

ENTSO-E consultation on Connection Codes Implementation Guidance Documents - Frequency Stability Parameters

A EURELECTRIC response paper

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On the consultation – from ENTSO-E website

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

These 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 IGDs consultation is scheduled as follows:

20 November 2017 – 21 December 2017 – ENTSO-E publishes **eight (8) draft IGDs** for consultation – **six (6) new** and **two (2) updates** (please see the list below). The comments received will support the finalisation of the IGDs.

The IGDs have been developed after extensive internal coordination with regional groups and system operation experts.

In addition, a public survey to manufacturers and other stakeholders was conducted as well as three public workshops:

- **1st Public Workshop:** [Workshop on the connection codes frequency parameters](#)
- **2nd Public Workshop:** [2nd Workshop on the connection codes frequency parameters](#)
- **3rd Public Workshop:** [3rd Workshop on the connection codes frequency parameters](#)

All the above have been completed with respect to the [Roadmap](#) that ENTSO-E prepared in March 2017. More information can be read [here](#). A preview of all the questions in this consultation can be accessed [here](#).

The IGDs under consultation are listed below and can be downloaded from the following [link](#).

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

- 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.
- 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.
- 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.

1. FSM

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

Yes

Q°2/Does the content of the IGD cover the technical issues of this topic appropriately?

Yes

Q°3/Comments on the technical information within this IGD

P.3: FRR is listed in the section Codes & Articles of this IGD but there is no recommendation on this function, whose specifications are tackled in the balancing and SOGL Regulation not in Rfg. On top of that, FRR is not included in the FSM which is the title of the IGD. For these two reasons, we suggest to remove FRR from this section.

P.3: The wording of the sentence 'Despite choices need to be made at national level, frequency-related issues normally require an equitable system-wide response and therefore collaboration between TSOs at synchronous area level is necessary' is too soft from our point of view. We propose to replace 'collaboration' by 'harmonisation'.

P.5: We propose to add 'mainly' in the sentence reading 'FCR obligation will be mainly covered by C&D PGMs' because FCR obligation could be covered through other means such as demand response for example.

P.6-7: Several uses of 'dead-band' should be replaced by 'insensitivity'.

P.8: The second figure shows one of the consequences if some units have a dead-band while others do not. With a dead-band, the energy effectively supplied remains below the energy supplied without a dead-band: the difference is represented by the area of the triangle between the red and blue dotted lines, close to 50Hz. A uniform application of 0mHz for dead-band is essential.

P.10: concerning the argument of the recommended default value of a 0 mHz for dead-band that is 'to comply with SOGL FCR technical requirements': more precisely, Article 154 and Annex V of SOGL network code stipulate that for any FCR providing unit, the maximum combined effect of inherent frequency response insensitivity and possible intentional frequency response dead band of the governor should be equal to 10 mHz in CE synchronous zone. The frequency response insensitivity mentioned in RfG should be understood as a maximum admissible value for new power generating units, specified by the TSO between 10 and 30 mHz. However, in practice, the insensitivity can be lower than 10 mHz, and the dead-band could be between 0-10 mHz, depending on the value for insensitivity.

Q°4/General (other) comments

General comment ON THIS IGD ONLY:

We welcome the very valuable 'educational effort' of the IGD on FSM.

The primary frequency control (FCR) is presently dimensioned for a load imbalance of 3 000 MW. It is expected that the Policy One of the Operational Handbook will be updated in application of

GLSO, but we would like to highlight the fact that harmonizing the different parameters of FSM may have impact on the behavior of the whole system (new load imbalance? new behavior – overshoot / damping - of PGMs in case of frequency step response?)

General comment ON ALL IGDs, except comment N°3

COMMENT 1: We really appreciate that ENTSO-E agreed with our request for harmonisation of these parameters, by recommending numerical values. This allows guaranteeing that Countries fairly share among them the efforts of frequency control, provided that all countries uniformly apply these recommendations. With this purpose in mind, a dedicated monitoring should be carried out by GC-ESC. Information on the frequency parameters established by each Country should be available very soon - if not already - since Art.7.4 of the Rfg Network Code states: ‘The relevant system operator or TSO shall submit a proposal for requirements of general application, or the methodology used to calculate or establish them, for approval by the competent entity within two years of entry into force of this Regulation.’

COMMENT 2: Instead of taking into account the current characteristics and limitations of available technologies, the determination of the numerical values recommended for the frequency parameters should be systematically based on the study in future needs of the power system, with a cost/benefit analysis. The stakeholders should have a clear view of the risks and the associated probability of occurrence to be covered, in order to check that the costs borne by the collectivity are proportionate.

We would also like to point out that where studies on the power system needs have been carried out, they take the major assumption that all conventional technologies (thermal, nuclear and even hydro) are completely phased out and that the market share of generation units connected through power electronics is almost of 100%. Since the path and the timeframe to reach such power mix is still uncertain, and with the objective to avoid unnecessary additional costs, it would be preferable to consider several scenarios for the increase of the market share of such units, in line with the technological improvements expected in the near future. The level of requirements should be adapted accordingly.

COMMENT 3: Some examples of present practices in some countries are provided in the IGD on automatic (re)connection. Such an overview is very interesting and even necessary to evaluate the steps leading to harmonisation. We suggest that a similar overview is included in each IGD, except on RoCoF possibly, given that it may be difficult to gather historical data and experience on this new requirement. We regret that there are so few countries in the list. At least 6 or 7 of the widest countries, in terms of annual production, should be included since they have a major impact on frequency control.

COMMENT 4: The application of RfG code will introduce some major changes with potential impacts on power system operation. In particular, new units will have to fulfill RfG requirements which are more or less harmonized whereas existing units fulfill heterogeneous rules which are specific to each country. For example, in many Countries, the normal frequency range is presently much smaller (49.5-50.5Hz) than in RfG (49-51Hz). The combination of these two ‘families of units’ should need some specific analysis such as high frequency deviation, islanding, system split and each frequency control scheme (FSM, LFSM, FRR) with different parameters.

General comment SPECIFIC FOR BALTIC SYSTEM

Baltic system will have two HVDC links and one AC transmission for synchronization with CE. The disconnection of a heavy loaded HVDC transmission and the normative incident that can lead to a large system split with power imbalance should be investigated.

2. LFSM

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

Yes

Q°2/Does the content of the IGD cover the technical issues of this topic appropriately?

No

Q°3/Comments on the **technical** information within this IGD

P.3: The constructive capabilities that go beyond the scope of the RfG should be suppressed from this IGD.

P.4: The acronyms 'DSR SFC, APC, RPC' are different from those of the IGD on FSM. They should be replaced or at least explained

P.5: Taking into account a historical incident such as the split that occurred in November 2006 has the advantage of being practical. Yet, do we have an idea of the probability that this happens again despite cooperation and harmonisation on methodologies enforced by SOGL? What was the cost of the incident? What is the cost to hedge permanently against this risk?

P.5: The sentence 'LFSM-U capability shall not be understood as requiring RES generation to run at a reduced active power output just to be prepared for an increase in case of an unlikely low frequency event.' is really relevant. However, it applies to any technology and not only to RES. We therefore propose to remove 'RES' from the sentence for a more technology-neutral approach.

P.5-6: The contradiction between LFSM-U requests and issue concerning generating units connected to distribution grid should be removed from this IGD since it deals with system operation rather than with constructive capability. On top of that, we question the 'operational feasibility' of these recommendations: do DSOs have tools to send the remote control to block LFSM in real time? Do concerned generating units have tools to apply this order?

P.11: 'evidently less stringent than what would be needed from a system engineering perspective' See general comment N°2 in the IGD concerning FSM. 'any intentional delay shall be prohibited': in some situations, and to avoid unintentional islanding, the network operator needs to define an intentional delay for some PGM. We propose to indicate that an intentional delay should be activated only at the request of the network operator.

Q°4/General (other) comments

Any topic out of the scope of the connection codes should be removed from the IGDs, which should only focus on requirements explicitly included in those codes. In particular, it is not the objective of IGDs to make recommendations on all the dynamic aspects of the frequency responses of generation units. The present IGD should stick to a numerical value for the initial delay (limited to 2 seconds). Moreover, some other dynamic aspects recommended are not compatible with some hydro power plants constraints.

3. (Re)Connection and P ramp

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

Yes

Q°2/Does the content of the IGD cover the technical issues of this topic appropriately?

No

Q°3/Comments on the **technical** information within this IGD

P.2: The HVDC code evokes the conditions for automatic disconnection specified by the RSO. What about the reconnection?

P.2: What is the definition of 'incidental disconnection'? We understand this concerns only incident on the grid and incidents that are not internal to the unit.

P.5: The French numerical value for maximum gradient corresponds to MV connected generators. Therefore, the value is correct, but only for MV connected generators. We propose to mention it.

It might be more helpful if there was a different setting on frequency and voltage protection envisaged (if indeed such protection is expected) from that allowed for reconnection. If there was a differential it would help if this IGD explained why and how it had been arrived at.

Q°4/General (other) comments

The examples provided at the end of the IGD are interesting but we are surprised that there are so few countries in this overview.

4. Frequency ranges

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

No

Q°2/Does the content of the IGD cover the technical issues of this topic appropriately?

No

Q°3/Comments on the **technical** information within this IGD

(P.2: Two bullet points - 2nd and 3rd of § Introduction - say the same thing)

P.3: Regarding the following sentence 'Unless the non-mandatory requirement of article 16(2)(a)(ii) is implemented at national level...', generators would like to report that simultaneous over-voltage and under-frequency provokes over-fluxing that could deteriorate some major equipment such as transformers, alternators and engines. Manufacturers provide curves which specify the maximum duration a unit can withstand before disconnection for a given

voltage/frequency ratio. Therefore, generators expect some practical recommendations based on these curves.

P.3-4: Would it be possible to clarify the sentence 'For the national implementation of the non-mandatory requirement of NC RfG article 16(2)(a)(ii), no strong evidence of the system need has been demonstrated if the implementation of article 13(1)(a)(i) is following the above mentioned recommendation.'?

Q°4/General (other) comments

There is no recommendation on the time period in application of Article 16(2)(a)(ii), that is a shorter period in case of simultaneous over-frequency + under-voltage and under-frequency + over-voltage.

So the sole effective recommendation is the time period associated to the high level of frequency deviation: we do wonder if this justifies a dedicated IGD.

(there are some problems with the template of the document : see 'HVDC min req. - template' in the header and page numbering in the footer)

5. Maximum admissible P reduction at low frequencies

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

Yes

Q°2/Does the content of the IGD cover the technical issues of this topic appropriately? =>

No

Q°3/Comments on the technical information within this IGD

No comment

Q°4/General (other) comments

COMMENT 1: Hydro generation should be studied as precisely as CCGTs and combustion turbines because hydro plants also have some constructive limits that do not permit to avoid the instantaneous decrease of active power.

COMMENT 2: As previously mentioned in GENERAL COMMENT 1 for IGD/LFSM, dynamic aspects should be removed from this IGD. Indeed, the distinction between transient and steady-state is not described in the RfG (Art. 13.4&5). This requirement should be understood for steady-state only, since the allowed limits (Fig. 2) are not compatible with the inherent constraints during the transient stage of some technologies, among which CCGTs but also hydro plants.

6. Demand Response – System Frequency Control

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

Yes

Q°2/Does the content of the IGD cover the technical issues of this topic appropriately?

No

Q°3/Comments on the technical information within this IGD

P.3: Concerning Article 29.2.g of the DCC, would it be possible to explain the meaning of the 2 values '10 mHz' and '50 mHz' as well as the link between them?

The IGD explains some of the background and issues and makes a valid point about harmonizing with the FCR to avoid unwanted flows.

However, as SFC, the way it is envisaged in this IGD is implemented in thousands or millions of discrete devices, all of which are likely to be either off or on, it would have been helpful to describe what the expectations are in achieving a behavior like that of a droop setting. We note that we have the same question regarding how RfG Art 13 2(b) is to be implemented.

Q°4/General (other) comments

No comment

7. Rate of Change of Frequency – RoCoF

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

Yes

Q°2/Does the content of the IGD cover the technical issues of this topic appropriately?

Yes

Q°3/Comments on the technical information within this IGD

P.2: When will the works of the task force on frequency measurement begin? Will the stakeholders be involved?

P.6: 'repetition of high RoCoF events': there should be a maximum number, here.

We note that it suggests measuring over 500ms – but it fall short of explaining how reliable, accurate and repeatable measurements might be made. The graph lacks units on its X and Z axes. We can guess that the X axis is Hzs-1, but it is not easy to guess what the units on the Z axis might be.

Q°4/General (other) comments

P.2: To complete the second paragraph ‘The resulting RoCoF ... related requirements’, Recital N°25 of the RfG states: ‘Synchronous power-generating modules have an inherent capability to resist or slow down frequency deviations, a characteristic which many RES technologies do not have. THEREFORE COUNTERMEASURES SHOULD BE ADOPTED, to avoid a larger rate of change of frequency during high RES production. Synthetic inertia could facilitate further expansion of RES, which do not naturally contribute to inertia’ The IGD does not provide any information on counter-measures that should be adopted by the TSOs. Moreover, the synthetic inertia does not represent, in the present state of the art, a real countermeasure.

8. Synthetic inertia

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

Yes

Q°2/Does the content of the IGD cover the technical issues of this topic appropriately?

No

Q°3/Comments on the technical information within this IGD

No comment

Q°4/General (other) comments

The IGD is interesting given the fact that it presents the ‘state of art’. Nevertheless, it remains quite theoretical.

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