Cover letter for the EWEA public consultation response to the ENTSO-E network code for Requirements for Grid Connection applicable to all Generators

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1 Introduction

This document introduces and summarises the response of the European Wind Energy Association (EWEA) to the public consultation on the ENTSO-E draft Network Code for Requirements for Grid Connection applicable to all Generators (NC).

The European wind industry has assessed the NC and has decided to submit this joint response. The platform for preparing the response was EWEA's internal Working Group (WG) on Grid Connection Requirements. The WG has collected and discussed more than 400 comments from the WG members but due to this large number has decided to agree on a more limited number of key comments, namely 70. These comments have been submitted via the web tool provided by ENTSO-E. This approach was chosen in order to make the most efficient use of resources given the extremely limited timeframe for response and the high number of comments. The high number of comments is due to many deficiencies in the draft NC as well as the time consuming and inflexible comment-submission procedure. In addition to the EWEA comments, a number of our members have submitted their specific comments directly.

This letter summarises the main points of concern of EWEA with the NC, namely:

- 2.1 Need for more clarity in formulation of the NC
- 2.2 Lack of justification and cost-benefit analysis
- 2.3 Key technical concerns
    - Excessive reactive power requirements
    - Unclear fault-ride-through specifications
    - Compliance should be robust and pragmatic
    - Simulation models: lack of specification and insufficient IPR protection
    - Offshore PPM requirements are insufficiently future-proof
- 2.4 Uncertainty about future Code drafting at national level and about the NC maintenance procedures

2 Principal concerns of EWEA with the NC

2.1 Need for more clarity in formulation of the NC:

Deficits in grid codes (like with any other applicable standard, rules, law, directive, etc.) caused by a lack of completeness, details, explicitness and clear definitions lead to additional time and costs for wind power projects. These costs make wind energy unnecessarily more expensive and hinder the increase in the installation of renewable energy technologies needed to meet the 2020 European renewable energy and climate targets. The clarification process often leads to different interpretations by developers and TSOs and results in either expensive retrospective plant modifications, or costly and time-consuming disputes.

Moreover, a lack of clarity and completeness leads to exceeding costs for all involved stakeholders. More seriously, in a long term perspective the frequently changing requirements may trigger hidden unintended behavior and thus jeopardize system security.

The lack of clarity is caused by minor editorial errors and the fact that many definitions are not solid enough. Prominent examples are the definitions of the terms Generating Unit, Power Generating facility and Power Park Module which should be improved. The wind industry would be in favour of a much simpler set of terms that are also closer to the use in daily practice (for example “power plant”). In the present draft the inconsistent use of defined terms lead to a lot of inadequate specifications. EWEA has identified the need to introduce the defined term “Power Park Unit”, in order to enable clear specification at wind turbine level in the wind farms. In total EWEA identified 68 definitions that need to be improved, and in its joint comments, as well as in the comments of the members, it provides suggestions for alternative formulations.

A second main issue in respect of the lack of clarity are the grey zones, namely where adequate specifications of requirements are missing or are incomplete, and thus are open for different interpretations. Completeness is vital because otherwise a multitude of different interpretations and even more uncertainty, especially in national implementation, may arise. Finally, it is of utmost importance to grant a transition period of three years, as laid down by Article 57, following the entry into force of the Network Code until its application. Due to the significant changes with respect to technical requirements and compliance testing imposed by the Network Code, the necessity of this transition period also needs to be reflected in the definition of “New Generating Unit” (Article 2). This implies that the reference date for the definition of a New Generating Unit should not be the day of the entry into force of this Network Code, but rather the day the Network Code applies.

2.2 Lack of justification and cost-benefit analysis

One of the major short-comings in the process is the absence of a proper reference document giving justifications and arguments for imposing more stringent requirements than apply today. EWEA is particularly concerned that there seems to be no cost-benefit analysis to justify requirements that could potentially be overly costly for the consumers and the wind power sector, and with no apparent benefit. We note the according ACER Framework Guideline requirements in this context:

"The network code(s) developed according to these Framework Guidelines shall define appropriate minimum standards and requirements applicable to all significant grid users."

And:

"Where 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."

The ENTSO-E motivation document which was published together with the draft NC is an informal document with no proper cost-benefit analysis; EWEA does therefore not consider it as a valid document for justifying that the minimum requirements are appropriate and will deliver a net benefit. A proper justification and cost-benefit analysis should be carried out.

2.3 Key technical concerns

EWEA wants to bring forward some specific technical concerns with the formulations in the NC.

Excessive reactive power requirements

The stringent nature of the reactive power requirements is reflected by the excessive ranges of U-Q and P-Q requirements. As specified in the draft NC these are a quantum leap away from typical industry practice. The stated limits are not feasible without over-sizing the power park modules involving a very important increment in cost of manufacturing for the same installed power.

Furthermore, the need should be justified: ENTSO-E should carefully consider if this excessive Q-range should be the standard for all of Europe. The limits seem to be set to be able to cope with both the very left and the very right side requirement in the two parts of Germany. It is very unlikely that these broad ranges are optimal for all of Europe,

and the economic impact will be significant. Furthermore, the many MVAr´s would be more adequately placed at a number of central locations in the transmission grid instead of at the remote sites where wind plants are located due to wind conditions and where it may not be possible to inject the full NC reactive power range due to network limitations.

With respect to reactive power below maximum capacity, although some wind turbine types can provide reactive power in situations where no active power is produced, not all designs fulfill such requirements and the cost effect of adaptations will be significant, especially below 110 kV. Asking for a Statcom behaviour at zero active power would discriminate against doubly fed induction generators, which technically can only feed in the full reactive power with a turning rotor (i.e. when generating electricity). This would reduce competition in the supply of wind turbines and increase costs. No European Grid Code asks for reactive power generation when generators are not producing electricity. To highlight the discriminatory potential of this, one could consider the following hypothetical analogy: from 01.01.2014 only new cars which can drive at least 150 km/h will be allowed to drive. It should be noted that when wind farms (or Power Park Modules) are producing low levels of (or no) active power, then other generators will be dispatched which will have a reactive power capability in accordance with the NC.

EWEA has formulated an alternative proposal for the article 16.3. This proposal is submitted as a formal part of EWEA's response on the consultation and reflects consensus on what would be acceptable from the wind industry's point of view.

FRT specifications: unclear, excessive and possibly causing patent infringements

The lack of clarity in specifying fault-ride-through has been an issue for years for the wind industry all over the world. The drafting of the NC RfG would be an opportunity to set things right for Europe. In this respect the specifications in the draft NC are making a step forward, but the target is still miles away.

One of the main concerns is the way the voltage profile is specified and presented, which does not adequately describe how the profile should be applied before and after fault clearing.

It should be explained and clearly indicated in the figure that the voltage in the fault period is the actual minimum forced voltage in the connection point, whereas the typical sloped line is a boundary curve (envelope) of the post-fault voltage trajectory (which in reality is oscillatory). In this respect, having only one (normalised) profile (with the values in a complimentary table) makes it easier to ensure that the application of the profile can be explained more safely and easily. For that purpose EWEA makes a concrete proposal that is included in the formal response.

Apart from being unclear, the FRT profiles in the NC exceed the total of all current European grid codes regarding the behaviour immediately following fault clearance. All European TSO's would have to increase their FRT requirements significantly to make them fit the ENTSO-E profile. Even if PPM are theoretically capable of riding through lower

voltages for longer times in comparison to synchronous generators ENTSO-E must verifiably demonstrate why the PPM FRT profiles are required to deviate significantly from the FRT profiles for Synchronous Generators. Increasing the FRT profile will significantly increase the cost of PPMs. The values in the EWEA table submitted together with our public consultation comments reflect what is acceptable for the wind industry.

Another major subject of concern is related to all the requirements for fast reactive current injection during a network fault (voltage dip). This includes the following issues:

- The overly detailed description of article 15.3 (including Figure 8) specifies the implementation of voltage support by fast reactive current injection (i.e. a solution), rather than the required overall performance (i.e. functional specification) – which would be the thing to do.

- The optimal voltage support by fast reactive current injection during faults is subject of experts' discussion and no universal solution is available. It is simply unacceptable that a rigid document like NC with status of European law makes such detailed requirement on short notice, because in future the implementation might possibly appear to be "just not good enough" to support the voltage in Europe.

- Moreover, every wind turbine manufacturer has its own solution to providing reactive current injection during faults depending on type of generator, technical philosophy and license agreements. As Figure 8 is close to a European patent, this leads to a high risk of infringing it or being not compliant to the ENTSO-E NC.

- The requirement in the NC implies that the reactive current needs to be present at the PPM connection point, which is technically not possible due to the involved communication delays, which may exceed 40ms. The requirement should rather be valid at the terminals of the units within the Power Park Module as this is state of the art and content of existing grid codes. This would require the inclusion of a new defined term "Power Park Unit" to describe such units.

As for the reactive current injection during asymmetrical faults, the need of this requirement has not been justified according to the ACER Framework Guideline in paragraph 2.1.

EWEA has formulated an alternative proposal for the articles 15.2 and 15.3. This proposal is submitted as a formal part of EWEA's response on the consultation and reflects consensus on what would be acceptable from the wind industry's point of view.

Compliance should be robust and pragmatic

The basic philosophy in the Compliance Chapter (Title 4) and the formulations in the various articles in the NC, are so open that they will result in a multitude of different compliance procedures throughout the EU. As the mutual recognition of testing and

evaluation results is not guaranteed throughout the EU, this will lead to high cost for the equipment manufacturers who will have to go through the different compliance procedures in the different markets. Apart from the costs, the solution proposed in the NC will lead to many disputes between Network Operators as well as between generators and Network Operators. Thus, the wind industry recommends that the whole philosophy of compliance of the NC should be revised in order to become more robust and cost-effective. The approach should be pragmatic and leading to common acceptable results in Europe. Therefore the compliance procedures need to be described more in detail to remove the excessive degree of freedom.

In addition, as far as the requirements for the actual evaluation and testing methods are specifically described in the NC, they are often not appropriate for, or technically applicable to, wind energy technology, and in many cases will lead to excessive costs (for example due to specific control characteristics of variable renewables and due to non-availability of remote data transfer equipment for type A, B and C units). It is recommended to adjust the specific requirements related to evaluation and testing methods in agreement with the wind energy sector (and other relevant sectors, notably solar PV) to its possibilities and needs before considering them as elements in a European Network Code.

Simulation models: lack of specification and insufficient IPR protection

Specific requirements in NC (Article 9) as to simulation models are unclear on what exactly has to be provided. This is mainly left to local TSO's for decision. This will lead to excessive efforts and costs for manufacturers who will have to provide models in different software platforms and specifications all over Europe. Furthermore with the present formulations, it is not ensured that appropriate models will be asked for or provided, because the term "all types of studies" is very general, and there is no requirement for the local TSO to clearly define the exact purpose of the simulations. The NC should be more specific on requirements for simulation models on essential topics (FRT, frequency stability). For other purposes, the scope and purpose must be agreed between the generating facility owner and the relevant network operator.

The draft NC is excessive in asking detailed block diagram and structure representation as this is forcing generators to reveal sensitive know how and compromises competitive developments of technology and the inherent right to protect this. Detailed documentation should be the very last option to apply when the TSO has to develop an in-house model of the technology in case the generator is not supporting the simulation software.

Requiring certain components to be included in the model is unjustified as different generation technologies include different components. The presence of certain sub-models does not guarantee the accuracy of this model for a specific study. The main objective here should be to aim at a certain accuracy and usability of the model. Moreover, the requirement as formulated in the draft NC cannot be met by a PV plant, as

there is no speed controller or no alternator. Thus also for legal reasons the requirement needs to be more open.

Offshore PPM requirements are insufficiently future-proof

The formulations in the draft NC indicate that ENTSO-E may not have had the time to deal with these aspects in sufficient depth and in detail. As it stands now, the chapter is poorly drafted and, to a large extent, requirements applicable onshore are also proposed to be applicable offshore. However, the physical grid conditions are fully different, which is also clearly seen from the high number of diverse topology configurations mentioned on page 49 of the NC. Especially the electrical conditions are different from onshore conditions. For instance, full capabilities of existing HVDC technologies must be taken into account, since this could lead to lower requirements for offshore PPMs operating behind a DC connection. It therefore does not make sense to request similar requirements as for onshore and AC-connected PPMs.

Therefore, EWEA suggests to ENTSO-E to:

- remove the entire offshore chapter from the NC;
- for AC connected offshore wind farms: integrate the requirements with the requirements for PPM;
- design a future proof chapter applicable for HV DC connected offshore wind farms at a later stage;
- include such a chapter in the upcoming NC for HVDC.

2.4 Uncertainty about future Code drafting at national level and about the NC maintenance procedures

A process to maintain the NC has not been covered so far in the draft NC or in the corresponding ACER framework guideline. The ENTSO-E rules of procedure however do state that the maintenance of the network codes should be carried out at least every five years by the relevant ENTSO-E committee. Yet, these rules of procedure do not describe which, if not all eventual changes have to go through comitology. In view of the rapid technical developments in both power system and generation technologies EWEA believes that **a more regular and flexible process of maintenance of the network codes is needed in order to adequately deal with technical and regulatory progress in all aspects of the power system**.

A more institutionalised review cycle of the NC for Grid Connection should be established through a dedicated feed-back loop between ENTSO-E and relevant stakeholders on a regular basis. This maintenance process should impose a consultation with the relevant stakeholders every 2 to 3 years, or more frequently upon request from a number of stakeholders on a specific topic, if the need arises. Such a regular consultation would improve the whole process in both directions; on the one hand it will help the NC to be

optimised by tracking and benefiting from the latest technology advancements. On the other hand it will allow manufacturers to adapt their products in the mentioned mid-term perspective of 2 to 3 years ahead.

A way of polling the stakeholders should also be set up and its results officially published to know which topics are pressing and need to evolve from the stakeholders' point of view. Finally, an independent group of experts has to weight the different stakeholder interests as a change that is regarded as necessary by one stakeholder is sometimes viewed as unnecessary by the others. This independent group or review panel would also embrace the whole maintenance process.

However, it remains an open question whether a fast-track option to change or amend network codes to reflect changes for technical requirements in a more practical way is needed, rather than the mere possibility of changes through a protracted comitology process.

3. Conclusions and outlook

EWEA's overall assessment of the result of the intensive period of work on this new European Network Code is that the job is still far from finished. The time period given to ENTSO-E was too short for the amount of work to be completed. Accepting the result as it is now would put a burden on the future and cannot be seen as an improvement from the present situation with national grid codes in Europe developing in a less coordinated manner, but with serious consultation of industry stakeholders.

The NC has attempted to capture all types of generation covered in a rather complicated structure. Many requirements are either unclear or stipulations of expected "nice-to-have" behaviour rather than appropriate and technically and economically justified minimum requirements. Furthermore, only around 50% of relevant requirements from the wind industry's perspective are covered. Instead of developing a consistent common approach in Europe, the draft NC could lead to an unfortunate development where national codes will continue to prevail in an unforeseeable way.

If the measures recommended in this paper are not taken, national implementation will most likely introduce new diversity by multitudes of own interpretation of the new NC requirements. Furthermore the NC introduces new excessive P-Q requirements without any documentation of being appropriate and justified minimum requirements. This is expected to lead to even more uncertainty than ever before.

In summary, EWEA has been arguing for years for a consistent approach all over Europe in specifying requirements for grid connection. The current draft RfG code does not move sufficiently in that direction – which is why EWEA has made constructive suggestions for changes in the draft NC via its response to the public consultation:

- Improvements to many definitions;
- A typical wind industry specification for reactive power - or a very comprehensive documentation of the need and the solution in the NC being optimal;
- An improved FRT specification (fault and post-fault period);
- A cost-effective and pragmatic compliance methodology;
- Simulation models to focus on purpose and specification.

Besides the development of the present NC document, the following points are essential:

- Areas left open for national codes must be dealt with consistently: A common structure for national codes must be established.
- The establishment of a European NC review panel is key to institutionalise the NC change management process.
- The inclusion of requirements intended to make the NC future-proof would only be appropriate if two criteria are met:
  - The requirements are developed through a transparent, inclusive, and evidence based process, with sufficient time for discussion and debate. It is not possible to develop such requirements through the mechanism of a one-off consultation such as the one currently underway on the draft Code.
  - The requirements are developed specifically for each generation technology. Attempting to set detailed and comprehensive universal specifications for technologies that differ widely in their characteristics leads to sub-optimal economic and engineering outcomes.

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