ENTSO-E Connection Network Codes Implementation Guidance Documents_HVDC related topics

Overview

Europe currently has three connection network codes: Requirements for generators (RfG), Demand Connection (DCC) and High Voltage Direct Current (HVDC). RfG has entered into force on 17 May 2016, the DCC on 18 August 2016 and the HVDC on 8 September 2016.

The Member States have the obligation to implement these codes no later than three years after their entry into force. Within this timeframe the relevant system operators or TSOs have 2 years to define and submit the national specifications, for the so-called non-exhaustive requirements, for approval by the competent entity.

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 and when necessary improved non-binding implementation guidance documents (IGDs), three of which are currently put forward for consultation.

The guidance documents are primarily 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 these Regulations at national level.

The current IGD consultation is scheduled as follows:

26 March 2018 – 4 May 2018 – ENTSO-E publishes **three (3) draft IGDs** for consultation (please see below). The comments received will support the finalisation of the IGDs.

More information can be read **here** *<user_uploads/cnc_igd-hvdc-related-topics_introductory-document.pdf>* .

A preview of all the questions in this consultation can be accessed **here** *</system-development/entso-e-connection-network-codes-implementation-gu/user_uploads/survey-on-igd-cba-1.pdf>* .

The IGDs under consultation are listed below and can be downloaded from the following **link** *<user_uploads/igds---hvdc-related-topics-1.zip>* .

1. **Embedded HVDC systems - frequency schemes in case of system split**
2. **HVDC systems default parameters**
3. **Interactions between HVDC systems and other connections**

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

1 What is your name?

Name

2 What is your email address?

If you enter your email address then you will automatically receive an acknowledgement email when you submit your response.

Email

3 What is your organisation?

Organisation

Embedded HVDC systems – frequency schemes in case of system split

NC HVDC Article 15 requires that the HVDC systems shall be capable of regulating by means of automatic control their active power as a function of the deviation of frequency from its nominal value measured at its connection point when operating in Frequency Sensitive Mode (FSM), Limited Frequency Sensitive Mode-Underfrequency (LFSM-U) or Limited Frequency Sensitive Mode-Overfrequency (LFSM-O). These requirements were designed consistently to the corresponding requirements for power generating modules by NC RfG with the aim of achieving similar response from power generating modules and HVDC systems in case of system frequency deviations, as well as the same mechanism for reserves sharing.

The interpretation of the FSM, LFSM-O and LFSM-U requirement is obvious for power generating modules that have only one connection point to which the active power frequency response in case of a frequency deviation shall apply. However, in case of HVDC systems the interpretation may not be so clear: the capability to provide active power frequency response is a relevant feature for HVDC systems connecting different synchronous areas, which are not connected to each other by AC lines, and therefore do not share the same frequency. In this situation, the HVDC system can provide support to one synchronous area, which suffers a frequency deviation, by increasing/decreasing the active power infeed/offtake. This active power regulation of the HVDC system providing support to one synchronous area has an immediate impact on the frequency of the other synchronous area, which then needs to be compensated by active power frequency response of generators in that area. This capability of HVDC systems was therefore conceived to be a mean to share frequency reserves across synchronous areas.

However, if an HVDC system is located within a single synchronous area, i.e. the HVDC system is embedded in one control zone or area according to Article 3.1 c) and d) of Regulation (UE) 2016/1447, the FSM and LFSM-O/-U features are not needed in normal operation, without prejudice that these control functions may be useful in case of system splits after which each HVDC terminal resides in a different frequency zone of the split synchronous area.

This IGD aims at clarifying the possible settings of the frequency control functionality for HVDC systems embedded in a synchronous area and recommending its configuration. In addition, the IGD addresses the need for coordination of the frequency control function with additional control functions which aim at guaranteeing the robustness of the control functions and contributing to system security.

1 Do you consider this IGD helpful to reasonably support the national implementation process? (Please select only one item)

Please select all that apply

☐ yes ☐ no

2 Does the content of the IGD cover the technical issues of this topic appropriately? (Please select only one item)

Please select all that apply

☐ yes ☐ no

3 Comments on the technical information within this IGD

Technical Comments

4 General (other) comments

General Comments

HVDC systems default parameters

This document addresses the need from TSOs in countries that are mandated to implement the EU regulation for HVDC systems, but do not intend to establish an HVDC system in the short and mid-term planning period.

It provides a list of the minimum set of requirements for an HVDC system and a guidance with the recommended default parameters for the non-exhaustive requirements to be applied when implementing the EU regulation.

The document includes a list of recommended parameter values and selection ranges for the minimum set of parameters to be specified based on current European practice with HVDC systems.

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

Please select all that apply

☐ yes ☐ no

2 Does the content of the IGD cover the technical issues of this topic appropriately? (Please select only one item)

Please select all that apply

☐ yes ☐ no

3 Comments on the technical information within this IGD

Technical Comments

4 General (other) comments

General Comments

Interactions between HVDC systems and other connections

This document addresses the increasing concern regarding potential interactions associated with HVDC systems. In addition, the document provides guidance on the analysis needed to be undertaken in order to identify possible interactions between HVDC systems and other grid connected equipment. The main areas to be analysed in details are namely:

- harmonic interactions between the network and the HVDC systems;
- resonances between other HVDC systems or synchronous generators and equipment (e.g., Closed-Cycle Gas Turbine, series compensation and wind turbine); and

sub synchronous oscillation or sub-synchronous torsional interactions between HVDC systems and generator shafts nearby as well as control interactions between different converter based modules. It is very important to keep in mind that the interaction between a HVDC system with the grid, should be analysed not only for the existing grid elements and planned projects, but also taking into account the long term plans that will take place in the life-time of the HVDC system [7].

The TSO has the task to specify the set of relevant studies required in Art. 29 (interactions between HVDC converter stations, or HVDC converter stations and other plants and equipment) and Art. 31 (sub-synchronous torsional interactions) of NC HVDC [2], relevant for the studies related to the equipment and relevant system conditions in the network system and securing exchange of all related information according to Art 51 (Information exchange and coordination).

The studies according to Art. 29 and 31 shall be provided by the HVDC system owner, unless Member States provide that the responsibility for the studies lies with the TSOs. In any case, the TSO shall assess the result of the studies based on their scope and extent, and may request additional studies if necessary. The TSOs may also review and replicate some part or all of the studies. In this case the HVDC system owner shall provide to the relevant TSO all necessary models and data that are adequate to perform the predefined studies. The study required by Art. 29 of NC HVDC shall identify the conditions, if any, where potential adverse interactions exists and propose possible necessary mitigation actions. Mitigating actions shall be reviewed by the TSO. It is understood that the TSO’s review should cover completeness, robustness and adequacy of the mitigation action(s).

Finally, it is of high importance that the relevant TSO shall continuously monitor the performance of the HVDC system (Art. 53). This is vital to identify the upcoming interactions due to grid development and to reduce the risks of uncertainties.

1 Do you consider this IGD helpful to reasonably support the national implementation process? (Please select only one item)

Please select all that apply

☐ yes ☐ no

2 Does the content of the IGD cover the technical issues of this topic appropriately? (Please select only one item)

Please select all that apply

☐ yes ☐ no

3 Comments on the technical information within this IGD

Technical Comments

4 General (other) comments

General Comments