission-connected demand facility or a transmission-connected distribution facility shall be capable of being remotely disconnected from the transmission system when required by the relevant TSO. If required, the automated disconnection equipment for reconfiguration of the system in preparation for block loading shall be specified by the relevant TSO. The TSO shall specify the time required for remote disconnection.

Proposal

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Definition of the conditions for reconnection post disconnection	Not specified	To be specified as part of the relevant connection conditions and/or System defence and/or System Restoration Plans	19.4(a)	TCDF, TCDS	3
Settings of the synchronisation devices(including frequency, voltage, phase angle range and deviation of voltage and frequency)	Not specified	Site specific	19.4(b)	TCDF, TCDS	1
Specification of the time required for remote disconnection	Not specified	0 Secs No time delays other inherent in the design of the relevant systems.	19.4(c)	TCDF, TCDS	3
Automated disconnection equipment for reconfiguration in preparation for block loading	Not specific	Site specific	19.4(c)	TCDF, TCDS	3

Table 34: Reconnection post disconnection

Justification:

Article 19.4 (a) - Definition of the conditions for reconnection post disconnection

The proposal is to include the necessary details regarding the reconnection of the users, both generation and demand, as part of the system defense and system restoration plans.

These plans are currently being drafted and will consist of the details of:

- All steps to be taken to prevent a partial or full system blackout,
- All steps to be taken to restore the system post a partial or full system blackout, including the conditions for the reconnection of both demand and generation users.

These plans are regularly tested and updated to reflect any changes to the transmission system or operational requirements.

Further details in relation to the system defense and system restoration plans will be available as part of the Emergency Restoration Network Code implementation process.

Article 19.4 (b) - Settings of the synchronisation devices (including frequency, voltage, phase angle range and deviation of voltage and frequency)

The proposal is to specify the settings of the synchronisation devices on a site – specific or case-by-case basis, as this will allow for the following:

- consideration can be given to specific capabilities of the demand facility,
- consideration can be given to specific capabilities of the transmission and/or distribution Systems, and
- the controlled reconnection of demand on a system wide basis

The exact settings for the synchronisation devices for a transmission-connected demand facilities or transmission-connected distribution systems will be agreed as part of the overall agreement of protection and control settings.

Article 19.4 (c) - Specification of the time required for remote disconnection

Upon receipt of a signal to disconnect from the transmission system, or following the activation of the low frequency or low voltage relay, the transmission-connected demand facility and transmission-connected distribution system should disconnect from the transmission system without delay, other than any delay which is inherent in the disconnection system or process.

Article 19.4 (c) - Automated disconnection equipment for reconfiguration in preparation for block loading

The proposal is to specify the automated disconnection equipment for reconfiguration in preparation for block loading on a site – specific or case-by-case basis, as this will allow for the following to be taken into consideration:

- the capability with existing equipment,
- the specific capabilities of the demand facility, and
- the controlled reconnection of demand on a system wide basis.

5.5 Instrumentation, Simulation and Control Theme

The non-exhaustive and non-mandatory protection and instrumentation parameters cover a number of different requirements. The following sub-themes are discussed in the next sections:

- Electrical and control schemes and settings
- Information exchange
- Simulation models

5.5.1 Electrical protection Schemes and settings

Article 16.1

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facility
- Transmission-connected distribution system

Requirement:

The TSO shall specify the devices and settings required to protect the transmission network in accordance with the characteristics of the transmission-connected demand facility or transmission-connected distribution system. The TSO and the transmission-connected demand facility owner or the transmission-connected distribution system operator shall agree on protection schemes and settings relevant for the transmission-connected demand facility or the transmission-connected distribution system.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Electrical protection schemes and settings	Not Specified	Site specific	16.1	TCDF, TCDS	1

Table 35: Electrical protection schemes and settings

Justification:

The proposal is to specify the electrical protection schemes and settings for TCDF and TCDS on a case-by-case basis, as per existing practices.

This allows for the following to be taken into consideration when specifying these requirements:

- variation in the configuration of TCDF and TCDS;
- variations in the configuration of the transmission station that the demand facility or distribution system is connecting to;
- compatibility with existing equipment; and
- operational issues, such as local constraint management.

5.5.2 Specification and agreement of control schemes and settings

Article 17.1

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facility owner
- Transmission-connected distribution system operator

Requirement:

The TSO and the transmission-connected demand facility owner or the transmission-connected distribution system operator shall agree on the schemes and settings of the different control devices of the transmission-connected demand facility or the transmission-connected distribution system relevant for system security.

Proposal:

Requirement	Requirement in DCC	Proposal	Article Number	Type Applicability	Justification Code
Specification and agreement of control schemes and settings	Not specified	Site specific	17.1	TCDF, TCDS	1

Table 36: Control schemes and settings

Justification:

The proposal is to specify the control schemes and settings for TCDF and TCDS on a case-by-case basis, as per existing practices.

This allows for the following to be taken into consideration when specifying these requirements:

- variation in the configuration of transmission-connected demand facilities and transmission-connected distribution systems;
- variations in the configuration of the transmission station that the demand facility or distribution system is connecting to;
- compatibility with existing equipment; and
- operational issues, such as local constraint management.

5.5.3 Information Exchange

Article 18.3

Mandatory non-exhaustive parameter selection

Applies to:

- TSO

Requirement

The TSO shall specify the information exchange standards. The TSO shall make publicly available the precise list of data required.

Proposal

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Specification of information exchange standards	Not specified	The publication of the necessary standards to SONI Website	18.3	TSO	3

Table 37: Information exchange standards

Justification:

Under articles 18.1 and 18.2, TCDF and TCDS are required to be equipped according to the standards specified by the TSO in order to exchange information with the TSO, whilst under article 18.3, the TSO must make the standard for information exchange publicly available. The proposal is to develop the necessary information exchange standard during the implementation phase of the network codes and to subsequently publish it to the SONI Website.

5.5.4 Content and format of simulation models

Article 21.3

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facilities
- Transmission-connected distribution systems

Requirement:

Each TSO shall specify the content and format of those simulation models or equivalent information. The content and format shall include:

- Steady and dynamic states, including 50 Hz component;
- Electromagnetic transient simulations at the connection point;
- Structure and block diagrams.

Proposal:

Requirement	Requirement in DCC	Proposal	Article Number	Type Applicability	Justification Code
Content and format of simulation models	<p>To include:</p> <ul style="list-style-type: none"> - Steady and dynamic states, including 50 Hz component; - Electromagnetic transient simulations at the connection point; - Structure and block diagrams. 	<p>The provided simulation models must include the following</p> <ol style="list-style-type: none"> Steady and dynamic states, including 50 Hz component, suitable for loadflow, fault level analysis (balanced and unbalanced faults) and RMS dynamic simulations; Electromagnetic transient simulations at the connection point; Structure and block diagrams. Harmonics, including harmonic impedance and harmonic emissions 	21.3	TCDF, TCDS	1

Table 38: Simulation Models

Justification:

The proposal under the DCC is in line with the current requirements under the Grid Code with the exception of (d) Harmonics including harmonic impedance and harmonic emissions. However, these harmonic requirements are required in order to fully model TCDF and TCDS. As such, the proposal is to required this information as part of the simulation models.

5.5.5 Recording requirements for comparison with the simulation models

Article 21.5

Mandatory non-exhaustive parameter selection

Applies to:

- Transmission-connected demand facilities
- Transmission-connected distribution facilities

Requirement:

Each relevant system operator or relevant TSO shall specify the requirements of the performance of the recordings of transmission-connected demand facilities or transmission-connected distribution facilities, or both, in order to compare the response of the model with these recordings.

Proposal:

Parameter	Parameter in DCC	Proposal	Article Number	Type Applicability	Justification Code
Recording requirements	Not specified	Application - specific	21.5	TCDFs, TCDSs	1

Table 39: Recording Requirements

Justification:

SONI currently determines the locations where power quality and event recorders are required and may install the recorders at the necessary locations or, where appropriate, request or contract out the installation of these recorders to third parties. The purpose of these recorders is to monitor and record a number of conditions, including but not limited to the following:

- system oscillations,
- harmonic distortion levels,
- system disturbances, and
- the compliance and performance of various users, including both demand and generation users.

These power quality and event recorders can also be used for the comparison and verification of models.

However, the data recorded by the power quality recorders can vary quite widely, from the data being recorded to the resolution of the recording itself, depending on its intended use.

As a result, the exact specification of the power quality and event recorders will be dependent on the intended application.

6. Conclusion

This concludes the joint submission of SONI and NIE Networks to the Utility Regulator of the proposal for the general application of technical requirements in accordance with Articles 12 – 21 and Articles 27 – 30 of the Commission Regulation (EU) 2016/1388 establishing a network code on requirements for Demand Connections.

SONI and NIE Networks would now like to request the approval of the Utility Regulator for each of the requirements proposed in this document.