ACER
European Union Agency for the Cooperation of Energy Regulators

NC RfG DC Recommendation:

Annex 4 – Reasoning to proposed amendments to the RfG Regulation

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1. INTRODUCTION

(1) ACER has prepared amendments to Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (the 'RfG Regulation'), in order to align it with recent technological advancements and changes in the electric power and transport sectors within the framework of the effort toward decarbonisation dictated such review of the relevant provisions.

(2) While the current structure of the RfG Regulation remains, profound amendments as well as new articles were introduced in the attempt to address the impacts of new developments in the electric power and transport sectors such as electricity storage and electromobility.

(3) The proposed amendments to the RfG Regulation are assessed against the objectives of the network codes as set out in Article 59(4) of the Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity ('Electricity Regulation').

2. TITLE I GENERAL PROVISIONS

(4) Following Protocol 1 to the EEA Agreement[1] (No 8 and 9), it is agreed that references to territories and to nationals of Member States for the purposes of the Agreement is to be understood to references also to the territories of the Contracting Parties (EU and EEA countries) and the nationals of the EFTA States.

(5) The changes recommended to the RfG Regulation subsequently led to changes in the definitions for clarity reasons (connection points and maximum capacity or Pmax).

(6) As the scope of application of the RfG Regulation (Article 6) is extended to include electric vehicles equipped with technology enabling the vehicle to provide electricity to the grid (V2G) and electricity storage, the relevant definitions were included in the RfG Regulation.

(7) According to Article 4(1) of RfG Regulation, existing power generating modules (PGMs) are not subject to the requirements of the NC RfG Regulation, except where they have been modified to such an extent that its connection agreement must be substantially revised (currently, this provision only applies to type C and D PGMs). However, the Grid Connection Network Codes (GC NCs) are not prescriptive as to the criteria for which a modification must be considered as requiring a substantial revision of the connection agreement, nor what is regarded as a substantial revision. With the newly introduced Article 4(a) significant modernisation is based on specified criteria, that the relevant TSOs should take into account when developing a proposal for defining significant modernisation of power-generating modules. The proposal is subject to public consultation and approval by the relevant regulatory authority or, where applicable, the Member State thus increasing the transparency and leaving no room for interpretation which can lead to legal uncertainty.

(8) In Article 7(4) of RfG Regulation, and in order to allow for a swift implementation of the requirements of the RfG Regulation, ACER proposes that the Member States may set a shorter time period for system operators to submit a proposal for part or all the relevant requirements and/or methodologies, communicating their decision to ACER.

[1] https://www.efta.int/sites/default/files/documents/legal-texts/eea/the-eeaagreement/Protocols%20to%20the%20Agreement/protocol1.pdf

(9) The significance of PGMs is based on their size and effect on the overall system. According to Article 5 of the RfG Regulation, PGMs are categorised as type A, B, C or D depending on both the installed capacity and the voltage level at the connection point. Paragraph 2 of the same article specifies a voltage-related criterion and sets out limits for capacity thresholds that are defined at national level. However, the correlation between maximum capacity and voltage level at the connection point can be affected by various factors, including geographical location or the PGM's operation within a larger site. Thus, with the proposed amendment, the cumulative character of the capacity and voltage criteria (in their present form) which can lead to some disproportionate technical requirements for smaller PGMs compared to their actual impact on the system is remedied by introducing a capacity threshold below which only the maximum capacity of the PGM is considered to determine the significance.

(10) Pump-storage hydro PGMs should fulfil all the relevant requirements laid down in the RfG Regulation, both when injecting into the network and withdrawing from the network. This may lead, in turn, to an inherent inability to comply with relevant rules by some of these PGMs, as demonstrated by the final report of the Requirements for pump-storage hydro power generation modules Expert Group under the umbrella of the Grid Connection European Stakeholder Committee (GC ESC[2]). Applicable requirements for generators have not addressed constraints arising from structural and operational particularities of pump-hydro storage PGMs. With the proposed amendments, a different treatment is introduced depending on the type of unit and operating mode so as to ensure that the application of the RfG Regulation is feasible.

(11) In Article 11 of the RfG Regulation, and in order for stakeholders' engagement to be expanded during consultation, ACER proposes an amendment so as to require ACER in co-operation with ENTSO-E and EU DSO Entity to organise shareholders involvement regarding the requirements for grid connection of all entities subject to the provisions of the RfG Regulation pursuant to Article 11.

3. TITLE II REQUIREMENTS

3.1 General requirements for type A PGMs

(12) It is crucial, in the context of the efforts to fight the climate changes and decarbonise the electric power and transport sectors, to shift to variable and distributed generation and implementing low-carbon technologies. In this respect, as the technical capabilities of power-generating modules have a massive impact on system security, it is important that all connected equipment is sufficiently robust to withstand disturbances and help prevent major interruptions or support the resynchronisation/restoration of the grid after a large system disturbance such as for example a system split or a black-out. For system security reasons, such as preventing large-scale loss of generation, some requirements applicable to type B PGMs should also be applicable to type A PGMs. ACER proposes to extend the type A requirements to include fault-ride-through capability, a voltage control system, reactive power capability, provision to reduce instead of ceasing active power and grid-forming capability. These additional requirements will enhance system security further considering the ramp-up of renewable generation, as demonstrated by the final report of the 'Baseline for type A power-generating modules' Expert Group[3] under the umbrella of the GC ESC. Such a new approach would significantly contribute to security of supply and sustainability at EU level (considering the high potential of type A renewable

[2] https://www.entsoe.eu/network_codes/esc/

[3] https://www.entsoe.eu/network_codes/cnc/expert-groups/

generation development) and to reduce the risk of loss of generation from these units during large system incidents.

(13) Due to challenges in combatting the climate change, ACER considers that the issue of PGMs' weather resilience should be duly addressed in the RfG Regulation for the efficient electric power system design. ACER also considers that the weather hazards resilience requirements should be considered at local (regional) level, and that relevant system operators and power-generating facility owners should take due account of possible extraordinary climate parameters. At the same time, further specifications of the possible events should be avoided as they may prove inefficient at European level due to diverse climate environments throughout Europe. Additionally, ACER emphasises the need for a proportionate approach and performance of the cost benefit analysis (CBA) when establishing weather resilience requirements.

3.2. General requirements for type B, C and D PGMs

(14) For types B, C and D PGMs it is also important to consider new needs for the system so that they continue to contribute to frequency stability and voltage support. The proposed new provisions introduce high voltage ride through requirements and also grid forming capabilities, the latter as elaborated in the final report of the 'Advanced Capabilities for Grids with High Shares of Power Park Modules' Expert Group[3] under the umbrella of the GC ESC. Furthermore, regarding the simulation models, the specification on the model type (black box, open source, generic, etc.) and quality to fit purposes of model use (interaction studies, system integration, compliance simulation, etc.) were lacking. Therefore, more details are proposed to be introduced to provide more information and clarity.

3.3. Introduction of requirements for type EV1, EV2 and EV3 V2G electric vehicles and associated V2G electric vehicles supply equipment and V2G electrical charging parks and electricity storage modules

(15) Because of the sheer installed volume and their role in the system balancing, electricity storage modules have an increasing significance for the power system. Designed properly, they possess the capability to provide several grid supporting functions without significant cost implications. Furthermore, V2G electric vehicles and associated V2G electric vehicle supply equipment are interacting with the grid in the same way as the stationary-battery-based electricity storage modules do and thus also need to be considered in the revised NC RfG Regulation. ACER's proposal regarding V2G electric vehicles is, to a certain extent, based on the final report by the 'Storage Expert Group' under the umbrella of the GC ESC with an important distinction, i.e., full-harmonisation of all pertaining technical requirements as the enablers of the seamless cross-border trade and transit of electric vehicles. Furthermore, the determination of significance of V2G electric vehicles and associated V2G electric vehicle supply equipment, up to a certain level of capacity, needs to be separated from other PGMs to enable the harmonisation of the requirements whilst considering differences between AC and DC charging.

3.4. Requirements for type A, B, C and D power park modules (PPMs)

(16) The number of installed type A PPM generation has reached a level where the operation of these devices has a major impact on system security. For system security reasons, like preventing large-scale loss of generation, it is proposed to extend the fault-ride-through (FRT) requirement to type A PPMs. Furthermore, the ranges of voltage and time provided by the currently applicable RfG Regulation have as a consequence a wide variety of national FRT profiles, depending on the national protection schemes. However, the fact that the mass operation of installed generation of this type has a significant impact on the system, dictates that the FRT requirements should be

mandatory as a harmonised and predefined voltage-time profile is also suggested. To this end ACER proposes a new article. Such requirements imply the capability of the PPM to remain connected to the grid during faults within defined voltage-time ranges, thus avoiding their disconnection. Further, in combination with the FRT requirement, it is essential that the active power from the PPMs affected by a fault recovers, understanding that even if they stay connected, they may reduce their active power during, and just after, the clearance of the fault.

(17) Recent studies[4] show that under the high penetration of non-synchronous power generation modules, a stable and robust power system operation of interconnected transmission systems can be ensured if grid forming capabilities are available during system operation. ACER proposes, in the newly introduced Article Y, that grid-forming capability is introduced in the RfG Regulation in order for the aligned requirements' availability throughout Member States (MS) to be facilitated for the purpose of initiation and acceleration of the process of grid-forming implementation. Further specifications in national implementations of the GC NCs' requirements may depend on the location of each Member State and urgency of the roll out of the grid forming capabilities. For these reasons, ACER proposes amendments in Article Y of the RfG Regulation stipulating the application of grid forming capability on type A PPMs, only on the basis of the assessment by each Member State.

(18) Article 20 of the RfG Regulation sets out the requirements for type B PPMs. ACER proposes amendments for the introduction of grid forming. ACER recommends that certain categories of type B PPMs should be subject to the requirement of grid forming capability on the basis of the assessment by each Member State, to accommodate different needs. For all other type B PPMs, not falling into these categories, ACER proposes the grid forming capability be mandatory. Also, a new paragraph 4 is added to Article 13 so as to include provisions on grid forming contribution to synthetic inertia for type B PPMs.

(19) Article 21 of the RfG Regulation determines the requirements for type C PPMs. ACER proposes amendments to Article 21 for the introduction of grid forming. ACER recommends that certain categories of type C PPMs should be subject to the requirement of grid forming capability on the basis of the assessment by each Member State, to accommodate different needs. For all other type B PPMs, not falling into these categories, ACER proposes the grid forming capability be mandatory. Also, a new paragraph 4 is added to Article 21 so as to include provisions on grid forming contribution to synthetic inertia for type C PPMs. With regard to reactive power capability, in the RfG Regulation, reactive power requirements are not set for the whole operational voltage range. This may lead to PGMs reacting insufficiently to high/low voltages. Therefore, ACER proposes that the figure depicting the U-Q/Pmax-profile of a power park module is amended so that it is clear that the voltage range represents the difference between the highest and lowest values at a certain value of Q/Pmax, and also amend the text accordingly.

(20) Due to Great Britain's exit from the European Union, relevant adjustments were proposed in Table 9 of the Article 21. Also, ACER proposes a change in the maximum range of voltage for Nordic Synchronous Area for the purpose of harmonisation of basic generation requirements as well as national requirements where the TSO operates both in Continental Europe and Nordic Area. In this Article, ACER further proposes technical requirements so that the stable behaviour of type C PGMs regarding voltage and frequency control can be ensured as well as a stable control behaviour in different modes of operation and in switching between modes. Furthermore, system stability is crucial in view of the system decarbonisation where a greater proportion of power electronics connected generation will be present in the system, displacing other conventional technologies such as synchronous generators. Therefore, in the same Article 21, more detailed

[4] ENTSO-E, Frequency Stability in long-term scenarios and relevant requirements, 3 December 2021

provisions are introduced by ACER so that such devices can contribute to the damping of system oscillations.

(21) Article 22 of the RfG Regulation defines the requirements for type D PPMs. The proposed amendments of paragraph 1 of Article 22, introduce provisions on grid forming capability for type D PPMs.

(22) As a greater proportion of power electronics connected generation is anticipated, replacing other conventional technologies such as synchronous generators in the context of decarbonisation, it is important for such devices to aid the damping of system oscillations. Therefore, ACER proposes the introduction of paragraph 2 in Article 22 so that system stability can be ensured.

3.5. Requirements for offshore power park modules

(23) ACER recommends the amendments in Article 24 for the improvement of clarity.

(24) In Article 25 voltage stability requirements are provided for AC-connected offshore power park modules. Voltage levels below 110kV have been identified as having cross-border impact. Therefore, ACER proposes that voltage levels below 110kV are considered by the relevant system operator. Furthermore, ACER recommends the amendment of the voltage ranges so that they are aligned with the capabilities defined by standards when these capabilities do not affect system needs.

(25) In Articles 27 and 28, ACER proposes a few editorial changes to improve clarity.

4. TITLE III OPERATIONAL NOTIFICATION PROCEDURE FOR CONNECTION

(26) Under Article 29 of the RfG Regulation, the relevant TSO must ensure that the commissioning and decommissioning of a power generating module can be notified electronically. In order to cut through the red tape, ACER recommends that the power generating owner notifies the system operator or the relevant authority about the commissioning and decommissioning of a power-generating module according to the national legislation whilst facilitating electronic notifications.

(27) In Article 30 on operational notification procedure for connection of type A power-generating modules, ACER proposes the removal of paragraph 3 as the relevant obligation therein is already provided in paragraph 1.

(28) As the scope of the RfG Regulation is proposed to be extended to include electric vehicles equipped with technology enabling the vehicle to provide electricity to the grid (V2G) and electricity storage, ACER proposes the introduction of two new articles on the corresponding operational notification procedure for connection of each new type EV2 and associated V2G electric vehicle supply equipment and operational notification procedure for connection of each new type EV3 and associated V2G electric vehicle supply equipment.

(29) As Article 32 concerns the procedure for type B and C power-generating modules, ACER proposes the removal of paragraphs 4 and 5 of the Article for consistency purposes with the amendment in Article 29. Further para 2(e) is amended for consistency with the amendment of Article 15(5).

(30) ACER proposes the removal of paragraph 5 of Article 35 on interim operational notification for type D power-generating modules as it is not considered to be appropriate to have an extension of ION status under the derogation regime.

5. TITLE IV COMPLIANCE

5.1. Responsibility of power-generating facility owner

(31) ACER proposes the introduction of a new paragraph 6 in Article 40 of the RfG Regulation to allow the flexibility for facility owners to delegate the performance of compliance testing to third parties.

5.2 Common provisions on equipment certificates

(32) Following the need for introducing relevant provisions regarding the certification process of PGMs, ACER proposes a new article for common provisions on equipment certificates. The article states the need for specifying a compliance scheme, in case the relevant system operator decides to use equipment certificates. Also, the possibility of mutual recognition of equipment certificates between Member States is proposed, along with the possibility of issuing certificates for power generating units or components that belong to a family. The level of detail to be introduced in the regarding certification process is kept general, where the details can be defined at national level in order not to interfere with existing, or under development, processes in the Member States that are following such approach for the compliance process of PGMs with the requirements of the RfG Regulation. Further, new definitions related to certification process have been introduced along with amendments to Article 29 so as the operational notification procedure shall include the compliance scheme in case the relevant system operator provides for the use of equipment certificates.

5.3. Compliance testing for V2G vehicles and V2G electric vehicles supply equipment

(33) In Article 42 of the RfG Regulation, ACER proposes provisions on compliance testing for V2G electric vehicles and V2G electric vehicles supply equipment which should be based on individual type-test certificates issued as per Regulation (EC) No 765/2008 regarding the V2G electric vehicle supply equipment on one side, and the V2G electric vehicle homologated platform on the other side. The recommended provisions also ensure that certification programs and procedures are harmonised, are cross linked and consist of associated procedures on data exchange, communication handshake and technical power transfer.

5.4. Compliance testing for type B power park modules and for type C power park modules

(34) As regards compliance tests for type B power park modules, ACER proposes in Article 47 of the RfG Regulation the introduction of limited frequency sensitive mode-underfrequency-electricity storage module (LFSM-U-ESM) response compliance test, as it is considered to be necessary that the PGMs should present a stable control behaviour in different modes of operation and in switching between modes. In this respect, in case of major system under-frequency, all ESMs connected to the system should have the capability of operating under limited frequency sensitive mode (LFSM-U). The LFSM-U is a special operating mode under which the ESM (regardless of being in charging or discharging phase) continuously adjusts its active power generation or consumption according to a frequency deviation when system frequency remains below a predefined under-frequency threshold. The LFSM-U applies at system emergencies where the upwards frequency containment reserve (FCR) is already fully deployed, but system frequency decreases further and jeopardises the system stability.

(35) As regards compliance tests for type C power park modules, ACER recommends the amendment of paragraph 4(a) of Article 48 of the RfG Regulation on FSM response requirements, so that in

the case of an electricity storage module the full operating range, between maximum consumption capacity and maximum capacity, is used.

5.5. Compliance tests for offshore power park modules

(36) ACER proposes the amendment of Article 50 as it does not include reference to all applicable Articles of the RfG Regulation as regards compliance tests for offshore power park modules.

5.6. Compliance simulations for type B synchronous power generating modules

(37) ACER proposes amendments in Article 51 of the RfG Regulation on compliance simulations for type B synchronous power generating modules, providing for the TSO the right to request that compliance is demonstrated for the stability of the Limited Frequency Sensitive Mode (LFSM-O) control in a close loop operation set up of the synchronous power-generating module. The LFSM-O is a special operating mode under which the module continuously adjusts active power generation or consumption following a frequency deviation when system frequency remains above a predefined over-frequency threshold. The LFSM-O applies at system emergencies where the downwards FCR is fully deployed but system frequency increases further. Additionally, ACER proposes the introduction of new paragraph 3 on the requirements on the reactive power capability simulation, so as PGMs should present a stable control behaviour in accordance with the requirements in Article 17. Further, ACER proposes a new paragraph 6, with regard to compliance simulations on the system restoration requirement as provided in Article 14.

5.7 Compliance simulations for type C synchronous power generating modules

(38) In Article 52 of the RfG Regulation, ACER proposes amendments to paragraph 2 and 4 for the compliance simulations for type C PMGs corresponding to the new requirements introduced in Article 15, regarding the technical capability of PMGs to have a stable control behaviour in different modes of operation and being able to switch between modes. In paragraph 5 of Article 52 of the RfG Regulation, ACER also proposes amendments to clarify the demonstration of compliance simulations of PMGs capabilities to provide reactive power.

5.8. Compliance simulations for type B power park modules

(39) ACER proposes amendments to Article 54(2) for compliance simulations for type B PPMs regarding the stable operation of the PPMs in difference control modes.

5.9. Compliance simulations for type C power park modules

(40) ACER proposes amendments to Article 55(2), (4) and (7) for compliance simulations for type C PPMs regarding the stable operation of those PPMs in difference control modes.

5.10. Monitoring

(41) In Article 59 of the RfG Regulation, ACER introduces amendments to update the monitoring process in accordance with Articles 30(5), 32(1), 32, 55(2)(a) of Regulation (EU) 2019/943. Further, ACER proposes in paragraph 3 of Article 59 that ACER in co-operation with ENTSO for Electricity should maintain a public online repository where relevant national information regarding the progress of implementation of the NC RfG Regulation should be made available. The information to be made available should at least include legal texts, implementation monitoring files, summaries of all the proposals for non-exhaustive requirements, TSO and DSO

requirements and compliance tests and process to be performed and links to the national implementation websites.

6.TITLE V DEROGATIONS

(42) Under Article 64 of the RfG Regulation, regulatory authorities maintain a register of all derogations they have granted or refused and provide the ACER with an updated and consolidated register at least once every six months, copying also ENTSO for Electricity. For the purposes of transparency, ACER introduced, an amendment according to which the register in Article 64 kept by the NRAs of all derogations granted or refused, is publicly available.

7.TITLE VI TRANSITIONAL PROVISIONS

(43) ACER proposes that Articles 66 to 70 of the RfG Regulation are deleted as they concern emerging technologies and new transitional provisions introduced under Title VI relating to the necessity of continuation of the application of Regulation (EU) 2016/631 to power-generating modules falling within its scope at the entry into force of the proposed amendments.

8. TITLE VII FINAL PROVISIONS

(44) As mentioned above, ACER proposes to introduce a new Article 71a, in order to provide legal certainty and clarity regarding the repeal of the RfG Regulation.

(45) In paragraph 2 of the newly introduced Article 71a, ACER proposes that Regulation (EU) 2016/631 should continue to apply to power-generating modules which fall within its scope of application at the entry into force of this Regulation and which are not subject to the requirements of this Regulation according to Article 4.