EURELECTRIC-VGB meeting with ENTSO-E

Brussels, June 28th

Requirements included in the
«Requirements for Grid Connection Applicable to All Generators » (RfG) draft network code
dated June 12th on which
VGB and EURELECTRIC totally disagree on, and explanation.

GENERAL COMMENTS

Essentially in its foundations this Network Code remains unchanged. Only the justification document has changed trying to give different arguments to support the Network Code. In a general way requirements for types A and B have been increased, while remain the same for C and D with some exceptions. Some of our concerns have been partially considered.

This last version includes another document ("*Network Code Requirements for Generators in view of the future European electricity system and the Third Package network codes")* that replaces the "Motivation and Approach" document released with the public consultation.

1. With this document ENTSO-E tries to justify the new grid code based on renewables penetration and focus on EC 2050 goal of CO2.

"Today RES usually provides even at peak generation less than 30 % of the power and most of the time much less but this will increase significantly in meeting the EC 2050 goal of CO2 emissions reduction of 80% - 95% below 1990 levels1."

"The capabilities identified in the RfG NC are those necessary to ensure the long term viability of the European power system(s); maintaining security of supply, allowing the IEM to function effectively and enabling the EU CO2 reduction targets to be met through the decarbonisation of electricity generation. The consequences of future generators being constructed without these capabilities are therefore severe and it is difficult to justify the reliance on unproven market based mechanisms to deliver these, particularly when considering the design life of generators (decades) and the costs of a retrofit programme. However, one must note here an important distinction: the NC RfG does not dictate how the ancillary services are to be procured or remunerated. Instead, it defines what generators should be capable of delivering. The delivery of these services will be done generally in a market based context as, for example, in the forthcoming Balancing Network Code."

Considering the expected long term application of the code, it is legitimate to question:

- The strategy, defined 2 years ago, to not set up a stakeholder group to avoid delays in the code development process. This concern has been raised many times, since ENTSO-E's mandate was

issued. The confusion caused by the lack of an early set-up stakeholder group can be illustrated by a few positive last minute changes like low voltage boundaries from 0.8 to 0.85.

- The necessary evolutions of this code have been disguised and translated into national TSO's initiatives under article 4(3) losing the initial spirit of the code: standardization of minimum requirements. The code changes and the adaptation of the EU electrical system to the future challenges have to be anticipated and handled via a stable legal framework. The implementation and possible amendment of the requirements go through many administrative and legal provisions and stages, giving room for disputes, appeals and delays, and leaving consultation with stakeholders at EU level.

2. ENTSO-E must demonstrate the technical necessity of any requirement deviating from current standards. For the time being, current rules offer a satisfying level of security, particularly in the (former) UCTE synchronous area. To avoid over-specified requirements and unjustified costs, ENTSO-E has the responsibility to explain in a quantitative way how the new risks are threatening system security, and the technical solutions to be considered.
3. In Art.2.1 of the FG regarding the technical requirements related to frequency and active power control and to voltages, ACER specifies *"Those rules shall be aligned as far as technically possible and economically beneficial throughout the EU, irrespective of synchronous area borders."* This philosophy is not applied by ENTSO-E because too many parameters of frequency and active power control and to voltages will be defined by the local TSO and will not be harmonized at an EU level.

SPECIFIC COMMENTS

- **Chapter Purpose and Objectives,** page 2 6th section "As indicated in (4) …"**:**
  - For ensuring system security, technical and operational capacities are taken into account, as well as other requirements imposed by authority and regulators. Therefore our proposal is that in case of a conflict between the NC RfG and other regulations, priorities shall be taken into account in the following order:
    1) nuclear safety (wherever relevant)
    2) occupational health and safety requirements for persons and the environment
    3) generating unit protection and network security
- **Article 3.6.c , Table 1**:
  - The values of the thresholds proposed in table 1 are not in line with existing practices and will increase the cost for PGF because fulfilling more requirements than before (e.g. Fault Ride Trough for modules less than 1MW in CE, LFSM for module less than 50 MW in CE, etc.).
  - The allocation of the requirements to the categories and the values of the thresholds have not been justified by any cost benefit analysis (CBA). E.g. the threshold for a type C in Continental Europe is 5 times bigger than for Great Britain, but for a type D only 2.5 times. Why?
  - The statement towards the bottom of page 2 ("To ensure system security …") that *"All requirements that contribute to maintaining, preserving and restoring system security in order to facilitate proper functioning of the internal electricity market within and between*

synchronous areas, and to achieving cost efficiencies through ***harmonization of requirements*** *shall be regarded as "cross-border network issues*" appears to contradict the proposed definition of thresholds by TSOs.

- The ACER's FG impose in Art.2.1 a classification of significant grid users taken into account the **voltage level** at the connection point. "Voltage level" is a notion used to indicate concepts like "low voltage", "medium voltage", "high voltage" and "extremely high voltage". ENTSO-E's classification ignores low, medium and high voltage classification as requested by ACER's FG. Eurelectric / VGB ask to follow the ACER definition.

- **Article 3.6.f :**
  - The reference of the last sentences in Art. 3.6.f *"and in addition those set forth in Article 15(2) (b), if they are type B, C, D."* is wrong. Art. 15 (2) can only be applied for Power park modules and not for Pump Storage Power Generating Modules.
  - If all requirements related to the document "RFG" are met, then it is not possible for Pump-storage Power Generating Modules to fulfill the requirements in pumping operation mode. The requirements could only be fulfilled during the turbine mode with regard to the water level. The Pumping Module in a Pump-storage Power Generating Module working as a motor and not as a generator is often designed for working in an I/O- and not continuously controllable Mode. If this will still be valid then ENTSO-E has to propose which requirements are not applicable to pump storage in pumping mode.
  - The non-limited operation time of synchronous compensators has not been justified.
- **Article 3.6.g –** ENTSO-E has introduced special consideration for power generation in industrial sites, but only for type A,B or C. It is not understandable why type D is out of this exception. Conditions of disconnection are allowed through an agreement to secure production processes for embedded generation. This requirement should be extended to all other type of PGF requested to disconnect to secure their process for environmental and safety purposes (nuclear, hydro, etc.).
- **Article 4.3 –** To comply with the objective of transparency requested by this regulation, each paragraph of the code mentioning Article 4(3) should be systematically completed by requesting the TSO to proceed to a public consultation. ENTSO-E denies the need of a public consultation systematically when a TSO requests Article 4(3) on the basis that the national framework will establish detailed procedures. This code has been requested by law to be developed under a public consultation and it should be the same for any provision to be granted pursuant to the network code during its implementation.
- **Article 5 –Recovery of costs.**
  It only deals with cost recovery by TSOs. However, most of the obligations are to be borne by the generators that are directly liable of the costs implied. On the contrary if there are any obligations which have to be borne by Network Operators, ENTSO-E passes those costs to customers.
- **Article 8.1 Table 2**
  - For continental Europe, the unlimited time requirement deviates from existing codes for several EU countries (FR, IT, NL, RO, etc.) and would lead to raise significantly the solicitations of generators for frequency response.
  - Limited frequency ranges: The time periods for operation are much larger than existing, which are based on industrial practice of generators and on existing system operation needs.

The code is not open for considering an agreement between TSO and PGFO (Power Generator Facility Owner) to adapt time periods to the different capacities of different technologies. The time periods have not been seriously discussed with the stakeholders and ENTSO-E has not provided a cost-benefit analysis to justify 30 min at least.

- Despite their impacts on equipment aging, no frequencies of occurrence are being proposed for limited time periods.
- This requirement is not linked with system operation and demand connection network codes.

- **Article 8.1.b** – The requirement is new in many synchronous areas. It has not been justified why it would be necessary in large synchronous area, nor evidenced by a CBA.
- **Articles 8.1.e –** The boundaries imposed in figure 2 are too general and not applicable for all intermediate power output capabilities. The power output capability reduction has to be agreed between the Relevant Network Operator and the PGF Owner in order to represent the real output capabilities of the PGF.
- **Article 8.1.f –** In previous version was point d. ENTSO-E now has included a time limit of 5 seconds for cease Active Power output.
  Currently is difficult to support from both technical and economical point of view reaching this level of control because of the different involved plants (e.g. their size, etc.). 5 seconds may not be sufficient to have a massive response of a large number of generators.
- **Article 9.2.a** - Previous version limits the capability of reducing Active Power to steps not bigger than 20% of maximum capacity. Now there is no limit.
- **Article 9.2.4.a** - ENTSO-E has included conditions for type B to reconnect after an incidental disconnection due to a network disturbance. What does that mean? Automatic reconnection system needs authorization but what happens with non-automatic reconnections? Is it really necessary that RNO authorizes all units to reconnect? Has this been justified?
- **Article 9.3.a.1 up to 4**: Every TSO is free to request any FRT curve. In principle, this is not acceptable: The alternative, mentioned after 9.3.a.4 must be general and the tables 3.1 and 3.2 must be replaced by our proposed tables (see annex) to prevent poor network protection for whole Europe due to the application of current Nordic value of 250ms Fault Clearance Time.
- **Article 9.3.a.5:** This specification is excessive. Not only protection for internal electrical faults can make disconnection necessary. Protection of human safety, environment and equipment, shall always prevail.
- **Article 9.3.a.7:** Again, an excessive requirement because FRT curve is, by definition, a compromise between the grid performance (to clear the faults) and the plant performances (to stay connected in a stable manner after the fault clearance). **Article 9.5.b** Previous version included requirements for protection, control schemes and settings for type C. This version extends such requirements also for type B. It must be clarified that only schemes and settings relevant for the Network shall be coordinated and agreed between the Network Operator and the Power Generating Facility Owner.
- **Article 9.5.b.2** – Unless plant protections do not run counter grid protections, it is the responsibility of the PGF owner to decide about the precedence of operational settings and electrical protections. For a PGM, this requirement is contrary to the concept of defense in depth protecting the PGF against electrical hazards generated by the grid.

- **Article 9.5.c** – The priority ranking of protections and control devices describes only issues related to the electrical components of a PGF. Environmental elements, general health and safety elements, thermal elements, nuclear elements will also have an impact on the control of the PGF. All those elements have a higher ranking than those mentioned in the text. The proposal has to be modified to take also those elements into account.
- **Article 10.2.b.2** – The *"frequency restoration action"* in terms of value and dynamics is not defined, and we cannot accept to leave unchanged the power reference without knowledge of the "*frequency restoration actions".* Requirement unclear and has to be better described.
- **Comment on figure 5** – A 0.2% of insensitivity on df/f axis should be shown in the figure.
- **Article 10.2.c.3 Table 4**: ENTSO-E has explained that the ranges were chosen because covering existing values in EU Countries. No justification has been provided why maximum existing ranges would suit the future system needs. The adequacy of the ranges with the needs expressed in the Load Frequency Control & Reserve code has not been evidenced.
- **Article 10.2.c.4** –A reselection of the deadband and the droop is a complex and intensive process. Such reselection cannot be imposed so easily as described in the NC. Due to the impact on the design of the PGFM, the droop proposed by the TSO has to be agreed by the PGFO.
- **Article 10.2.c.5**: The code should not propose (even under Article4(3)) combination of parameters which are not physically possible. For example, requesting up to 10% extra active power within 1 second or even less is not realistic. For a thermal unit, it would result in continuous operation of boilers at 10% more power and an extra bye-pass to drop this power on the condenser. Results: higher CO2 emissions, higher pollution, higher fuel costs and consumption.
- **Art. 10.2.c.7 -** Longer activation times are admitted by the relevant TSO due to system stability reasons. In this sentence also the provision of Art. 10.2.c.5 has to be added : the parameters in table 5 shall take into account the technology dependent limitations. Without this modification, a contradiction remains between two provisions.
- **Article 10.2.d** – This provision opens the possibility to implement later a secondary control. The performances of this frequency restoration control are very important for cross border trade (particularly when considering power control dynamics at PFGM level). The contrast between the heavily detailed provisions for the 10.2.c FSM and this very general and vague requirement (moreover not linked with Load Frequency Control and Reserve code) cannot be accepted if it is considered that both are main contributors to cross border exchanges. ENTSO-E should align the level of specification for 10.2.c FSM and 10.2.d Frequency restoration control and link the values with the provisions of the Load Frequency Control and Reserve code.
- **Article 10.2.e** – Pumps of Hydro Power Plants have to be disconnected when achieving a frequency below 50 Hz which is defined and agreed between PGFO and TSO. All other requirements (e.g. voltage range, frequency stability, etc.) of the operation modes have to be based on the technology of pump group. (e.g. request for reactive power should be avoided; normal operation mode ad rated power with cos phi = 1.0).
- **Article 10.5.a** – As black start is not mandatory; all related technical provisions should be specified by the TSO when requesting a quote. 10.5.a.2 and 3 have to be deleted.
- **Article 10.5.b.2** – This is the only one requirement in the code specifying a minimum value (55%) for the power output. This value has not been justified and should be agreed between TSO and PGFFO.

- **Article 10.5.c.2** – Because of the impact of PGFM design, the capability to trip to house load should be considered in the same figure with black start (i.e. by the possibility for TSO to request a quote).
- **Article 10.6.b** – All the parameters to record are intended to be used by the Relevant Network Operator or Relevant TSO for the assessment of PGF performance. As all performance criteria in the Network Code are defined at the connection point, i.e. on the HV network, it is self-evident that the instrumentation should be installed at that location. Considering that:
    - the use of the instrumentation is for the Relevant Network Operator;
    - the location of the installation of the instrumentation is under the control of the Relevant Network Operator;
    - the PGF Owner has no equipment beyond the HV connections of the generator step-up transformer,

  the instrumentation required to be installed for monitoring the fault performance, dynamic performance and power quality indices should be installed by the Relevant Network Operator according to their specifications. Not only is there no technical benefit from installing such equipment within the PGF, but the data gained from in the PGF would be very difficult to translate to the connection point and would lead to dispute and confusion.

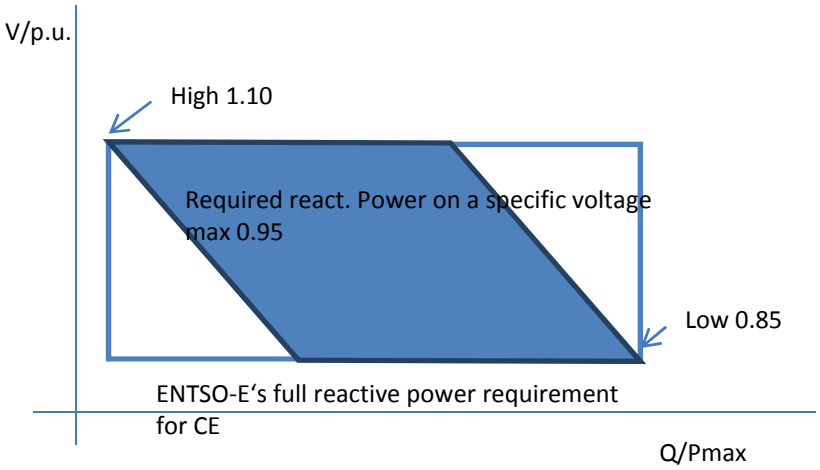
  This requirement should be replaced by a requirement for TSOs
    - to equip the connection point with a fault recording system and
    - to deliver real time data to PGFO
- **Article 10.6.g** – If the use of a spare component results in no change in the performance of an existing plant, i.e. it does not have any significant impact on the grid connection, then there is no need to notify the TSO in the first place.
- **Article 11.2.a Tables 6.1 and 6.2**
    - The proposed voltages unlimited ranges (– 10% to +11.8% for table 6.1) and (– 10% to +5% for table 6.2) are contrary to EN 60034 (– 5% to +5%). This break-through proposal, which implies the use of load tap changers is not necessary everywhere and has not been explained, justified or evidenced (FAQ 20 uses a syllogism: IEC 60034 + on load tap changers => network code is not contradictory with IEC! However, it is not possible to IEC 60034 certify a generator + a step up transformer with on load tap changers because IEC applies only for motors and generators!).

      The needs for requesting extended voltage ranges should be established on power load flow studies, performed under TSO's responsibility. To get the capability to control the voltage, TSOs should not rely only on plant capabilities but also on grid means (compensators, etc.), both based on international electrical standards. As DSOs have to keep the voltage in the right ranges to avoid damages for customers, the connection point for a PGM should be considered (from TSO's perspective) as a special point of the grid where the voltage has to be kept in normal system operation conditions in a range maximizing PGM reliability (– 5% to +5%).
    - Some voltage ranges have changed. If finally ENTSO-E has listened to the stakeholders changing 0.8 to 0.85 pu from both tables, it is still unclear and not justified why the 110 kV to 300 kV unlimited mode has been increased to 0.9-1.118 pu.

- Out of the unlimited range, the 60 minutes time for operation has not been justified. That will dramatically increase, if frequently experienced, the aging of the electrical components. If no significant degradation of the voltage quality is expected by TSOs (voltage quality criteria are supposed to be in the system operation code) then a limited time for operation not greater than 30 min would be acceptable. Why ENTSO-E has not proposed to discuss frequency of occurrences?

- **Article 11.3.a Tables 7.1**
  - During the two previous stakeholders meetings, it has been explained that the values for the ranges of FRT parameters [0.14; 0.25]s are covering all parameters experienced in EU countries' grid codes. Please notice the Polish grid code requests a Tclear equal to 0.12 s (ref 2.B.3.2.1 and 2.B.33.1.30). Why the Polish grid code is not considered?
  - The tables 7.1 and 7.2 must be replaced by our proposed tables to prevent poor Network protection for whole Europe due to the application of the current Nordic value of 250ms Fault Clearance Time.
- **Article 11.4.a** - ENTSO-E has included a new general system management requirement: Is it necessary to request this authorization to synchronize a hydro power plant unit of 15 MW connected to a 220 kV power line? Only in Spain there are hundreds of hydro power units that will need this authorization. If there was an agreement that covers the settings of synchronization why generators would need another authorization in real time?
- **Article 13.2.a** – Whatever the distance between the step-up transformer and the connection point, the PGF owner is always responsible for the compliance of the PGFM with the reactive power capabilities and voltage at the connection point. Therefore, PGF owner is responsible for the provision of supplemental reactive power and the TSO shall agree.
- **Article 13.2.b.2 & Table 8** –
  - The maximum voltage range of Q/Pmax is excessive and not consistent with generator's proposal of 1.05pu
- **Article 54**
  - There are a lot of deadlines in this Article (see 2, 4, 6) … for the TSO. What would happen if the TSO breaks one of the deadlines?
  - Involving of stakeholders at early stage: ENTSO-E disagrees, because the NC's intention is mainly to define the connection requirements for new generating units and because of the FG. All initiatives coming from TSO to change/adapt the local provisions implementing the code should be transparent and request the involvement/comment of stakeholders through a public consultation.
- **Article 13.2.b.2 & Table 8 –**

  ENTSO-E sticks to its idealistic proposal on the justification that TSO's choice for inner envelope will be transparent. The proposed wording allows TSOs to choose extravagant (in terms of costs for generators) shapes like the one in blue below. TSOs should be required, before proposing a new shape, to justify why they need a reactive capability different from previous practices, and systematically, CBA and public transportation should be performed. Existing design (alternator + step-up transformer) have a Q/Pmax capability about 0.7 at connection point!



- **Chapter 2 Article 38 to 51**

  The articles for compliance testing are too much detailed. It is completely sufficient for compliance purposes to refer to the articles related to the requirements. It is common practice that the test procedure is agreed between PGM Owner and TSO/RNO, and since the code is specific enough, there is also no room for interpretation of the results.

  It can be required, that the PGM shall evidence the compliance with the network code. So there is no need at European level to define a test procedure in this network code (i.e. frequency steps…). Thus the compliance testing article should be more functional.

  It would be also important to set up a timeframe for the tests (i.e. after receiving an inquiry for testing from the PGM Owner, the TSO/RNO shall guarantee that the tests can be carried out within x weeks), this would give the PGF Owner as well as the TSO/RNO more planning security.

  Nevertheless article 37 states that: "*allow the Power Generating Facility Owner to carry out an alternative set of tests, provided that those tests are efficient and sufficient to demonstrate compliance of a Power Generating Module to the requirements under this Network Code*;" which makes the descriptions of article 38 to 51 too detailed and superfluous.

  To make a long story short, the TSO/RNO wants evidences, that the PGM fulfills the requirements of this Network code and therefore a document should be sufficient.

  Better functional definitions on compliance testing would help to avoid misunderstandings (active/reactive power conditions in the grid, etc.).

FRT proposed tables

	Uret	Uclear	Urec1	Urec2	tclear	trec1	trec2	trec3
Continental Europe	0.05 - 0.3	0.7 - 0.9	Uclear	0.85 - 0.9 and ≥ Uclear	≤0.15	tclear	trec1 - 0.7	trec2 - 1.5
Nordic	0.05 - 0.3	0.7 - 0.9	Uclear	0.9 - 1.0	≤0.25	tclear	trec1 - 0.7	trec2 - 1.5
Great Brittain	0.05 - 0.3	0.7 - 0.9	Uclear	0.9 - 1.0	≤0.14	tclear	trec1 - 0.7	trec2 - 1.5
Ireland	0.05 - 0.3	0.7 - 0.9	Uclear	0.9 - 1.0	≤0.15	tclear	trec1 - 0.7	trec2 - 1.5
Baltic	0.05 - 0.3	0.7 - 0.9	Uclear	0.85 - 0.9 and ≥ Uclear	≤0.15	tclear	trec1 - 0.7	trec2 - 1.5

Table 3.1

	Uret	Uclear	Urec1	Urec2	tclear	trec1	trec2	trec3
Continental Europe	0.05 - 0.15	Uret - 0.15	Uclear	0.85 - 0.9	≤0.15	tclear	trec1	1.5 - 3.0
Nordic	0.05 - 0.15	Uret - 0.15	Uclear	0.9 - 1.0	≤0.25	tclear	trec1	1.5 - 3.0
Great Brittain	0.05 - 0.15	Uret - 0.15	Uclear	0.9 - 1.0	≤0.14	tclear	trec1	1.5 - 3.0
Ireland	0.05 - 0.15	Uret - 0.15	Uclear	0.9 - 1.0	≤0.15	tclear	trec1	1.5 - 3.0
Baltic	0.05 - 0.15	Uret - 0.15	Uclear	0.85 - 0.9	≤0.15	tclear	trec1	1.5 - 3.0

Table 3.2

	Uret	Uclear	Urec1	Urec2	tclear	trec1	trec2	trec3
Continental Europe	0	0.25	0.5 - 0.7	0.85 - 0.9	≤0.15	tclear - 0.45	trec1 - 0.7	trec2 - 1.5
Nordic	0	0.25	0.5 - 0.7	0.85 - 0.9	≤0.25	tclear - 0.45	trec1 - 0.7	trec2 - 1.5
Great Brittain	0	0.25	0.5 - 0.7	0.85 - 0.9	≤0.14	tclear - 0.45	trec1 - 0.7	trec2 - 1.5
Ireland	0	0.25	0.5 - 0.7	0.85 - 0.9	≤0.15	tclear - 0.45	trec1 - 0.7	trec2 - 1.5
Baltic	0	0.25	0.5 - 0.7	0.85 - 0.9	≤0.15	tclear - 0.45	trec1 - 0.7	trec2 - 1.5

Table 7.1

	Uret	Uclear	Urec1	Urec2	tclear	trec1	trec2	trec3
Continental Europe	0	Uret	Uclear	0.85	≤0.15	tclear	trec1	1.5 - 3.0
Nordic	0	Uret	Uclear	0.85	≤0.25	tclear	trec1	1.5 - 3.0
Great Brittain	0	Uret	Uclear	0.85	≤0.14	tclear	trec1	1.5 - 3.0
Ireland	0	Uret	Uclear	0.85	≤0.15	tclear	trec1	1.5 - 3.0
Baltic	0	Uret	Uclear	0.85	≤0.15	tclear	trec1	1.5 - 3.0

Table 7.2

ENTSO-E's treatment of the significant deviations within the new network code 'Requirements for Generators' from requirements under existing national codes.

Summary

It is clear that undertaking to produce one network code from the multitude of disparate existing network codes will result in more onerous requirements for some jurisdictions. For that reason, ACER's Framework Guidelines for Electricity Grid Connection (20/07/2011) specifically indicate how this situation should be resolved. In section 2.1 of the Framework Guideline, it is written –

"*When the minimum standards and requirements, introduced by the network code(s), deviate significantly from the current standards and requirements, there should be a cost-benefit analysis performed by ENTSO-E that justifies this deviation and demonstrates additional benefits from requiring the higher standard*".

Is ENTSO-E respecting this requirement in the Framework Guidelines?

It is asserted here that ENTSO-E has not respected its obligations under the Framework Guidelines by deliberately downplaying the significance of the network code changes. Where any justification is provided by ENTSO-E, this does not take the form of a cost-benefit analysis and fails in all cases to demonstrate any additional benefits to any system user.

Significant Deviations

Stakeholders in the process have identified multiple clauses in the proposed Network Code which are considered to be significantly different from those in existing national grid codes. ENTSO-E's position thus far is that any deviations are modest and the code does not impose any significant deviation from existing codes and standards.

The stakeholder presentations and minutes of the bilateral meetings, available on the ENTSO-E website, show that the industry, utility and DSO participants do not agree with that assessment.

For example, the minutes of the meeting between Eurelectric WG Thermal / VGB / EUTurbines and ENTSO-E on 20/12/2011 records the VGB assertion that the frequency ranges are significantly different (doubled) from existing requirements on the UCTE system. EUTurbines questions whether the ROCOF requirements are even feasible.

The DSO Technical Expert Group in its meetings with ENTSO-E in August and December 2011 is recorded as expressing serious concern over the new ROCOF requirement and notes that 'any new requirements should be justified by CBA (not just retroactivity) as required by the ACER FG".

EUR, a specification body from 19 European nuclear operators, in its presentation to ENTSO-E on 15/02/2012, states that the implications of the changes in frequency and voltage requirements in the new Network Code pose a major concern for nuclear safety.

It is clear that if the changes between existing national grid codes and the new network code were insignificant or modest, stakeholders would not be so concerned about the impact on their plants including not only operational impacts and safety considerations but even the technical feasibility of the requirements themselves.

ENTSO-E's Justifications

ENTSO-E's presentations to the stakeholders, available on their website, have put forward its position on the significance of the deviations under a slide titled "Does the Network Code deviate significantly from existing grid codes?" In this, it asserts that the changes are 'modest' for most countries. ENTSO-E write that all comments in the pilot consultation process and various bilateral discussions were used to the form the basis that "..the Network Code does not impose significant variations from existing standards and grid codes." It points stakeholders to the more detailed responses in the document "Frequently asked questions (FAQs) providing an in depth technical justification of the main aspects of this draft Network Code".

This FAQ document makes neither attempt at a 'cost benefit analysis' nor any demonstration of the 'additional benefits from requiring the higher standard'; it provides no in-depth technical justification of the higher standard from any perspective, let alone that based on the needs of the system. Under FAQ 10, addressing the issue of significant deviations, it is stated that "ENTSO-E believe that there is no significant deviation from existing requirements because the Network Code has been developed by taking and improving requirements from different existing national codes and standards that have proven their efficiency on the respective issue and could be considered best practise." ENTSO-E then compares at a high level, the new Network Code and the existing grid codes for the synchronous areas. It is clear from this review and from more in-depth study that the new Network Code is most closely aligned with the existing grid code in Ireland. It is not difficult to see that applying standards applicable to the Irish island system which is 1/50th the size of the UCTE system must have an significant impact on UCTE or other system connected generation even without ENTSO-E 'improving' those requirements.

Example 1: Frequency Ranges in CE area

The new Network Code proposes that the continuous operating range of frequency will now be doubled in size to 49Hz – 51Hz. The previous standard was 49.5Hz – 50.5Hz. ENTSO-E's justification for this change is supposed to be in FAQ 19. In this they state that significant frequency deviations 'may' occur with the increased penetration of renewables. The wider range of frequency for normal operation, while being doubled, is not considered by ENTSO-E as a problem for generation as the range remains within the relevant IEC standard for unlimited operation. **No additional benefits are identified by requiring this new range. There is no an in-depth justification of the new requirement. Conveniently, alternatives to requiring a wider frequency range are avoided.** These items would be expected to be clearly demonstrated under ENTSO-E's obligations in the Framework Guidelines.

In fact, ENTSO-E has entirely missed the point of the objections to the wider frequency ranges by concentrating on the technical capabilities of the rotating machinery under IEC 60034. Changing the normal operating range of the system frequency changes the amount of time that a unit must provide regulating power to the system with consequential impact on the lifetime of the governor and turbine components. EUR and VGB independently arrived at a figure of an increase in the time spent in frequency regulation of 30%. Furthermore, the generating unit is now operating less efficiently due to the off-nominal frequency experienced by the unit auxiliary motors and pumps. It is not the technical capability of the generator that ENTSO-E must consider; it is the impact on the whole station that must be weighed.

Example 2: The Fault Ride Through Range

The new Network Code proposes that the fault ride through time for severe voltage dips is a selectable value in the range 150ms – 250ms. This range is chosen to reflect the existing requirements in the UCTE, Ireland and GB systems (mostly 150ms) and the Nordel system (250ms). In FAQ 24 ENTSO-E addresses the topic and lays out in some detail why, in general terms, fault ride through capability is required. However, ENTSO-E does not attempt to address the fact that areas which currently have a Fault Ride Through time of 150ms are now exposed to a potential change to 250ms. That is clearly a significant deviation from existing codes and is not addressed by ENTSO-E. It arises, most likely, from the consensus based approach (amongst constituent TSOs) to the production of the network code rather than clearly identifying the needs of the system. If a best practise approach is considered worthy for ENTSO-E to use for generator requirements, it is clear that this standard should also be applied to the TSOs in the Nordel region and they should be required to accept a reduced fault ride through time of 150ms.

Example 3: The conjunction of widened Voltage and Frequency Ranges

The new Network Code widens the voltage ranges that will be expected on the UCTE system, which combined with the widened frequency ranges, poses a serious concern of over fluxing damage to generators, transformers and motors in stations where the generator transformer is not equipped with an On-Load Tap Changer (OLTC). This is especially applicable in France, The Netherlands and Belgium. ENTSO-E states that the risks can be avoided by retro-fitting an OLTC. ENTSO-E does not consider the feasibility, cost or impact on plant reliability of such retro-fitting. Note that CIGRE record in their last transformer survey that 41%[1] of all transformer faults are related to the OLTC. The risks arising from this significant deviation are not addressed in a cost benefit analysis by ENTSO-E as required by the Framework Guideline.

[1] To provide an evaluation of the impacts of the transformer failures on load factor, EDF's thermal and nuclear transformers (having no OLTC) contribute to reduce the total load factor of about 1% by year..