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# Connection Network Codes – Introduction to the public consultation of Implementation Guidance Documents

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## 1. Introduction

### Overview of connection codes

The European Connection Network Codes - [Requirements for Generators \(RfG\)](#), [Demand Connection Codes \(DCC\)](#) and [High Voltage Direct Current Connections \(HVDC\)](#) – have been developed in accordance with Regulation (EU) 714/2009 and are cornerstones to fulfil the third energy package.

The first connection network code, which entered into force on 17 May 2016, is the Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (RfG). The forthcoming Commission Regulations establishing DCC and HVDC are currently under scrutiny with the EU Parliament and Council and are expected to enter into force in August/September 2016.

In order to support the implementation of network codes at national level, and as required by the codes, ENTSO-E has produced non-binding guidance on implementation, which it is further required to consult on with stakeholders. This guidance is provided through so-called Implementation Guidance Documents (IGDs).

### Legal background for IGDs

Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (RfG), in chapter 8, article 58 – Non-binding guidance on implementation, stipulates:

- 1. No later than six months after the entry into force of this Regulation, the ENTSO for Electricity shall prepare and thereafter every two years provide non-binding written guidance to its members and other system operators concerning the elements of this Regulation requiring national decisions. The ENTSO for Electricity shall publish this guidance on its website.*
- 2. ENTSO for Electricity shall consult stakeholders when providing non-binding guidance.*
- 3. The non-binding guidance shall explain the technical issues, conditions and interdependencies which need to be considered when complying with the requirements of this Regulation at national level.*

The same requirements are defined in DCC (Article 56) and HVDC (Article 75).

### Objectives of IGDs

The main objective of the implementation guidance is to support system operators in the process of determination on national level of non – exhaustive requirements during the national implementation. The objectives of the implementation guidance documents are:

- to facilitate a common understanding of technical issues specified in the connection network codes, in context of new technologies and new requirements (e.g. synthetic inertia)
- to deliver broader explanations and background information and to illustrate interactions between requirements,
- to recommend coordination/collaboration between network operators (TSO) where either explicitly required by the connection codes or reasonably exercised from a system engineering perspective,
- to give guidance to national specifications for non-exhaustive requirements, and

- to express the need of further harmonisation beyond what is requested by the CNCs when reasonable from a system engineering perspective.

## How have IGDs been drafted?

The IGDs were drafted by ENTSO-E experts taking account of the input received from stakeholders during the process as follows:

- [23 September 2015 workshop](#) - stakeholders were informed of the intent to draft IGDs and gave their initial views on how they saw this being accomplished. They wished to be strongly involved in the process. Consequently ENTSO-E organised ahead of the entry into force of the codes:
  - A [survey on Stakeholders' priority](#) issues for IGDs. This survey took place between 25 December 2015 and 22 January 2016. As a result ENTSO-E has taken on board further topics for IGDs. The outcomes of the survey were presented in the workshop on 29 February.
  - A [public stakeholder workshop on 29 February](#) with the objective of defining the content of IGDs to address each of the priority issues previously identified. The outcomes can be accessed on the event site.
- Regular input and updates from stakeholders on their expectations for the IGDs and regular updates on the next steps within the European [Connection codes Stakeholder committee](#).

## How to respond to this consultation?

ENTSO-E has prepared the consultation in a transparent and open manner. When drafting the IGDs, the expectations of the relevant stakeholders have been taken into consideration by means of a stakeholder survey and a subsequent workshop. In line with this strategy, the next two years of national implementation shall be accompanied by continuous stakeholder interaction primarily at national level, but supplemented through the European connection codes Stakeholder Committee, and by other means of stakeholder interaction (e.g. further workshops) where necessary.

The implementation guidance documents were drafted from a topic perspective and therefore most of them cover more than one connection code simultaneously. Considering that at this stage only RfG has entered into force and that the other two codes are expected to follow in August/September 2016 ENTSO-E is conducting the consultation on the IGDs in two steps as presented below. As such the IGD consultation is scheduled as follows:

- 1 July – 15 August 2016 – ENTSO-E publishes draft IGDs for consultation from the RfG perspective. The comments received will support the update of the IGDs which ENTSO-E shall publish no later than 17 November 2016 according to the RfG regulation.
- After the entry into force of DCC and HVDC, ENTSO-E will consult again on these IGDs from the DCC and HVDC perspective. Based on the outcomes of this second consultation ENTSO-E will further enhance the IGDs and will publish these new IGDs within the 6 month deadlines defined by the DCC and HVDC regulations.

## 2. List of Implementation Guidance Documents

### Style of IGDs

ENTSO-E has developed 18 IGDs (as per list below). The IGDs were developed in an easy to read and short format (not more than 10 pages) and focus on the most relevant information of each topic. Each IGD includes information on the legal framework (Codes & Articles), objectives of the IGD, interdependencies between/in the codes, system and technology characteristics, further information, and recommendations on collaboration between the system operators at different levels and between them and grid users.

## List of IGDs

No	Titles of IGD	Short descriptions
a	Compliance tests and simulations	Objective is to give guidance on the compliance of equipment connected to the system with the technical requirements forming part of the Connection Network Codes and as detailed within these.
b	Cost-benefit analysis	The purpose of this IGD is to collate the main considerations when preparing national processes for implementing CBAs, including the benefit of input from third parties.
c	Fault current contribution from PPMs & HVDC converters	Its objective is to give guidance on the purpose of these requirements and on how to design these specific requirements for power park modules or HVDC systems connected to distribution or transmission networks to deliver an adequate reactive current injection during short circuits and after fault clearing when the voltage has not recovered.
d	Harmonisation	Its objective is to give a general overview on both opportunities and constraints related to further harmonisation beyond what is justified to facilitate market integration. Reflecting the constraint that cross border considerations have been the main focus, with a system engineering view and associated collaboration. Could standards help to create desired further harmonisation?
e	Instrumentation, simulation models and protection	Its objective is to give guidance on considerations for how to add practical details at national level on these aspects / processes.
f	Making non-mandatory requirements at European level mandatory in a country	Its objective is to give guidance on how to proceed, when deciding if a non-mandatory requirement should be made mandatory in a specific country where the need for this requirement can be demonstrated.
g	Need for synthetic inertia for frequency regulation	The purpose of this IGD is to define under what system circumstances synthetic inertia should be considered including considerations of forward needs, what are the alternatives, how could the functional requirements be defined and what is the readiness of technologies.
h	Parameters of non-exhaustive requirements	Its objective is to give a general overview on the non-exhaustive parameters of the NC RfG, DCC and HVDC which will need a national choice and to provide a general guidance on these parameters. Specific guidelines on some technical issues are foreseen in other IGDs (e.g. Voltage issues, Frequency parameters, restoration issues).
i	Parameters related to frequency stability	Its objective is to give guidance on considerations on national choices for all frequency related non-exhaustive aspects.

j	Post fault active power recovery	Its objective is to give guidance on the purpose of these requirements and on how to proceed when implementing the requirements on post-fault active power recovery for Type B Synchronous Power Generating Modules, Type B Power Park Modules and HVDC systems.
k	Reactive power control mode	This IGD gives guidance relating to the choice of control mode for reactive power and allowing the selection to reflect the national / local needs. When choosing relevant national parameters, considerations includes how to link from steady-state operation to dynamic fast fault current contribution.
l	Reactive power management at transmission/distribution interface	The purpose of this IGD is to collate the main considerations associated with the 3 requirements in NC DCC for reactive power exchange, including changing needs to regulate voltage as embedded RES capacity increases and availability of transmission based capacity reduces.
m	Reactive power requirement for PPMs & HVDC converters at low / zero active power	Its objective is to give guidance on considerations relevant to defining the need for reactive power at low active power operation, including impact of switching capability on and off whenever an active power is exceeded or gone below, as the power source (e.g. wind) or set-point varies.
n	Real time data and communication	Its objective is to give a general overview of the different categories of information flows (e.g. DSO-TSO, DSO-DSO, DSO-Generating unit) and its purposes.
o	Rate-of-change-of-frequency withstand capability (RoCoF)	Its objective is to give advice on what considerations are appropriate before selecting a national value for RoCoF withstand for generators within scope of RfG. Consider also the relevance of the fully exhaustive withstand values in NC HVDC for both HVDC and for HVDC connected PPMs.
p	Selection of national parameters for RfG type classification	The purpose of this IGD is to collate the main considerations in defining lower MW boundaries for the type B, C and D as defined in the NC RfG.
q	Special issues for Type A generators	Its objective is to give guidance on how to deal with small units largely “off the shelf” with less individual engineering. This could represent a significant share of the installations in a country.
r	Voltage related parameters for non-exhaustive requirements	Its objective is to give guidance on considerations on the non-exhaustive voltage parameters of the NC RfG, DCC and HVDC needed to make the national choices.

Two IGDs, which were originally communicated for delivery at this stage as well have been postponed for the following reasons:

- IGD on interaction of HVDC controllers

The discussions on the technical content of this IGDs continues. Since this IGDs addresses solely issues with relevance to NC HVDC, ENTSO-E now endeavours to publish it for the HVDC-related consultation later this year.

- IGD on system restoration issues

The topic strongly interacts with the network code on electricity emergency and restoration (NC ER). ENTSO-E has therefore decided to wait for the adoption of this NC by the EC in order to be able consider the content of the final version.