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ACER draft amendments to the Network Code on HVDC

Fields marked with * are mandatory.

Introduction

This consultation aims at presenting ACER's draft amendments to the **Commission Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules ('NC HVDC').**

Responses to this consultation should be submitted by 8 September 2024.

Background

Important developments in the policies of decarbonisation of the European Union (EU) energy and transport sectors have taken place since the inception of the development of the first European Grid Connection Network Codes (GC NCs) in 2012.

In the framework of the Grid Connection European Stakeholder Committee (GC ESC), the European Commission proposed for ACER to initiate the process towards the amendment of the existing GC NCs in September 2022. The amendment process to the NC HVDC, as presented to the GC ESC is outlined in the Figure below:

In the context of the ongoing revisions of the European grid connection network codes, ACER will consult with stakeholders to collect views on ACER's concrete amendment proposals to the network code on grid connection requirements for high voltage direct current systems and related power park modules (NC HVDC).

The revisions to the NC HVDC aim to:

- Enhance the existing grid connection regulatory framework.
- Align the code with the ACER Recommendation on reasoned proposals for amendments to the network codes on requirements for grid connection of generators and on demand connection.
- Ensure the interconnected system is adapted to emerging trends, such as the increasing generation capacity of offshore networks (AC hubs) and the connection of new system users (storage, demand facilities, including power-to-gas demand units).

Stakeholder's details

ACER is highly committed in processing personal data in a lawful way.
Find out more how we process your data: https://www.acer.europa.eu/the-agency/about-acer/data-protection

* Name of the stakeholder:

WindEurope

* Contact person:

Riccardo Longo

* Contact person's email address:

riccardo.longo@windeurope.org

* Country of the stakeholder's headquarters or main country of operation:

Belgium

* Type of the stakeholder:

- ○ Generator (including association)
- ○ Consumer (including association)
- ○ Transmission system operator (including association)
- ○ Distribution system operator (including association)
- ○ Manufacturers (including association)
- ○ Academia/research institution
- ○ Regulatory authority
- ◉ Other (please, elaborate)

Please, elaborate on your answer above, if necessary:

European wind association

* Do you consent to the publication of the stakeholder's name?

- ◉ Yes
- ○ No

* Do you consent to the publication of provided answers?

- ◉ Yes
- ○ No (please, note that your answer, without your name and organization, may be shared with the EU institutions and national authorities)

Instructions

Stakeholders are invited to submit their comments to the **NC HVDC articles** amended by ACER in three mandatory steps:
1. download the ACER draft amendments in the Word file provided below. The file could also be accessed on the right panel of the consultation form under the Background Documents;
2. comment on the ACER's draft amendments through this online consultation form and adding your alternative text proposals to the table, if any; and
3. uploading the alterative amendment proposals to the **entire NC HVDC** document using the Track Changes mode in the ACER draft amendments file downloaded from Step 1.

Where the stakeholder does not have any comments regarding the amendments, the relevant cells in the consultation form can be left blank.

The mandatory steps for submitting the comments are listed below.

Step 1

Please see ACER's draft amendments in the Word file provided below. The file could also be accessed on the right panel of the consultation form under the Background Documents.

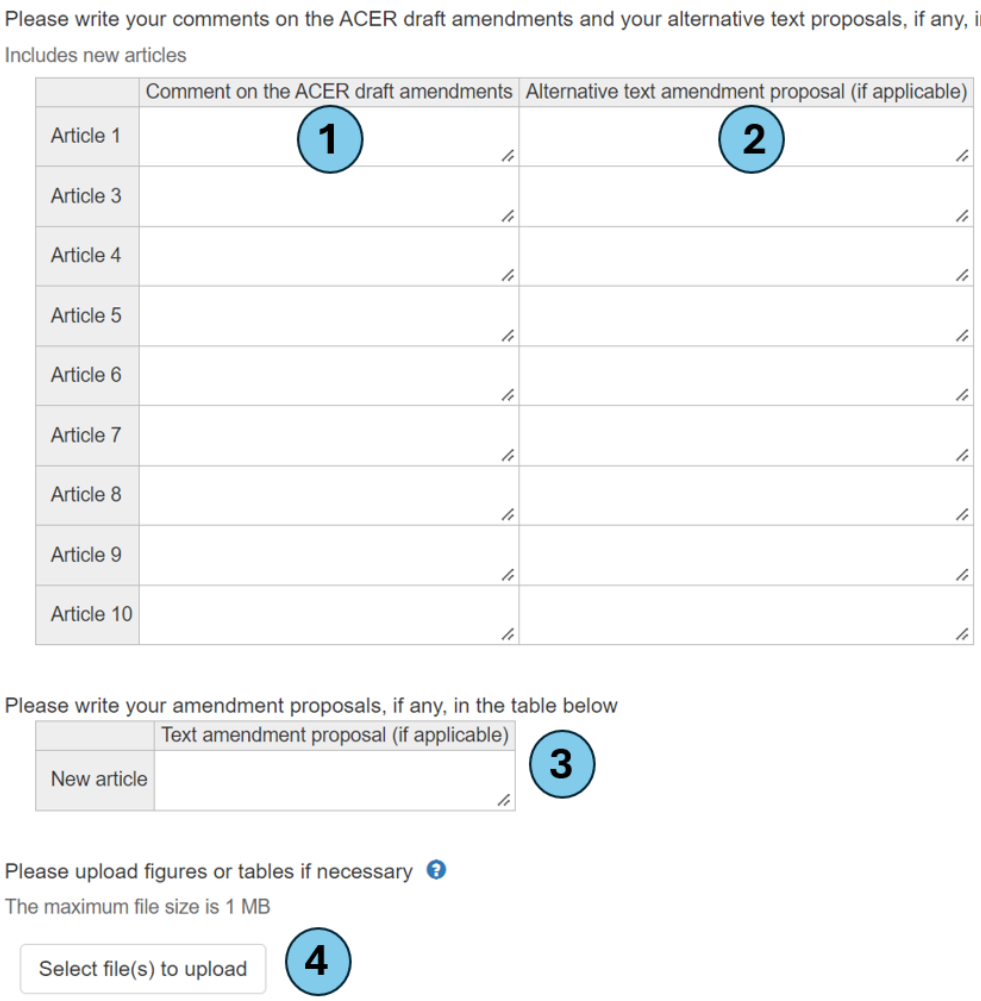
Download ACER draft amendments to the NC HVDC here

Step 2

Kindly note that this consultation form follows the structure of the NC HVDC amended legal text provided by ACER in Step 1.

The paragraph numbering in the form reflects paragraph numbers in the amended legal text. Nevertheless, stakeholders can comment on the deleted paragraphs/articles/titles, which are marked as [deleted]. New articles and titles are marked as [new].

Please use this form to comment on ACER draft amendments and/or to provide an alternative text proposal. The instructions are the following:



1. Leave comments on the ACER draft amendment proposals.
2. Propose (if any) alternative wording of the relevant provision, as you provided in the Word file.
3. Provide (if any) your proposals for adding new provisions to the relevant section of the NC HVDC, as you provided in the Word file.
4. Upload figures or tables if necessary; text inputs should be provided directly in the consultation form.

Step 3

Where the stakeholder would like to propose an alternative amendment to the entire **NC HVDC**, please upload the Word file (**downloaded from Step 1**) containing all your alternative amendment proposals in the Track Changes mode to the next **FILE UPLOAD** section and rename it with your stakeholder's name ("ACER_draft_HVDC_stakeholder_name"). You can also upload your justification documents, where applicable.

In case the file size exceeds the 1MB limit, which is a consultation tool limit, kindly send the document to the functional mailbox shown on the right panel of the consultation form. Please rename the file with your stakeholder's name as indicated above and send it with the subject "ACER draft HVDC legal text [stakeholder name]". Note that only submissions sent within the consultation deadline will be considered.

To facilitate the process, please, make sure that the **alternative text proposals provided in this consultation form are consistent**, to the extent possible, **with those in the Word file** you are uploading, taking into account the character limitations of each cell (max 5000 characters).

File upload

Please upload your file here
The maximum file size is 1 MB
Only files of the type pdf,doc,docx,odt,txt,rtf are allowed
58533b44-98e3-48e6-b7f4-eb4178fcf9ac/ACER_draft_amendment_proposal_NC_HVDC_WindEurope.docx

Kindly note that in case the file size exceeds 1MB, the file can be sent to the functional mailbox shown on the right panel of the consultation form under Contact. Please ensure that the file name and email subject are consistent with the instructions in Step 3.

Please also upload any other document (i.e. **justifications)** below, if relevant.

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Due to the significant length of this survey:

- you have the possibility to edit your answer after submission. When clicking on "Submit" button, you will be given a Contribution ID which you can then use to access your answers and edit them, if necessary.
- we kindly suggest that you download the entire survey as .pdf (link on the right), prepare your answers and then upload them at once in the EU Survey Tool, to avoid a session timeout on submission.

The maximum length of each cell is 5000 characters. This is the maximum technical limit set by the EUsurvey tool, which cannot be increased.

Whereas Section

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

Numbers in the first column correspond to the recitals of the amended version of NC HVDC Whereas section, including new recitals

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
(1)		

(2)	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	Regulation (EU) 2019/943 sets out non-discriminatory rules governing access to the network for cross-border exchanges in electricity with a view to ensuring the proper functioning of the internal market in electricity. In addition Article 3 of Directive (EU) 2019/944 of the European Parliament and of the Council ( ) requires that Member States shall ensure, a level playing field where electricity undertakings are subject to transparent, proportionate and non-discriminatory rules, fees and treatment. Where requirements constitute terms and conditions for connection to national networks, Article 59(7) of the same Directive requires regulatory authorities to be responsible for fixing or approving at least the national methodologies used to calculate or establish them. In order to provide system security within the interconnected transmission system, it is essential to establish a common understanding of the requirements for isolated AC networks, High-Voltage Direct Current (HVDC) systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules. Those 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 achieve cost efficiencies, should be regarded as cross-border network issues and market integration issues.

(3)		
(4)	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	System security depends partly on the technical capabilities of HVDC systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules. Therefore, regular coordination at the level of the transmission and distribution networks including isolated AC networks and adequate performance of the equipment connected to the transmission and distribution networks as well as isolated AC networks with sufficient robustness to cope with disturbances and to help to prevent any major disruption or to facilitate restoration of the system after a collapse are fundamental prerequisites.

(5)	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	Secure system operation is only possible if there is close cooperation between isolated AC networks’ operators and owners of HVDC systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules and system operators. In particular, the functioning of the system under abnormal operating conditions depends on the response of the HVDC systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules to deviations from the reference 1 per unit (pu) values of voltage and nominal frequency. In the context of system security, the networks incl. isolated AC networks and the HVDC systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules should be considered as one entity from a system engineering point of view, given that those parts are interdependent. Therefore, as a prerequisite for grid connection, relevant technical requirements should be set for HVDC systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules.

(6)		
(7)	Isolated AC Networks and their specificities need to be considered too for the benefit of customers. Designing these following a business-as-usual approach will drive costs unnecessarily.	Different synchronous electricity systems in the Union have different characteristics which need to be taken into account when setting the requirements for HVDC systems, isolated AC networks, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules. It is therefore appropriate to consider regional and isolated AC networks design specificities when establishing network connection rules as required by Article 58(1) and (2) of Regulation (EU) 2019/943.
(8)		
(9)	Frequency-related requirements should not necessarily be the same for isolated AC networks within the same synchronous area	Due to its cross-border impact, this Regulation should aim at the same frequency-related requirements for all voltage levels, at least within a synchronous area but not necessarily in isolated AC networks. That is on the one hand necessary because, within a synchronous area, a change in frequency in one Member State would immediately impact frequency and could damage equipment in all other Member States. As isolated AC networks are by definition not synchronously connected to synchronous areas, a change in frequency in one Member State would not impact the frequency in an isolated AC network.

(10)	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	To ensure system security, it should be possible for HVDC systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules in each synchronous area of the interconnected system to remain connected to the system and/or relevant isolated AC network for specified frequency and voltage ranges.
(11)		
(12)		
(13)	Cost-effective system design is relevant to ensure full market integration	The regulatory authorities, Member States and system operators should ensure that, in the process of developing and approving the requirements for network connection, they are harmonised to the extent possible and cost-effective in order to ensure full market integration. Established technical standards should be taken into particular consideration in the development of connection requirements.

(14)	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	A process for derogating from the rules should be set out in this Regulation to take into account local circumstances where exceptionally, for example, compliance with those rules could jeopardise the stability of the local network or where the safe operation of an isolated AC network, HVDC system, asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit or asynchronously connected electricity storage module might require operating conditions that are not in line with this Regulation.

(15)	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	In the case of asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules, new modules, facilities and units could, in the future form part of a meshed isolated AC network (e. g. off-shore grid) connecting to more than one synchronous area. In this case, certain technical requirements should be set in order to maintain system security and ensure that future meshed networks can be developed cost- effectively. However, for certain requirements, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units or asynchronously connected electricity storage modules should only be required to fit the equipment / isolated AC networks needed for system security at the time it becomes necessary.
(16)		
(17)		
(18)		
(19)		

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New recital	Mixed customer sites comprising asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units or asynchronously connected electricity storage modules on a single site should be connected at a single interface point. Rules for grid connection for such mixed sites shall be determined on national level based on this connection scheme. Explanation: The amended NC HVDC does not give any guidance, how Mixed Customer Sites – customer systems comprising generation, storage and/or loads within a single customer site having a single interface point to the isolated AC network - shall be dealt with. This should be at least addressed by national implementation.

Definitions (Article 2)

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

Includes new definitions

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 2(1)		
Article 2(2)[deleted]		
Article 2(2)		
Article 2(3)		
Article 2(5)[deleted]		
Article 2(6)[deleted]		
Article 2(4)		
Article 2(5)		
Article 2(6)		
Article 2(7)		
Article 2(8)[NEW]	Proposal for editorial improvement: More general text as an isolated AC network could become connected to more than one synchronous area.	‘isolated AC network’ means an AC network which is not part of a synchronous area, which is connected to one or more synchronous areas via one or more HVDC systems. This definition does not include the transmission and distribution systems or their parts, of islands of Member States of which the systems are not operated synchronously with either the Continental Europe, Nordic, Ireland and Northern Ireland or Baltic synchronous area;
Article 2(9)[NEW]	Language close to NC RfG, no unilateral definition of requirements by the network operator.	‘interface point’ means the AC interface at an isolated AC network as identified in the agreement with the isolated AC network operator at which technical specifications affecting the performance of the relevant equipment can be prescribed;

Article 2(10)[NEW]	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	‘remote-end HVDC converter station’ means an HVDC converter station which is not synchronously connected to any synchronous area but to one or more isolated AC networks;
Article 2(11)[NEW]	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	‘asynchronously connected power park module’ or ‘A-PPM’ means a power park module that is connected via an interface point to an isolated AC network
Article 2(12)[NEW]	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	‘asynchronously connected power-to-gas demand unit’ or ‘A-PtG-DU’ means a power-to-gas demand unit that is connected via an interface point to an isolated AC network
Article 2(13)[NEW]	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	‘asynchronously connected electricity storage module’ or ‘A-ESM’ means an electricity storage module that is connected via an interface point to an isolated AC network
Article 2(14)[NEW]	“isolated AC networks“ needs to be added here as an important term, this regulation is related to.	‘asynchronously connected demand facility’ or ‘A-DF’ means a facility which consumes electrical energy and is connected via an interface point to an isolated AC network
Article 2(15)[NEW]		
Article 2(16)[NEW]		
Article 2(17)[NEW]		
Article 2(18)[NEW]		

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New definition	‘relevant isolated AC network operator’ means the isolated AC network operator to whose system HVDC systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units or asynchronously connected electricity storage modules are or will be connected; Comment: New definition proposed for the operator of an isolated AC network, which does not necessarily need to be a relevant system operator (= TSO or DSO). To our understanding it is still to be determined in most EU member states which entities might become the operators of such future new isolated AC networks. But this topic is not the scope of the NC HVDC. Therefore, some neutral language is proposed at this stage. This does not exclude the option that DSOs or TSOs might become isolated AC network operators, but it also does not anticipate any decision on this subject. Similar logic could also apply when the definition of HVDC system owner got introduced.

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE I - GENERAL PROVISIONS

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

Includes new articles

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 1	See above in Whereas- Section. Needs to be added here as an important term, this regulation is related to.	This Regulation establishes a network code which lays down the requirements for grid connections of high-voltage direct current (HVDC) systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules to synchronous areas and/or isolated AC networks. It, therefore, helps to ensure fair conditions of competition in the internal electricity market, to ensure system security and the integration of renewable electricity sources, and to facilitate Union-wide trade in electricity. This Regulation also lays down the obligations for ensuring that system operators make appropriate use of HVDC systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules capabilities in a transparent and non-discriminatory manner to provide a level playing field throughout the Union.
		1. The requirements of this Regulation shall apply for: a) HVDC systems connecting synchronous areas or control areas, including back-to-back schemes at their connection points; b) HVDC systems embedded within one control

area and connected to the transmission network;
c) HVDC systems embedded within one control area and connected to the distribution network when a cross-border impact is demonstrated by the relevant transmission system operator (TSO). The relevant TSO shall consider the long-term development of the network in this assessment;
d) HVDC systems connecting synchronous areas and isolated AC networks at their connection points and interface points (where applicable);
e) HVDC systems connecting to isolated AC networks at their interface points, and;
f) Asynchronously connecting power park modules, asynchronously demand facilities, asynchronously power-to-gas demand units and asynchronously electricity storage modules connecting to an isolated AC network, pursuant to paragraph 2;

2. Relevant system operators, in coordination with relevant TSOs, shall propose to competent regulatory authorities the application of this Regulation for asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules with a single connection point to a transmission network or distribution network which is not part of a synchronous area for approval in accordance with Article 5. All other power park modules, demand facilities, power-to-gas demand units and electricity storage modules which are connected to isolated AC networks but are asynchronously connected to a synchronous

Article 3	Point 1: Proposal for general improvement by considering the relevance of isolated AC networks in the scope of this regulation. Point 2: Same comment as above. Point 4 and 5: Relevance of interface points to be considered, too. Point 6: Adding the relevant isolated AC network operator here as in NC RfG per definition only TSOs or DSOs can be relevant system operators. The language proposed here shall ensure neutrality and does not give any precedent on the non-technical regulatory framework. Point 7: Proposal for clarification. It would be helpful, if regulators could share their opinion on how synchronous power generating modules shall be dealt with (the wording “asynchronously synchronous power generating modules” was deliberately avoided).	area are considered asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules and fall within the scope of this Regulation. ….. 4. The connection requirements for HVDC systems provided in Title II shall apply at the connection points or interface points of such systems, except the requirements provided for in Article 29(4) and (5) and Article 31(5), which can apply at other connection points, and Article 19(1) which may apply at the terminals of the HVDC converter station. 5. The connection requirements for asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units, asynchronously connected electricity storage modules and remote-end HVDC converter stations provided for in Title III shall apply at the interface points of such systems, except the requirements provided for in Article 39(1)(a) and Article 47(2), which apply at the interface point in the synchronous area to which frequency response is being provided. 6. The relevant system operator or relevant isolated AC network operator shall refuse to allow the connection of a new HVDC system, asynchronously connected power park module, asynchronously connected demand facility, asynchronously

connected power-to-gas demand unit or asynchronously connected electricity storage module which does not comply with the requirements set out in this Regulation and which is not covered by a derogation granted by the regulatory authority, or other authority where applicable in a Member State pursuant to Title VII. The relevant system operator or relevant isolated AC network operator shall communicate such refusal, by means of a reasoned statement in writing, to the HVDC system owner, asynchronously connected power park module owner, asynchronously connected demand facility owner, asynchronously connected power-to-gas demand unit owner or asynchronously connected electricity storage module owner and, unless specified otherwise by the regulatory authority.

7. This Regulation shall not apply to:

(1) HVDC systems whose connection point is below 110 kV unless a cross-border impact is demonstrated by the relevant TSO. The relevant TSO shall consider the long-term development of the network in this assessment;

(2) HVDC systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units or asynchronously connected electricity storage modules connected to the transmission system and distribution systems or to parts of the transmission system, or distribution systems, of islands of Member States of which the systems are not operated synchronously with either

		the Continental Europe, Nordic, Ireland and Northern Ireland or Baltic synchronous area. (3) synchronous power generating modules connected to isolated AC network.
		1. Except for Article 26, Article 31, Article 33 and Article 50, existing HVDC systems and existing asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules are not subject to the requirements of this Regulation, unless: (a) the HVDC system or asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit, asynchronously connected electricity storage module has been modified that its electrical and grid-dynamic characteristics, relating to paragraph (1)(c), have significantly altered. In these cases, prior to carrying out a modification: (i) the HVDC system or asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit, asynchronously connected electricity storage module owners who intend to undertake the modernisation of a plant or replacement of equipment affecting the electrical characteristics of the HVDC system or asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit, asynchronously connected

Article 4	Point 1. (a) (iii) This is to clarify that the facility which will be modified also is the only facility which will need a new connection agreement and comply with new requirements. Point 1. (c) (ii) HVDC systems and A-PPMs. etc. should be addressed specifically. Copied from NC RfG and inserted here for A-PPMs. Etc. A harmonized approach seems adequate and cost-effective regarding these conditions. Point 1. (c) (iii) Proposal to define a range for Y, following the general approach from NC RfG. Maximum short circuit contribution capability is not a well-defined term. Reference to existing standards would help but wasn't this a "no-go"? Point 1. (c) (iv) Proposal to define a range for Z, following the same approach as the NC RfG.	electricity storage module shall notify their plans to the relevant system operator in advance; (ii) if the relevant system operator considers that the extent of the modernisation or replacement of equipment is significant, in respect of any of the criteria in paragraph (1)(c) below, the system operator shall notify the relevant regulatory authority or, where applicable, the Member State; and (iii) the relevant regulatory authority or, where applicable, the Member State shall decide if the existing connection agreement needs to be revised or a new connection agreement is required and which requirements of this Regulation shall apply for HVDC system or asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit, asynchronously connected electricity storage module who have been modified; or (c) For the purposes of this Article a significant alteration will be defined according to these parameters: (i) a percentage increase of X% above the existing maximum power transmission capability of the HVDC installation; (ii) an increase above the existing maximum capacity of a asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit, asynchronously connected electricity storage module, whether this increase results from one modernisation or cumulatively from several successive modernisations, of a minimum percentage to be defined in the range 5-20 % (within this range, different percentages may be

defined for different technologies depending on their constraints);

(iii) a percentage deviation of Y% defined in the range of 25 %- 50% from the HVDC system or asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit, asynchronously connected electricity storage module maximum short circuit contribution capability with the short circuit contribution described in terms defined in established technical standards; or

(iv) a percentage deviation of Z% defined in the range of 10 %- 20% from the existing required reactive power capability triggered by the HVDC system or asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit, asynchronously connected electricity storage module; or

(v) a change of components/assets of an HVDC system, asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit or asynchronously connected electricity storage module, apart from maintenance and repair activities and spare parts, whether or not those parts are purchased new at the time of their incorporation in the HVDC system, asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit or asynchronously connected electricity storage module; or

(vi) a change of the underlying technology of

		the HVDC system.
Article 5	Seems to be very much in line with "NC RfG 2.0" except for this missing paragraph: "System operators shall ensure that system users' equipment shall offer a cyber- protected data exchange interface where relevant." Any reason, why this is not included in this draft?	
Article 6		
Article 7		
Article 8		
Article 9		
Article 10		

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New article	Additional paragraph for Article 7: System operators shall ensure that system users' equipment shall offer a cyber-protected data exchange interface where relevant. Comment: such paragraph is proposed for the amended NC RfG. why not also in NC HVDC?

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE II - GENERAL REQUIREMENTS FOR HVDC CONNECTIONS

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 11	An HVDC System can only react to what's happening at connection points or interface points. The document should be carefully checked and edited such that the approach: "requirements apply either at a connection point or interface point" gets consistently applied.	1. An HVDC system shall be capable of staying connected at the connection points and remaining operable within the frequency ranges and time periods specified in Table 1, Annex I for the short circuit power range as specified in Article 32(2).
Article 12		
Article 13	1. A "Not relevant for a radial offshore connection as the active power transmitted is related to the power generated offshore"	(a) an HVDC system shall be capable of adjusting the transmitted active power up to its maximum HVDC active power transmission capacity in each direction following an instruction from the relevant TSO dependent on active power availability.
		1. (a) Within the HVDC system voltage, current and energy limits, the HVDC converter station shall be capable of behaving as a controllable voltage source behind an internal impedance (i.e. a Thevenin source) during both the normal operation and immediately after a grid disturbance, without exceeding voltage and current limitations of the HVDC system. The Thevenin source is characterized by its voltage amplitude, voltage phase angle, frequency, and internal impedance all of which shall be adjustable in such a way as to ensure stability in the connected electrical power networks; 1. (b) (i) While the HVDC system voltage, current and energy limits are not exceeded, the

		instantaneous AC voltage characteristics of the Thevenin source of the HVDC converter station shall be constant or nearly constant in the sub-transient to transient time frame at the connection point of the HVDC converter station (grid side). The positive and the negative sequence current exchanged between the HVDC converter station (converter unit side), and AC grid shall flow naturally according to grid and converter impedances to the extent possible without exceeding current limitations of the converter.
	Point 1. (a): Text added as it depends on the disturbance, e.g. solid fault. In such events current needs to be limited quickly and grid forming behavior will be lost if a voltage source is emulated. Point 1.b (i): Suggested to reformulate to NERC formulation instead since earlier formulation is not clear. A natural flow might result in a very high negative sequence current e.g. for a unbalanced fault. At the same time high positive sequence current might be required. Priority must be given since converter current is limited to 1 p.u.. the natural flow is ok during steady state but not during large disturbances. Point 1. (b) (ii): Generally, TSO needs to respect the HVDC system owner's contractual timelines. Proposal: Any additional specifications needed shall	1. (b) (ii) If the HVDC system and individual converter capabilities, voltage, current and energy limits are exceeded, the current, energy and voltage shall be kept within their admissible limit values. As part of the connection agreement the relevant TSOs shall specify, in agreement with the HVDC system owner where so relevant, additional requirements describing the behaviour of the HVDC system and individual converter when the limitation is reached. The modalities of that notification and due dates shall be specified in accordance with the applicable national regulatory framework. 1. (c) (iii) The HVDC system shall be capable of

Article 14	become part of the connection agreement. On time availability of such specification are of greatest importance for the overall HVDC system project. If not defined on EU level, at least on national investors in HVDC systems need to have sufficient security for having all relevant requirements available on time for planning and executing their project. Point 1. (c) (iii): bumbpless is more or less impossible to achieve for a large disturbance, e.g. a large phase jump at high SCR. Hence, reformulating the sentence Point 2.: bumbpless again, same argument as for 1. c. Also include that synchronization conditions must be agreed between the HVDC system owner and the relevant TSOs. Point 5. (d) Related to offshore connections, the change in active power needs to be mirrored to offshore. Frequency stability needs of the isolated AC network to be well reflected in this requirement.	stable and transition that is as smooth as possible when reaching the HVDC system current or converter limits, without interruption, in a continuous manner and returning to the behaviour described in paragraph (1)(b) as soon as the limitations are no more necessary 2. Where an HVDC system is required to have the capability referred to in paragraph 1, the HVDC system shall be capable of supporting system survival by means of stable and transition that is as smooth as possible towards and from island mode of system operation (islanding), without interruption, in a continuous manner while complying with paragraph (1)(b) and paragraph (1)(c). The energy needed for this function and the synchronization conditions shall be agreed between the HVDC system owner and the relevant TSO, in coordination with adjacent TSOs; 5. If grid forming capability as prescribed in paragraphs 1-5 of this Article is not requested, an HVDC system shall be capable of contributing to limiting the transient frequency deviation by adjusting its active power as a function of the measured rate of change of frequency both in low and/or high frequency regimes, if specified by the relevant system operators or relevant isolated AC network operators, in coordination with the relevant TSOs. For HVDC systems connected to an islanded AC network the change in active power needs to be

		mirrored offshore. The following shall apply: a) the HVDC system shall be capable without intentional delay of adjusting the active power injected to or withdrawn from AC grid within its rated power; b) this active power adjustment shall be performed based on the measured rate of change of frequency. The measurement method shall be agreed between the relevant TSOs and the HVDC system owner; c) when the frequency has recovered, the operating point of the HVDC system shall return to its pre-disturbance active power value or an operating point according to the power available for transmission through the HVDC system; d) the requirements regarding rate-of-change-of-frequency measurement as well as the dynamic performance parameters of rapidly adjusted active power injected to or withdrawn at connection points or interface points shall be agreed between the relevant isolated AC network operator, relevant TSOs and the HVDC system owner and the energy needed for this function shall be coordinated with sources external to the HVDC system and if applicable within the isolated AC network's design and operational limits.
Article 15		

Article 16	Keep "system frequencies", when the connection points are located in different synchronous areas. Related to offshore connections, the change in active power needs to be mirrored to offshore”	1. If specified by the relevant TSO, utilizing the available power at the AC connection points of the HVDC system, an HVDC system shall be equipped with an independent control mode to modulate the active power output of the HVDC converter stations depending on the frequencies at all connection points of the HVDC system in order to contribute to the stabilisation of the system frequencies. For HVDC systems connected to an islanded AC network the change in active power needs to be mirrored offshore.
Article 17	Please change the wording to "infeed / outfeed", since the active power can flow in both directions and can cause either an imbalance with a positive or negative sign. For maximizing the value of the HVDC System for the network, a TSO may want to specify multiple values. When a TSO specifies values, the probability of faults shall be considered and clearly distinguished between more frequent faults like single converter faults or OHL faults and very infrequent faults like converter bipole faults or cable faults (example for best practice: NGESO)	1. An HVDC system shall be configured in such a way that its loss of active power infeed / outfeed in a synchronous area shall be limited to values specified by the relevant TSOs for their respective load frequency control area and fault probability, based on the HVDC system's impact on the power system.
Article 18		

Article 19	For clarification.	1. If grid forming capability as prescribed in Article 14 is not requested and if specified by the relevant system operator, in coordination with the relevant TSO, an HVDC system shall have the capability within HVDC converter design rating to provide fast fault current at a connection point in case of symmetrical (3-phase) faults.
Article 20		
Article 21		
Article 22		
Article 23		
Article 24		
Article 25	Allowances for HVDC systems shall not lead to more stringent requirements or higher risk of equipment damage for asynchronously connected power park module, asynchronously connected demand facility, asynchronously connected power-to-gas demand unit, asynchronously connected electricity storage module and isolated AC systems.	4. The relevant TSO may specify voltages (Ublock) at the connection points under specific network conditions whereby the HVDC system is allowed is allowed to block, while not violating the voltage against time profiles as defined in accordance with NC RfG Articles 13 to 22, except Articles 13a and 14a. Blocking means remaining connected to the network with no active and reactive power contribution for a time frame that shall be as short as technically feasible and which shall be agreed between the relevant TSOs and the HVDC system owner.
Article 26		

Article 27	Editorial change for clarification. Some clarification on how fast “fast recovery” needs to be would be helpful. Adding the sentence “The recovery shall be as fast as possible within the capability of the HVDC system”	HVDC systems that include DC overhead lines, shall be capable of fast recovery from transient faults within the HVDC system. The recovery shall be as fast as possible within the capability of the HVDC system. Details of this capability shall be subject to coordination and agreements on protection schemes and settings pursuant to Article 34.
Article 28	Text added as this level might be exceeded when sync. Conditions are not reasonable and to ensure a cost-effective and optimized design	Unless otherwise instructed by the relevant system operator, during the energisation or synchronisation of an HVDC converter station to the AC network or during the connection of an energised HVDC converter station to an HVDC system, the HVDC converter station shall have the capability to limit any voltage changes to a steady-state level specified by the relevant system operator in coordination with the relevant TSO. The level specified shall not exceed 5 per cent of the pre-synchronisation voltage, exception to this shall be granted when synchronous condition of the connected AC network is beyond reasonable limits. The relevant system operator, in coordination with the relevant TSO, shall specify the maximum magnitude, duration and measurement window of the voltage transients.

Article 29	Parties need to agree on schedule considering the process for connecting the new HVDC system. Text added to ensure that the studies are feasible.	1. When several HVDC converter stations or other plants and equipment are within close electrical proximity, the relevant TSO may specify that a study is required, and the scope and extent of that study, to demonstrate that no adverse interaction will occur. Timelines shall be coordinated between the relevant TSO and the owner of the connecting HVDC system. Additionally, the studies to be conducted shall be agreed upon by the relevant HVDC system owners, plant and equipment owners, and TSOs to ensure their feasibility. If adverse interaction is identified, the studies shall identify possible mitigating actions to be implemented to ensure compliance with the requirements of this Regulation.
Article 30		
Article 31		
Article 32		
Article 33		
Article 34		

Article 35	Article 14 (5) doesn`t describe synthetic inertia but limiting the transient frequency deviation	Priority ranking of protection and control 1. A control scheme, specified by the HVDC system owner consisting of different control modes, including the settings of the specific parameters, shall be coordinated and agreed between the relevant TSO, the relevant system operator and the HVDC system owner. 2. With regard to priority ranking of protection and control, the HVDC system owner shall organise its protections and control devices in compliance with the following priority ranking, listed in decreasing order of importance, unless otherwise specified by the relevant TSOs, in coordination with the relevant system operator: (a) network system and HVDC system protection; (b) grid forming capability as defined in Article 14(1) to (5), if applicable; (c) inertial response as in Article 14(6), if applicable; (d) active power control for emergency assistance; (e) automatic remedial actions as specified in Article 13(3); (f) FSM and LFSM-O/U; and (g) power gradient constraint.

Article 36	Similar as mentioned above: the relevant isolated AC network operator needs to be included in these coordination processes.	Changes to protection and control schemes and settings 1. The parameters of the different control modes and the protection settings of the HVDC system shall be able to be changed, if required by the relevant system operators, isolated AC network operators or the relevant TSO, and in accordance with paragraph 3. 2. Any change to the schemes or settings of parameters of the different control modes and protection of the HVDC system, including the procedure, shall be coordinated and agreed between the relevant system operators, the relevant isolated AC network operators, the relevant TSOs and the HVDC system owner, and in particular if the schemes and settings of the different control devices are necessary for transmission system stability and for taking emergency action. 3. The control modes and associated setpoints of the HVDC system shall be capable of being changed remotely, as specified by the relevant system operator or isolated AC network operator, in coordination with the relevant TSO.
Article 37		

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New article	

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TITLE III - REQUIREMENTS FOR ASYNCHRONOUSLY CONNECTED POWER PARK MODULES, ASYNCHRONOUSLY CONNECTED DEMAND FACILITIES, ASYNCHRONOUSLY CONNECTED POWER-TO-GAS DEMAND UNITS, ASYNCHRONOUSLY CONNECTED ELECTRICITY STORAGE MODULES AND REMOTE-END HVDC CONVERTER STATIONS

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 38	WTGs with grid forming capability as prescribed in RfG 2.0 Article Y are not yet commercially available from any OEM. None of the WTG OEM provided or committed to any clear timeline when such capability will be commercially available to the market. Consequently, developers are not able to deliver projects with WTGs with grid forming capability in the near future due to market non-availability. Mandating minimum requirements in such a case can prove to be an impediment to the roll out of renewables. It must be ensured that the timeline for requirements for grid forming WTGs is realistic. In addition to RfG 2.0 Article Y (6) grid forming should not be made mandatory as long as the technology is not commercially available. To sum it up: system stability and safe operation of the power system cannot be based on a concept that so far only exist in scientific papers with no commercially available and certified technology so far. Furthermore, a clear and joint technical framework needs to be defined across all member states implementing the RFG to allow the WTG OEMs to develop the envisaged capability. The TSOs are responsible for system stability therefore in a first instance they have to ensure that commercially available alternatives to ensure grid stability without grid forming WTGs are installed (synchronous condenser, energy storage, existing conventional power plants…) until grid forming WTGs are commercially available. The legislators have to ensure that the energy transition is enabled. If non-available technologies like grid forming are legally requested, the needed investment security is endangered. This would delay the ramp up of installed	The requirements applicable to offshore power park modules under Articles 13 to 22, except Articles 13a, 14a, Y(5), Y(6), Y(7), 20(4), 20(5), 21(4) and 21(5) of RfG 2.0 shall apply to DC-asynchronously connected power park modules and asynchronously connected electricity storage modules subject to specific requirements provided for in Article 39, Article 40, Article 40a, Article 40b, Article 41 Article 42, Article 43, Article 44 and Article 45 of this Regulation. [...]

	capacity for years. Editorial comment: the term “RfG 2.0” is frequently used . Though it’s understood what is meant, a formally correct wording is expected in the final regulation draft.	
Article 39	Point 1. (a) Several factors influence process time, including but not limited to: frequency control set-up (centralized vs de-centralized), cybersecurity scrutiny, through how many entities the signal is routed until the wind turbine starts to pitch. For example, signals provided from external entities will be slower processed than signals obtained within the PPMs internal control cycle, due to cybersecurity measures. (a) and (b): Proposal for clarification (as a location like a connection point cannot provide any signal) and for making clear, where such signal is made available by whom. It does not appear adequate that e.g. a A-PPM owner having a A-PPM connected to an isolated AC network becomes responsible to transfer some signal from some TSO where isolated AC network has some HVDC connection to their A-PPM. Such signal can be most cost-effectively provided by HVDC System owner’s and isolated AC network operator’ s assets. Point 1. (c): Unilateral definition by the rel. TSO without aligning with owners and relevant isolated AC network operators is not regarded as appropriate. Safe and stable	1. With regards to frequency response: (a) an asynchronously connected power park module, asynchronously connected power-to-gas demand unit, asynchronously connected electricity storage module shall be capable of receiving the measured frequency from the TSO’s network in the synchronous area to which frequency response is being provided as a fast signal at its interface point. This fast signal shall be provided from the relevant isolated AC network operator. An asynchronously connected power park module, asynchronously connected power-to-gas demand unit, asynchronously connected electricity storage module shall be able to process this signal no later than 0,3 second from receiving to completion of processing the signal for activation of the response; (b) The utilization of such fast signal shall a be coordinated between the relevant isolated AC network operator and the relevant TSO; (c) asynchronously connected power park modules, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules connected via HVDC systems to more than one control areas shall be capable of delivering coordinated frequency control as agreed between the owners, the relevant isolated AC network operator and the relevant TSO, in coordination with adjacent TSOs. ……

	of the isolated AC network must be considered and ensured. Point 3: Connection is at the isolated AC network, not at a remote-end HVDC converter station. Aligned needed with HVDC requirements with 1 Hz/s (measured at any point in time as an average of the rate of change of frequency for the previous 1 second) Point 8. (f): Needs to be well coordinated for maintaining stability in the isolated AC network the asynchronously connected power-to-gas demand unit is connected to.	3. With regard to rate-of-change-of-frequency withstand capability, an asynchronously connected power park module, an asynchronously connected demand facility, an asynchronously connected power-to-gas demand unit and an asynchronously connected electricity storage module shall be capable of staying connected to the isolated AC network and operable if the system frequency changes at a rate up to +/– 1 Hz/s (measured at any point in time as an average of the rate of change of frequency for the previous 1 second) at the interface point of the asynchronously connected power park module, the asynchronously connected demand facility, the asynchronously connected power-to-gas demand unit and the asynchronously connected electricity storage module for the 50 Hz nominal system. …. 8 . (f) if disconnection occurred according to subparagraph (e), on return of frequency above the frequency threshold, a time delay and ramp procedure as coordinated with the isolated AC network operator shall be initiated before normal operation resumes;

Article 40	For the entire Article: replace “remote-end HVDC converter station isolated AC network” by “interface point. By definition, A-PPMs, etc. are connected at interface points with isolated AC networks. Point 2. (b) (ii): Question for clarification: What are the asset terminals in this context? With the new topology introduced in NC HVDC, this paragraph does not seem to be needed anymore and should be obsoleted. If this paragraph is expected to fill a requirement gap, a better specification of the cases it applies to should be chosen. Additional language needed, otherwise this requirement could become contradictory to the grid forming requirements. Point 3. “as prescribed in Article 14” should be added for clarification. Additional language proposed got providing more clarity. The provision / transfer of active power is limited by the AC transmission stability limits. Extreme case: If there is a solid three phase fault at the interface point, the A-PPM cannot inject any active power into the isolated AC network.	3. With regard to priority to active or reactive power contribution for asynchronously connected power park modules and asynchronously connected electricity storage modules and in case grid forming capability as prescribed in Article 14 is not requested, the relevant isolated AC network operator, in coordination with the relevant TSO shall specify whether active power contribution or reactive power contribution has priority during faults for which fault-ride-through capability is required. If priority is given to active power contribution, its provision shall be established under conditions and within a time from the fault inception as specified by the relevant isolated AC network system operator while respecting the fundamental stability constrains for power transfer in AC networks, in coordination with the asynchronously connected power park module owner or asynchronously connected electricity storage module owner and the relevant TSO.
Article 40a[NEW]		

Article 40b[NEW]	Besides electrical and inherent energy storage capabilities of the asynchronously connected power park modules, their synthetic inertia capability is also affected by mechanical limits and these should be explicitly acknowledged besides the other limitations. An Additional sentence proposed for clarification and avoiding contradicting requirements.	If grid forming capability as set out in Article 14(4) is requested, the asynchronously connected power park modules and the asynchronously connected electricity storage modules shall be capable of providing synthetic inertia within the power park module's capability, including current limits, mechanical limits and inherent energy storage capabilities of each individual unit, if requested by the relevant system operator. If grid forming capability as set out in Article 14 (4) is requested, Article 40 (3) is not applicable. Inherent energy storage means an energy reserve available in physical components of a power park module, which has not necessarily been designed to suit the grid forming requirements of this Article, but may be used for such purposes, without affecting the design of the physical components of individual units.
Article 41		
Article 42		
Article 43		
Article 44		
Article 45		
Article 46	Proposal for clarification: making clear that connection related requirements in Articles 11 to 39 shall become applicable at the interface point of the remote-end HVDC converter station.	The requirements of Articles 11 to 39 defined apply to remote-end HVDC converter stations, subject to specific requirements provided for in Article 47, Article 48, Article 49 and Article 50. Where requirements of Articles 11 to 39 refer to a connection point, they shall apply accordingly to the interface points of remote-end HVDC converter stations.
		1. Where a nominal frequency other than 50 Hz, or a frequency variable by design is used in the isolated AC

network connecting the asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules, subject to relevant isolated AC network operator and TSO agreement, Article 11 shall apply to the remote-end HVDC converter station with the applicable frequency ranges and time periods specified by the relevant isolated AC network operator, taking into account specificities of the isolated AC network and the requirements laid down in Annex I.

2. With regard to frequency response, the relevant isolated AC network operator, the remote-end HVDC converter station owners, the asynchronously connected power park module owners, the asynchronously connected demand facility owners, the asynchronously connected power-to-gas demand unit owners and the asynchronously connected electricity storage module owners connecting with their assets to the relevant isolated AC network operator's isolated AC network shall agree on the technical modalities of the fast signal communication in accordance with Article 39(1). The HVDC system shall be capable of providing the network frequency as a signal to the remote-end HVDC converter station's interface point and by the relevant isolated AC network operator the fast signal shall be further relayed to the interface points of connected asynchronously connected power park module, asynchronously connected power-to-gas demand unit and asynchronously connected electricity storage modules. Frequency shall be measured at the connection point of the HVDC system or a predefined connection point in the synchronous area to which frequency response is being

Article 47	Point 1.: What is relevant for design and operation of an isolated AC Network should be decided by the relevant isolated AC Network operator. Point 2.: The relevant isolated AC network operator needs to be added here. For clarification. It appears most cost-effective to utilize the HVDC system to relay the fast signal. It should be further relayed by the isolated AC network operator to the connected A-PPMs, A-ESM, etc. as it is their infrastructure that is situated between the remote-end HVDC converter station and the connected A-PPMs, A-ESMs, etc. Last sentence deleted as it seems to be related to active power frequency response. Maybe it was intended to place this somewhere else in the text? Point 3.: Change proposal for the clarification. Frequency stability of the isolated AC network needs to be maintained. Point 4.: Change proposal for the clarification. Frequency stability of the isolated AC network needs to be maintained.	provided in coordination with the relevant TSO; For an HVDC system connecting an asynchronously connected power park module, an asynchronously connected demand facility, an asynchronously connected power-to-gas demand unit and an asynchronously connected electricity storage module the adjustment of active power frequency response shall be limited by the capability of the DC-asynchronously connected power park modules. 3. Where two or more remote-end HVDC converter stations are connected to one or more interface points of the same isolated AC network, the remote-end HVDC converter stations and their respective HVDC systems shall be capable of continuously operating stably over the full operating range between the maximum and the minimum HVDC system active power transmission capacity and contributing to the frequency control of the isolated AC network they are connected to. 4. Where paragraph 3 applies, the relevant isolated AC network operator in coordination with adjacent TSOs, shall specify that a study is required, in order to define coordinated frequency droop slope parameters of the remote-end HVDC converter stations including power sharing ratio between the remote-end HVDC stations and their respective HVDC system. This study shall also include robustness against control interactions during frequency changes response. The process for the necessary study to be conducted and relevant data to be provided by all grid users involved, as well as mitigating actions identified and implemented, shall be in accordance with the process in Article 29. 5. If grid forming capability as set out in Article 14(5)

Point 5.: Frequency stability of the isolated AC network needs to be maintained. That’s why there is close coordination needed, especially if an isolated AC network is connected via different HVDC Systems to different synchronous areas.

is requested, the remote end HVDC converter station shall be capable of adjusting at its interface point the isolated AC network frequency and/or voltage phase angle in order to use some synthetic inertia capability from asynchronously connected power park modules and asynchronously connected electricity storage modules connected to the isolated AC network. These adjustments have to be coordinated in detail between the isolated AC network operator and the relevant TSOs by fully respecting the frequency stability needs of the isolated AC network.

3. Where two or more remote-end HVDC converter stations are connected to one or more interface points of the same isolated AC network, the remote-end HVDC converter stations and their respective HVDC systems shall be capable of continuously operating stably over the full operating range between the maximum and the minimum HVDC system active power transmission capacity and contributing to the frequency control of the isolated AC network they are connected to.

4. Where paragraph 3 applies, the relevant isolated AC network operator in coordination with adjacent TSOs, shall specify that a study is required, in order to define coordinated frequency droop slope parameters of the remote-end HVDC converter stations including power sharing ratio between the remote-end HVDC stations and their respective HVDC system. This study shall also include robustness against control interactions during frequency changes response. The process for the necessary study to be conducted and relevant data to be provided by all grid users involved, as well as mitigating actions identified and implemented, shall be in

		accordance with the process in Article 29. 5. If grid forming capability as set out in Article 14(5) is requested, the remote end HVDC converter station shall be capable of adjusting at its interface point the isolated AC network frequency and/or voltage phase angle in order to use some synthetic inertia capability from asynchronously connected power park modules and asynchronously connected electricity storage modules connected to the isolated AC network. These adjustments have to be coordinated in detail between the isolated AC network operator and the relevant TSOs by fully respecting the frequency stability needs of the isolated AC network.
Article 48	Proposal for simplification following the general principle: remote end HVDC stations get connected to an isolated AC network at an interface point. Proposal for simplification: Merging Table 12 and 13 into Table 12. As this Article deals the voltage ranges in isolated AC networks, the relevant isolated AC network operator should be in charge.	1. With respect to voltage ranges: (a) a remote-end HVDC converter station shall be capable of staying connected to an isolated AC network and operating within the voltage ranges (per unit) and time periods specified in Table 12, Annex VIII, or for voltage level below 110kV as specified by the relevant isolated AC network operator. The applicable voltage range and time periods specified are selected based on the reference 1 pu voltage;

Article 49	Needs to be added when following the general principle: remote end HVDC stations get connected to an isolated AC network at an interface point.	Network characteristics With regard to the network characteristics, the remote-end HVDC converter station owner shall provide relevant data to the relevant isolated AC network operator and any asynchronously connected power park module owner, asynchronously connected demand facility owner, asynchronously connected power-to-gas demand unit owner and asynchronously connected electricity storage module owner in accordance with Article 42.
Article 50		

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New article	New Article proposed for referring to the voltage operation ranges defined in Table 9, Annex II instead of Tables in the RfG. This is also driven by the proposals to modify Table 9 (and Table 10) and these changes do impact the FRT requirements. This article is proposed to be Article 40c: Fault-ride-through capability of asynchronously connected power park modules and asynchronously connected electricity storage modules. Instead of Table (10)3.2.1 in NC RfG 2.0, the proposed Table X.1.3 shall apply. Instead of Table (19) 7.2.1 in NC RfG 2.0, the proposed Table X.1.4 shall apply.

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TITLE IV - INFORMATION EXCHANGE AND COORDINATION

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 51	Point 3.: For Clarification by further specification	3. The automatic controller referred to in paragraph 1 shall be capable of receiving the following signal types from the relevant system operator: (a) operational signals, receiving at least the following: (i) start-up command; (ii) active power setpoints; (iii) frequency sensitive mode settings; (iv) reactive power, voltage or similar setpoints; (v) reactive power control mode change; (vi) power oscillation damping control ON/OFF; and (vii) synthetic inertia ON/OFF.

Article 52	Modification online by operator may have severe impact on design/stability and is not recommended by OEMs. This is a legal issue and it must be clarified that OEM cannot take responsibility. Hence, the following text is added. What is the difference between (a) and (b)? Fast frequency control not mentioned in Articles 14 and 35. It is proposed to remove " (b) fast frequency control, if applicable as referred to in Article 14 and Article 35;"	Parameters and settings The parameters and settings of the main control functions of an HVDC system shall be agreed between the HVDC system owner and the relevant system operator, in coordination with the relevant TSO. The parameters and settings shall be implemented within such a control hierarchy that makes their modification possible if necessary. In case of a trip or impact on stability to the system due to modification of parameters and settings from relevant system operator the HVDC system owner is not responsible for these events. Those main control functions are at least: (a) grid forming capability, if applicable as referred to in Article 14 and Article 35; (c) frequency sensitive modes (FSM, LFSM-O, LFSM-U) referred to in Article 15, Article 16 and Article 17; (d) frequency control, if applicable, referred to in Article 16; (e) short circuit contribution during faults as referred to in Article 19 and Article 35; (f) reactive power control mode, if applicable as referred to in Article 22; (g) power oscillation damping capability, referred to Article 30; (h) subsynchronous torsional interaction damping capability, referred to Article 31.
Article 53		

Article 54	Point 2. : Proposal for editorial improvement; Using the same language here as in the NC RfG 2.0. In addition, asking for a generic model is contradicting the project-specific conditions specified in (a) - (c) that should be provided in the model. To account for the limitations of generic models, the sentence has been rephrased and point (d) has been erased. Point 3. : It seems that the requirements are for HVDC models. Therefore, this should be specified.	2. For the purpose of electromechanical dynamic (RMS) simulations used in network studies, the relevant TSO shall have the right to specify the model requirements. Without prejudice to the Member State's rights to introduce additional requirements, the HVDC system models shall be open-source generic model for RMS simulations delivered for cross-border network stability studies and to the extent possible: (a) be valid for the specified operating range and all control modes of the HVDC system; (b) include representation of HVDC converter unit, HVDC lines/cables and control systems that influence the dynamic behaviour of the HVDC transmission system in the specified time frame; (c) include the relevant protection function models as agreed between the relevant TSO and the HVDC system owner; The above listed simulation model requirements and information must not violate manufactures intellectual property. 1. For the purpose of electromagnetic transient (EMT) simulations, the relevant TSO shall have the right to specify the model requirements. Without prejudice to the Member State's rights to introduce additional requirements, the HVDC models shall:

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New article	

Please upload figures or tables if necessary

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TITLE V - OPERATIONAL NOTIFICATION PROCEDURE FOR CONNECTION

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 55		
Article 56		
Article 57		
Article 58		
Article 59		
Article 60		
Article 61		
Article 62	Point 3. (d) : Draft regulation is referring to Article 54: HVDC System modeling requirements, which is not well matching with A-PPM technology. Proposal for improvement and achieving higher clarity: Referring to NC RfG 2.0.	3. (d) simulation models as specified in NC RfG 2.0 Article 15 (5) (c) and as required by the relevant system operator in coordination with the relevant TSO;
Article 63		
Article 64		
Article 65		
Article 66		

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New article	

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TITLE VI - COMPLIANCE

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 67		
Article 68		
Article 69		
Article 70		
Article 71		
Article 72		
Article 73		
Article 74		
Article 75	Point 3.: Proposal for clarification by putting some emphasis on the NC RfG and DCC for avoiding conflicts or non-harmonized approaches.	3. The non-binding guidance shall explain the technical issues, conditions and interdependencies, especially with other connection network codes, which need to be considered when complying with the requirements of this Regulation at national level.
Article 76		

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New article	

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TITLE VII - DEROGATIONS

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 77		
Article 78		
Article 79		
Article 80		
Article 81		
Article 82		
Article 83		

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New article	

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TITLE VIII - FINAL PROVISIONS

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 84		
Article 85		
Article 85a[NEW]		
Article 86		

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
New article	

Please upload figures or tables if necessary

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Annex I - Frequency ranges referred to in Article 11

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Annex I		

Please upload figures or tables if necessary

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Annex II - Requirements applying to frequency sensitive mode, limited frequency sensitive mode overfrequency and limited frequency sensitive mode underfrequency

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Annex II	Point 1. (a) : The isolated AC network operator should decide on these parameters. Comment on Table 2: No ranges are given for droop s1 and s2, how shall this be please interpreted?	1. (a) the HVDC system shall be capable of responding to frequency deviations in each connected AC network by adjusting the active power transmission as indicated in Figure 1 and in accordance with the parameters specified by each TSO or isolated AC network operator within the ranges shown in Table 2. This specification shall be subject to notification to the regulatory authority. The modalities of that notification shall be determined in accordance with the applicable national regulatory framework.

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Annex III - Voltage ranges referred to in Article 18

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Annex III		

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Annex IV - Requirements for U-Q/Pmax-profile referred to in Article 20

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Annex IV		

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Annex V - Voltage-against-time-profile referred to in Article 25

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Annex V	New text related to Urec2 and Urec3 and the times proposed for having a correct reference to the changes proposed on Annex VIII. Remove this text “Fault-ride-through profile of an HVDC converter station” since it can be interpreted as the simulated fault profile which is not the case.	Please refer to attachment with revised Annex V Table 7.1 and 7.2. Figure 6: The diagram represents the lower limit of a voltage- against-time profile at the connection point, before, during and after a fault. Uprefault is the prefault voltage, Uret is the retained voltage at the connection point during a fault, tclear is the instant when the fault has been cleared, Urec1 and trec1 specify a point of lower limits of voltage recovery following fault clearance. Ublock is the blocking voltage at the connection point. The time values referred to are measured from tfault.

Please upload figures or tables if necessary

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Annex VI - Frequency ranges and time periods referred to in Article 39(2)(a)

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Annex VI		

Please upload figures or tables if necessary

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Annex VII - Voltage ranges and time periods referred to in Article 40

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Annex VII	Editorial proposal: Merge Table 9 and 10 to Table 9 as there is no obvious need to separate nominal voltages. For future cost-effective isolated AC networks, 275 kV equipment / nominal voltage is expected to play an important role (larger power transfer as with 220 kV but less needs for reactive power compensation than for 400 kV). That's why adding this nominal voltage level is proposed here. For voltages between 0,85 pu – 0,9 pu: Draft amendment was in line with the values and time for the CE region defined in NC RfG 2.0. For the Irish and Nordic synchronous area, already the NC RfG includes different language for the minimum times to operate at 0,85 pu – 0,9 pu voltage level. This approach overcomes the lack of flexibility in the original NC HVDC draft and allows for more cost-effective design choices for isolated AC networks. Requirements for the temporary operation at voltages above 1 p.u. shall respect equipment ratings and insulation classes as defined in established international standards like IEC (which shall not be mentioned in the legal text) for cost effective system designs. Finally, it should be the isolated AC network operator who makes the choices for their system	Please refer to attachment with revised Annex VII Table 9.

	design. As mentioned several times above, this could be the relevant TSO, but it is not necessarily the relevant TSO. That's why neutral language is proposed once again.	

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Annex VIII - Reactive power and voltage requirements referred to in Article 48

Please write your comments on the ACER draft amendments and your alternative text proposals, if any, in the table below

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Annex VIII	Editorial proposal: Merge Table 12 and 13 to Table 12 as there is no obvious need to separate nominal voltages. For future cost-effective isolated AC networks, 275 kV equipment / nominal voltage is expected to play an important role (larger power transfer as with 220 kV but less needs for reactive power compensation than for 400 kV). That's why adding this nominal voltage level is proposed here. For voltages between 0,85 pu – 0,9 pu: Draft amendment was in line with the values and time for the CE region defined in NC RfG 2.0. For the Irish and Nordic synchronous area, already the NC RfG includes different language for the minimum times to operate at 0,85 pu – 0,9 pu voltage level. This approach overcomes the lack of flexibility in the original NC HVDC draft and allows for more cost-effective design choices for isolated AC networks. Requirements for the temporary operation at voltages above 1 p.u. shall respect equipment ratings and insulation classes as defined in established international standards like IEC (which shall not be mentioned in the legal text) for cost effective system designs. Finally, it should be the isolated AC network operator who makes the choices for their system design. As	Please refer to attachment with revised Annex VIII Table 12.

	mentioned several times above, this could be the relevant TSO, but it is not necessarily the relevant TSO. That's why neutral language is proposed once again.	

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Other additional provisions

Please write your amendment proposals, if any, in the table below

	Text amendment proposal (if applicable)
Other new provisions	

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Useful links

more info on ACERs HVDC public consultation (https://www.acer.europa.eu/documents/public-consultations/pc2024e05-public-consultation-amendments-electricity-grid-connection-network-code)

Background Documents

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