ENTSO-E and WindEurope joint assessment on Forced Oscillations amendment proposal for Requirements for Generators Network Code

Justifications of the counterproposal

- ENTSO-E and WindEurope agree that any imposed forced oscillation is a disturbance for our electrical transmission system, while disagreeing on the potential risks introduced regarding power system stability.
- From ENTSO-E's view in general PPMs should in general not be allowed to impose any forced oscillations, while WindEurope states that oscillations physically cannot be completely omitted, hence the low limits introduced in article 21 for type C PPMs.
- Due to the nature and design of wind turbines, they are not able to completely reduce the oscillations, hence the relaxation of requirements for OPPMs for the frequency range 0.1-2Hz.
  - Challenges with oscillations increase with the size of wind turbines. The price for limiting oscillations will also increase with turbine size.
  - Relaxation is mainly relevant for offshore wind turbines, which are much larger than onshore turbines.
  - Onshore requirement is applicable for all types of PPM, not just wind
  - For onshore PPMs a limit of 500 kW has been introduced, to relax requirements for wind farms <100 MW (0.5% x 100 MW = 500 kW)
- The original limits were defined in alignment with the Energinet position and Tennet NL and based on observation that existing offshore wind parks can stay below this value with limited effort.
  - Ranges have been introduced following a number of discussions with WindEurope, taking into consideration the fact that at the moment there are still a lot of unknowns and there is no proper justification for putting one single limit.
  - More specific limits and an assessment method will be described in the Implementation Guidance Document (IGD) after further analysis.
- The damping value includes a minimum of 100 seconds, which is a reduction compared with the original WindEurope proposal. To allow time for better justification of the limit, the range was set to 100-180 seconds.
- To occasionally allow for more than 2 exceedances per hour the 95th percentile value per week was introduced.
  - There is a total of 168 hours a week, meaning the 95th percentile will allow for more than 2 hourly exceedances for up to 8 hours a week. (85th percentile allows for up to 25 hours)
  - There is no upper count limit for these 8 (to 25 hours), however the total duration of exceedances must comply to a maximum of 1% to 2% of the time per day.

- o Exceedance of the limits in (a) and until damped below limits, is considered 1 count.
- o Exceedances which last less than 10 seconds are not considered as a count, since these are well damped and therefore have a limited impact on grid stability.
- sub (d) was added to avoid limiting the effect of for example the POD
- The requirement is not relative to voltage stability so the proposal from WindEurope to include it into Article 25 is not the most relevant location. The requirement for PPMs shall be included in Article 20 as it is relative to system stability for Type C PPM and the requirement for offshore wind parks in Article 26.
- WindEurope highlights if for all ranges the most stringent values are chosen, compliance may only be achieved with significant cost impacts.
- ENTSO-E highlights the increased risk for the power system stability, if in areas with a large amount of offshore wind the least stringent values are chosen.

Final proposal

[ONSHORE] – addition to **Article 21 - Requirements for type C power park modules**

4. In the frequency range between 0,1 Hz and 20 Hz, the control systems and design characteristics of Type C power park modules shall be subject to the following requirements relative to the total active power and current forced oscillations, when system conditions are within the frequency ranges as specified in table 2 and voltage ranges as specified in table 10:

(a) The forced oscillations shall not exceed continuously the maximum of:

(i) a limit in the range of +/- 0,1% to +/- 1% of the maximum capacity, as defined by the relevant TSO. The default limit shall be +/-0,5%.

(ii) a limit in the range of 200 kW to 500 kW, as defined by the relevant TSO. The default limit shall be 500 kW

(b) In case that the limits defined in (a) are temporarily exceeded, forced oscillations shall:

(i) not exceed a limit in the range of +/- 0.5% to +/- 3% of the maximum capacity, as defined by the relevant TSO. The default limit shall be +/-2,5%.

(ii) be within the limits defined in (a) within a range of 100-180 seconds, as defined by the relevant TSO. The default limit shall be 180 sec.

(iii) be damped to be lower than 50% of the limit specified in (i) within 50% of the time limit specified in (ii)

(c) While always respecting the criteria defined in (b), temporarily exceedance of the limits defined in (a), not considering oscillations that are damped to be within the limits within 10 seconds, is allowed for:

(i) a maximum percentage of time per day, as defined by the relevant TSO in a range between 1% and 2%. The default limit shall be +/- 1%.

(ii) a maximum in a range of 2-4 times per hour, based on the range of the 85th to 95th percentile of hourly exceedances measured over one week, as defined by the relevant TSO. The default maximum shall be 3 times and default percentile shall be 95.

(d) Forced oscillations originated from system support requests by the relevant system operator, such as power oscillation damping, are excluded from this requirement.

[OFFSHORE] – addition to **Article 26 - Robustness requirements applicable to AC-connected offshore power park modules**

3. Outside of the frequency range between 0,1 Hz and 2,0 Hz, the system stability requirement laid down in Article 21.4 shall apply to AC-connected offshore power park modules.

In the frequency range between 0,1 Hz and 2,0 Hz, the control systems and design characteristics of an AC-connected offshore power park modules shall be subject to the following requirements relative to the total active power and current forced oscillations, when system conditions are within the frequency ranges as specified in table 2 and voltage ranges as specified in table 10:

(a) The forced oscillations shall not exceed continuously the maximum of:

(i) a limit in the range of +/- 0,5% to +/- 2% of the actual value, as defined by the relevant TSO. The default limit shall be +/- 1%.

(ii) a limit in the range of +/- 0,25% to +/- 1% of the maximum capacity, as defined by the relevant TSO. The default limit shall be +/- 0,5%.

(b) In case that the limits defined in (a) are temporarily exceeded, forced oscillations shall:

(i) not exceed a limit in the range of +/- 2,5% to +/- 5% of the maximum capacity, as defined by the relevant TSO. The default limit shall be +/- 4%

(ii) be within the limits defined in (a) within a range of 100-180 seconds, as defined by the relevant TSO. The default limit shall be 180 sec.

(iii) be damped to be lower than 50% of the limit specified in (i) within 50% of the time limit specified in (ii).

(c) While always respecting the criteria defined in (b), temporarily exceedance of the limits defined in (a), not considering oscillations that are damped to be within the limits within 10 seconds, is allowed for:

(i) a maximum percentage of time per day, as defined by the relevant TSO in a range between 1% and 2%. The default limit shall be 1%.

(ii) a maximum in a range of 2-4 times per hour, based on the range of the 85th to 95th percentile of hourly exceedances measured over one week, as defined by the relevant TSO. The default maximum shall be 3 times and default percentile shall be 95.

(d) Forced oscillations originated from system support requests by the relevant system operator, such as power oscillation damping, are excluded from this requirement.