The European Utility Requirements (EUR)

Position from EUR Working Group for "ENTSO-E Network Code for Requirements for Grid Connection Applicable to all Generators"

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Description of the code (1)

- Frequency and voltage ranges are wider than today; longer duration time for extreme events, should be combined within one diagram
- No frequency of occurrence is given
- Reactive power demands from generators will be higher than today Nuclear power plants are normally designed for a power factor of 0.90, in some cases 0.85 for new plants
- The Fault-Ride Through curve requires novel and unproven technology in many plants
- There must be possibility to reduce produced power depending on the grid voltage and the frequency
- Standards
- Nuclear Safety aspects especially on existing plants must be considered when defining for instance the voltage and frequency domain

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WENRA

- Western European Nuclear Regulators Association (WENRA) letter, 2012-10-03 to ACER:

Some requirements in the final draft of the code (https://www.entsoe.eu/resources/network-codes/requirements-for-generators/) have the potential to negatively influence nuclear safety. In fact, the definition for the range for frequency and voltage is too large. For nuclear power plants, which are working as 100% base load power plants, the technical safety limit is 48 Hz. Under this limit, the frequency may have a negative impact on frequency dependent aggregates. Furthermore load following is contradictory to the common practice in several WENRA countries.

A safe and high-performance electrical grid is primordial for nuclear safety. The importance of the electrical grid was highlighted by the accidents of Fukushima and Forsmark. We therefore suggest to include the following statement as a new paragraph in Article 3 (6) (e) in the ENTSO-E NC: *"For nuclear power plants, nuclear safety considerations are prioritized in the case of a conflict between nuclear safety considerations and the Network Code"* or to reject the ENTSO-E NC, so as to revise it including the above mentioned concerns.

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Consequences on nuclear safety

- **Safety systems have very stringent capacity requirements. If these not are fulfilled the plant is regarded as not operable**
- **The grid is the most reliable source of auxiliary power**
- **Operation in the lower frequency and voltage domain specified by ENTSO-E will change the safety systems performance**
  - A solution could be to disconnect the safety systems from the grid and energies them from the on-site diesel generators
    - Would drastically increase the core damage frequency and not to be allowed by Nuclear Safety Regulators
  - Frequent operation in this domain would not be accepted by Nuclear Safety Regulators
- **Changes in safety classified auxiliary power to permit operation in this domain will be very costly and require long lead times (5-6 years) and long outages**
- **Changes necessary to fulfil the new requirement could be so costly that it can result in premature shutdown of existing nuclear power plants**

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Summary (1)

- Voltage requirements
  - The frequency of over and under voltages could in the short run be challenging
  - After replacing (in many power plants) with tap changers the requirement could be handled
- Frequent under-frequency. The new requirement will result in large replacements of electrical safety equipment. It will also require new generators in many plants
- Frequent frequency control will shorten the lifetime of the plant. It is also prohibited in many countries
- Frequency control and load following will make the business case for new plants more challenging

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Summary (2)

- The use of frequency converters, only to fulfill the grid code, is unsuitable
- Improvement of the ENTSO-E Network Code:
  - Keep frequency of occurrence as it is today
  - Set reactive power demands as they are today
  - Set the Fault-Ride Through curve as it is recommended in the EUR Grid Requirement (150 ms critical fault clearing time)
  - Give possibility to reduce power depending on the grid voltage and the frequency
  - Nuclear Safety aspects especially on existing plants must be considered when defining the voltage and frequency domain
- To fulfill the code will be very costly for existing plants and sometimes result in a premature shutdown
- The code will drive cost for new plants

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Thank you for your attention!

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