
ENTSO-E Connection Codes Implementation Guidance Documents - HVDC and DCC

Overview



Europe currently has three connection network codes: **Requirements of generators (RfG)** <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2016_112_R_0001>), **Demand Connection (DCC)** <http://eur-lex.europa.eu/legal-content/ES/TXT/?uri=uriserv:OJ.L_.2016.223.01.0010.01.SPA&toc=OJ:L:2016:223:TOC> and **High Voltage Direct Current (HVDC)** <<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1481125223575&uri=CELEX:32016R1447>>).

The Member States have the obligation to implement these codes no later than three years after their entry into force. Within this timeframe the Member states have 2 years to define the national specifications for the so-called non-exhaustive requirements.

In order to support the implementation at national level and also in line with the legal requirements of these network codes ENTSO-E has drafted a set of 18 non-binding implementation guidance documents which we currently put forward for consultation. These guidance documents are addressed to the transmission system operators and other system operators concerning the elements of the codes requiring national decisions. They shall explain the technical issues, conditions and interdependencies which need to be considered when complying with the requirements of this Regulation at national level.

ENTSO-E has consulted these IGDs from the RfG perspective from 1 July–15 August 2016. The comments received resulted in the update of the IGDs which were published on 17 November.

Now ENTSO-E starts the consultation of the updated IGDs from the DCC and HVDC perspective, consultation which will close on 16 January 2017. Based on the outcomes of this second consultation ENTSO-E will further update the IGDs and will publish these updates on 7 March 2017.

More information can be read **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/160929_CNC_IGD_introduction%20document_v4.pdf?Web=1> .

A preview of all the questions in this consultation can be accessed <https://consultations.entsoe.eu/system-development/entso-e-connection-codes-implementation-guidance-d/user_uploads/160630_all-cnc-igds-drafts-for-consultation.zip-1> **here** <https://consultations.entsoe.eu/system-development/entso-e-connection-codes-implementation-guidance-d/user_uploads/160630_overview-igd-consultation-questions.pdf-2> .

All the IGDs are listed below and can be downloaded from the following **link**

<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161117_igds%20published.rar> or individually below:

- **Compliance monitoring** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Guidance%20on%20Compliance_for%20publication.rar>
- **Cost-benefit analysis** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD%20Guidance%20on%20CBAs_for%20publication.rar>
- **Fault current contribution from PPMs & HVDC converters**
<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Fault%20Current%20Contribution%20from%20PPMs%20%20HVDC_for%20consultation_for%20publication.pdf?Web=1>
- **Harmonisation** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Harmonization_for%20publication.pdf?Web=1>
- **Instrumentation, simulation models and protection**
<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Instrumentation_simulation_models_and_protection_for%20publication.pdf?Web=1>

[20RfG/161116_IGD_Instrumentation%20simulation%20models%20and%20protection_for%20publication.pdf?Web=1](https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Instrumentation%20simulation%20models%20and%20protection_for%20publication.pdf?Web=1)>

- **Making non-mandatory requirements at European level mandatory in a country** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Making%20Requirements%20Mandatory%20at%20National%20Level_for%20publication.pdf?Web=1>
- **Need for synthetic inertia for frequency regulation**
<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Need%20for%20Synthetic%20Inertia_for%20publication.rar>
- **Parameters of non-exhaustive requirements**
<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_General%20guidance%20on%20parameters_for%20publication.pdf?Web=1>
- **Parameters related to frequency stability**
<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Frequency%20parameters_for%20publication.pdf?Web=1>
- **Post fault active power recovery** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Post-fault%20active%20power%20recovery_%20for%20publication.rar>
- **Reactive power control mode** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Reactive%20power%20control%20modes%20PPMs%20%20HVDC_for%20publication.pdf?Web=1>
- **Reactive power management at transmission/distribution interface**
<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Reactive%20power%20management%20at%20T%20and%20D%20interface_for%20publication.pdf?Web=1>
- **Reactive power requirement for PPMs & HVDC converters at low / zero active power** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Reactive%20power%20requirement%20for%20PPMs%20%20HVDC%20at%20low%20zero%20power_for%20publication.pdf?Web=1>
- **Real time data and communication**
<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_RealTimeDataMonitoring_for%20publication.pdf?Web=1>
- **Rate-of-change-of-frequency withstand capability (RoCoF)**
<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_RoCoF%20withstand%20capability_for%20publication.zip>

- **Selection of national parameters for RfG type classification**

<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Selecting%20national%20MW%20boundary_for%20publication.pdf?Web=1>

- **Special issues for Type A generators**

<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Special%20issues%20associated%20with%20type%20A%20generators_for%20publication.pdf?Web=1>

- **Voltage related parameters for non-exhaustive requirements**

<https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Parameters%20related%20to%20voltage%20issues_for%20publication.pdf?Web=1>

Why we are consulting

ENTSO-E is consulting the IGDs for three main reasons:

1. Although the main addressees of the IGDs are the system operators, the connection codes have a significant impact on manufacturers, power generating module operators, demand facilities and distribution networks.
2. The IGDs are drafted as supporting material for the connection codes implementation at the member state level and shall aim to give guidance for national specifications for non-exhaustive requirements.
3. The IGDs are legally requested to be consulted with stakeholders before their release within the six month of the entry into force of the Regulations.

Introduction (required)

1 What is your name?

Name

2 What is your email address?

This is optional, but if you enter your email address then you will be able to return to edit your consultation at any time until you submit it. You will also receive an acknowledgement email when you complete the consultation.

Email

3 What is your organisation?

Organisation

Comment the IGD Rate-of-change-of-frequency withstand capability

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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_RoCoF%20withstand%20capability_for%20publication.zip> .

4 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Making%20Requirements%20Mandatory%20at%20National%20Level_for%20publication.pdf?Web=1> .

5 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD%20Guidance%20on%20CBAs_for%20publication.rar> .

6 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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).

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_General%20guidance%20on%20parameters_for%20publication.pdf?Web=1> .

7 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD Compliance monitoring

Its 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Guidance%20on%20Compliance_for%20publication.rar> .

8 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Reactive%20power%20management%20at%20T%20and%20D%20interface_for%20publication.pdf?Web=1> .

9 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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 otherwise 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Reactive%20power%20requirement%20for%20PPMs%20%20HVDC%20at%20low%20zero%20power_for%20publication.pdf?Web=1> .

10 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Post-fault%20active%20power%20recovery_%20for%20publication.rar> .

11 For this IGD please give us your comments on:

Do you consider tis IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Fault%20Current%20Contribution%20from%20PPMs%20%20HVDC_for%20consultation_for%20publication.pdf?Web=1> .

12 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD Need for synthetic inertia for frequency regulation

The purpose of this IGD is to define under what system circumstances SI 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Need%20for%20Synthetic%20Inertia_for%20publication.rar> .

13 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD Frequency related parameters for non-exhaustive requirements

Its objective is to give guidance on considerations on national choices for all frequency related non-exhaustive aspects.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Frequency%20parameters_for%20publication.pdf?Web=1> .

14 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Instrumentation%20simulation%20models%20and%20protection_for%20publication.pdf?Web=1> .

15 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Parameters%20related%20to%20voltage%20issues_for%20publication.pdf?Web=1> .

16 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD Determination of the thresholds for Types B, C & D power generating modules

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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Selecting%20national%20MW%20boundary_for%20publication.pdf?Web=1> .

17 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Reactive%20power%20control%20modes%20PPMs%20%20HVDC_for%20publication.pdf?Web=1> .

18 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD Harmonisation

Its objective is to give a general overview on further harmonisation via the national implementation process. Reflecting that a system engineering view and associated collaboration is driving this process. Could standards help to create desired further harmonisation?

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Harmonization_for%20publication.pdf?Web=1> .

19 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_RealTimeDataMonitoring_for%20publication.pdf?Web=1> .

20 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments

Comment the IGD 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 and considerations but that could represent a significant share of the installation present in a country.

The full IGD can be accessed **here** <https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_Special%20issues%20associated%20with%20type%20A%20generators_for%20publication.pdf?Web=1> .

21 For this IGD please give us your comments on:

Do you consider this IGD helpful to reasonably support the national implementation process?

Please select only one item

Yes No

Does the content of the IGD cover the technical issues of this topic appropriately?

Please select only one item

Yes No

Comments on the technical information within this IGD

General (other) comments