Summary of Eurelectric comments – ENTSO-E proposal for a revised Network Code Requirements for Generators

April 2023

Eurelectric notes with great concern ENTSO-E's considerable change suggestions to NC RfG without a robust cost-benefit analysis, shared and discussed in advance with the stakeholders concerned. This not only risks enshrining new requirements in a cost-inefficient way, but ultimately endangers the European Green Deal by making small and medium CO2 free generation unnecessarily more expensive and cumbersome to install and operate. One of ENTSO-E's goals is, understandably, to increase system stability, but this needs to be done in an inclusive and cost-efficient manner with involvement of affected stakeholders and underpinned by a cost-benefit analysis.

Example 1: The voltage requirements in Art. 13.10 (table 10.1 & 10.2) will increase the cost for all PGMs connected at 110kV or above as the transformers at these sites were not designed for these new voltage ranges.
On such sites, the installation of a few wind turbines or solar panels will become extremely costly due to the new transformers required at the connection point.

Example 2: the proposal in Art. 5.4 to erase the voltage criterion in the classification only for new PGMs below 10MW will be a hurdle for new installations slightly above this limit. As an example, instead of building 4 wind turbines of 3MW each, only 3 will be installed in that case. A European level playing field is needed instead of national derogation to the RfG provision on this topic.
Besides the above-mentioned examples related to voltage criteria, there are other concerns depicted in the examples below which should be clarified:

Example 3: The revised NC RfG risks disincentivising efficiency improvements as a consequence of a different classification: For example, when upgrading the efficiency of an existing installation, such as a hydro power plant, classification thresholds could be exceeded by only a small value which in turn has significant consequences for the requirements the plant has to fulfil.

Example 4: In several Expert Groups, the question was raised if the requirements for a new PGM should be defined at the connection point or at the terminals of the Power Generating Unit (PGU). Eurelectric proposes to relocate the location of the verification of requirements to the terminals of the PGM.

Only by doing so, a real European energy market is possible by respecting equal requirements for PV panels at a nuclear, thermal power plant or at a domestic building.

Further points of concern include:

1. The ENTSO-E proposal is in breach of European standards by imposing **over-voltages for 20 minutes or more** in Art. 13.10 (table 10.1 & 10.2). in combination with fig. X in Art 14.4. The European standards accept over-voltages only for one minute (See IEC 62271-1 topic 6.2.6.1 and 6.2.7.1). The current proposal is to extend this period to "20 minutes or more" neglecting the thermal effects created by over-voltages in transformers, alternators and other devices and endangering these installations. ENTSO-E should therefore respect the European standards and impose similar requirements for all grid operators. According to Art.25.2 of SOGL, the voltage ranges of all PGMs must be respected by the TSO, so it will take years before the TSOs can allow the proposed over-voltages. ENTSO-E can use this period to start the process to modify the standards. In Art. 14.3.c the issue of consecutive faults is described causing a black-out in Australia in 2016. ENTSO-E supposes that thunderstorms in Europe are of a similar nature to those in Australia. The current frequency of number of lightning strikes in Europe is significantly lower than in Australia, rendering this provision useless.

2. ENTSO-E`s RoCoF proposal is not consistent with Recital (25) of this NC and imposes unrealistic requirements on synchronous PGMs in Art.13.1.b. The study made for EirGrid by KEMA-DNV entitled "*RoCoF, An independent analysis on the ability of Generators to ride through Rate of Change of Frequency values up to 2Hz/s*" contains following table:

Generation Units Result Summary					1 Hz total frequency drop			
Generator Set	Unit Size	Inertia Constant H	Xd	Terminal Voltage	Stable	during	RoCoF	
[name]	[MW]	[Sec.]	[p.u.]	[kV]	[@ 0.5 Hz/s]	[@ 1.0 Hz/s]	[@ 1.5 Hz/s]	[@ 2.0Hz/s]
CCGT Single-shaft	400	5.5	1.9	20	Y	Y*	Y*	N
CCGT Dual-Shaft	260	6	2.3	17	Y	N	N	N
CCGT Dual-Shaft	140	9	2.1	17	Y	N	N	N
Steam Thermal (Reheat)	300	5	1.7	17	Y	Y*	Y*	N**
Steam Thermal (Once Through)	250	4.5	2.3	20	Y*	Y*	N	N
Steam Thermal (Fluidized bed peat)	150	8	2.2	11	Y*	N	N	N
OCGT	50	1.5	2.9	11	Y*	Y*	Y*	Y*
Salient-pole Hydro	30	2.7	1.4	11	Y	Y	Y	Y

The tables give a general overview of the findings where:
Y is used to indicate stable operation
Y* is used where a pole slip is only observed for a 0.93 leading power factor operation mode;
N is used when a pole slip is also observed for power factors of 1 unity or/and 0.85 lag;
N** is used when no pole slip is observed for power factors of 1 unity or/and 0.85 lag but negative power generation is detected.

The conclusion is simple: the most significant PGMs (type CCGT and NPP) cannot withstand a RoCoF of 1.0 Hz/sec for more than 500ms.

Some simulations performed by EU Turbines and others performed by EDF show that due to their structural large inertia, nuclear power plants and big thermal power plants are not able to withstand RoCoF requirements proposed by ENTSO-E (4Hz/s for 0.25s, 2Hz/s for 0.5s, 1.5Hz/s for 1s and 1.25Hz/s for 2s), thus a more realistic value of 1Hz/s for 0.5s should be considered.

Recital 25 of the RfG NC (accepted by ENTSO-E) specifies:

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.

This Recital imposes a mitigation of the local extreme values of RoCoF and not an increase of the withstand capability to those extreme values. On the other hand, ENTSO-E admits that at a RoCoF above 1Hz/sec, the system will go into a black-out because the protection systems are too slow. A reasonable approach would be that ENTSO-E does its utmost to avoid the occurrence of high RoCoF events, via the installation of batteries or synchronous compensators as the Italian TSO Terna is doing now.

3. Regarding the proposals for a **significant modernisation**, several comments can be made:

   - There is no consideration for ACER's Policy Paper imposing the procedure of a significant modernisation also to PGMs type A & B. See topic 49 of the Policy Paper: *Regarding types A and B PGMs, amended rules on significant modernisation should apply to them as well, contrary to what is currently written in the NC RfG since modifications to these PGMs can significantly increase their impact on the system.*
   - In Art.4.1.a.iv ranges are proposed to be specified by each country, endangering so a European level playing field as specified by ENTSO-E for this issue in its "Amendment proposals for RfG NC" Amendment 3. The ranges must be defined by values.
   - Eurelectric prefers a more general notion for spare parts and not "recognised" spare parts in Art. 4.9. The definition of Maintenance according to IEC 13306 also must be respected.

4. Nothing is proposed regarding the interaction of a HVDC terminal or large PPM on new synchronous PGMs regarding **Sub Synchronous Torsional Interactions**. This phenomenon was discussed in the Expert Group Interaction Studies and Simulation Models but not integrated in the final report because it was not specified in the terms of reference.

5. Requirements for **synchronous condensers** are missing in the ENTSO-E proposal.
   Several studies show the need for inertia and short-circuit power as generated by synchronous machines or in an artificial way by PPMs. Synchronous condensers (synchronous machines unable to inject active power) are essential to increase system

stability but they were never in the scope of the grid operators. Grid operators do not have any experience with those rotating heavy machines. Eurelectric proposes to classify those synchronous condensers as an element of the non-frequency related system services that should be offered by third parties according to the market principles. These kinds of installations should be described in the new version of the RfG NC as creating a dedicated network code only for those machines is too time consuming.

6. Eurelectric notes that time-unlimited operation is still requested for the frequency range 49Hz-51Hz (Table 2, Article 13), whereas such values are rarely reached. For instance no frequency lower than 49,7 Hz was reached during the period 2014-2021 except in Spain in July 2021. The SOGL defines a maximum standard frequency deviation of 50 mHz for continental Europe. It would be better to impose an unlimited range of 49.8 to 50.2 Hz and a time period of a couple of hours for the ranges 49.0 to 49.8 Hz and 50.2 to 51.0 Hz.
   Also, the extension to 52.5 Hz for 10s is unacceptable without any additional studies. It seems that this new requirement is closely linked to the new RoCoF profile for over frequency, which as described before seems irrelevant. Thus, it should not be applied.