

Public Consultation

on

**the amendments to the Electricity Grid Connection Network
Codes**

(NC HVDC)

PC_2024_E_05

Evaluation Report

19 December 2024

1. INTRODUCTION

This report summarises the responses received to the public consultation on the 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 ('public consultation'), and provides an evaluation of the points raised, in relation to the Agency for the Cooperation of Energy Regulators (ACER) consultation document PC_2024_E_05.

In the context of the ongoing revisions of the European grid connection network codes, ACER has consulted with stakeholders, between 17 June to 8 September 2024, 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 No 3/2023 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).

The consultation resulted in a total of 18 responses provided by stakeholders (ENTSO-E, EU DSO and European energy stakeholders representing the industry across Europe). One of the 18 responses was marked as confidential in full and therefore has not been included in this evaluation report. The list of respondents is available on ACER's website, alongside their responses. In the present document we explain how the non-confidential responses received have been taken into account for the network code's amendment. The steps following the results of this public consultation are also outlined in this document.

2. EVALUATION OF RESPONSES

Following the close of the public consultation, ACER assessed stakeholders' views regarding amendment proposal on the NC HVDC.

Below we provide a summary and analysis of the responses received. It should be noted that the following tables provide the responses received in the 2024 public consultation and focuses on the issues raised by the respondents.

Abbreviations

- A-PPM:** asynchronously connected power park module
- A-ESM:** asynchronously connected electricity storage module
- A-PtG-DU:** asynchronously connected power-to-gas demand unit
- A-DF:** asynchronously connected demand facility
- DSO:** Distribution System Operator
- EG CROS:** Expert Group Connection Requirements for Offshore Systems
- EG CSM:** Expert Group Criteria for Significant Modernisation
- FRT:** Fault ride through
- GC ESC:** Grid Connection European Stakeholders Committee
- HVDC Systems:** High Voltage Direct Current Systems
- IGDs:** ENTSO-E Implementation Guidance
- LFSM-O/U:** Limited Frequency Sensitive Mode -Under frequency/Over frequency
- LFSM-UC:** Limited Frequency Sensitive Mode -Under frequency for consumption
- NC DC:** Network Code Demand Connection
- NC DC 2.0:** ACER recommendation (03-2023) on proposed amendments to NC DC
- NC RfG:** Network Code Requirements for Generators
- NC RfG 2.0:** ACER recommendation (03-2023) on proposed amendments to NC RfG
- NRA:** National Regulatory Authority
- PGM:** Power Generating Module
- PPM:** Power Park Module
- RoCoF:** Rate of change of frequency
- RSO:** Relevant System Operator
- TSO:** Transmission System Operator

3. WHEREAS SECTION

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
EU DSO ENTITY	Recital (2)	The level playing field should be for all participants, not just electricity undertakings.	Partly agree	Recital (2) refers to all participants. More specifically, Recital (2) makes reference to Article 3 of the Directive (EU) 2019/944 of the European Parliament and of the Council (the 'Electricity Directive') which in paragraph 4 refers to 'electricity undertakings'. According to Article 2(57) of the Electricity Directive 'electricity undertaking' means a natural or legal person who carries out at least one of the following functions: generation, transmission, distribution, aggregation, demand response, energy storage, supply or purchase of electricity, and who is responsible for the commercial, technical or maintenance tasks related to those functions, but does not include final customers'.	
Statnett	Recital (3)	The stakeholder states that according to Article 58(2) of the Electricity Regulation, the network codes establish a minimum degree of harmonisation, and not a total harmonisation. According to the stakeholder, Member States may have additional requirements, as long as they do not negatively affect cross-zonal trade.	Disagree	ACER considers that Recital (3) of the NC HVDC adequately describes the need for a clear legal framework for grid connections, facilitating Union-wide trade in electricity, ensuring system security, facilitating the integration of renewable electricity sources, increasing competition and allowing more efficient use of the network and resources, for the benefit of consumers.	
Statnett	Recital (7)	The stakeholder proposes the following sentence to be added: 'The network codes provide the minimum degree of harmonisation and are without prejudice to the Member States' right to establish national network codes which do not affect cross-zonal trade'.	Disagree	The establishment of network codes according to Article 59 of Regulation (EU) 2019/943 of the European Parliament and of the Council (the 'Electricity Regulation') does not preclude Member States from adopting national network codes. This is also expressly provided in Article 58(2)(d) of the Electricity Regulation and shall not be replicated and/or interpreted in the NC HVDC.	
WindEurope	Recital (2), (4), (5), (7), (9), (10), (13), (14), (15)	The stakeholder proposes to add in several recitals the term 'isolated AC network', as they consider it to be an important term. Furthermore, they state that 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. In addition, frequency-related requirements should not necessarily be the same for isolated AC networks within the same synchronous area and a cost-effective system design is relevant to ensure full market integration.	Disagree	According to Article 1 of ACER proposed amendments to NC HVDC, '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.'. Furthermore, according to Article 3(1)(e), the requirements of the NC HVDC shall apply to HVDC systems connecting isolated AC networks. Therefore, the requirements are applied to the connecting equipment at their interface or connection point. In light of the above, the addition of the term 'isolated AC network' to the recitals could not be accepted. The NC HVDC provides harmonised requirements to be applied to the connecting equipment in scope at the interface point, which differ from the requirements at the connection point, thus providing a cost-effective system design. In this respect, we also make reference to Article 5(3)(c) of the HVDC NC, where it is expressly provided that when applying this Regulation, Member States, competent entities and system operators shall 'apply the principle of optimisation between the highest overall efficiency and lowest total costs for all parties involved'.	
WindEurope	New Recital	The stakeholder proposes to add a new Recital stating that: '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.' The stakeholder considers that 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.	Disagree	According to Article 1 of ACER proposed amendments to the NC HVDC, '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.' Thus, the scope of application has been extended to include storage and/or demand connected at the isolated AC network. Furthermore, the network codes do not preclude Member States from adopting national network codes (see also Article 58(2)(d) of the Electricity Regulation).	

4. DEFINITIONS (ARTICLE 2)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
CurrENT Europe	Article 2(1)	The stakeholder considers that the definition should include high-capacity DC systems such as MVDC superconducting cable systems. The Regulation should enable higher current DC technologies that can transfer the same or higher capacity at lower / medium voltage levels.	Disagree	As drafted, the NC HVDC applies to HVDC systems regardless of if the MVDC superconducting cable systems related technologies are used or not. In this respect, the NC HVDC is technology neutral. Furthermore, according to Article 3(7)(a), the Regulation shall apply to HVDC systems whose connection point is below 110 kV, provided that a cross-border impact is demonstrated by the relevant TSO. For local MVDC systems national or local requirements may apply.	
ENTSO-E	Article 2(2)	The stakeholder proposes for consistency to change "a demand facility" to " <i>an asynchronously connected demand facility, an asynchronously connected power-to-gas demand unit</i> ".	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.	
TERNA S.p.A.	Article 2(8)	Given the impact that the definition of " <i>Isolated AC Network</i> " on the scope of application of HVDC NC, the stakeholder welcomes the clarification made by ACER in the second sentence of Article 2(8). In stakeholder's view, it is of the utmost importance that unequivocal legal clarification is provided within the Network Code so that the definition of <i>Isolated AC Network</i> does not include " <i>transmission or distribution systems of islands of member states that are not operated synchronously</i> " (as also provided in Article 3(7)(b)). In stakeholder's view, the second part of Article 2(8) guarantees the legal certainty of NC scope of application and coherence in the interpretation of Article 2(8) (definition of <i>Isolated AC Network</i>) and Article 3(7)(b) (exclusion of application for transmission or distribution systems of islands of Member states not operated synchronously) as these transmission/distribution systems do not have a cross-border impact.	Partly agree	According to article 3(7)(b) ' <i>HVDC systems, A-PPMs, A-DFs, A-PtG-DUs or A-ESMs 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</i> ' do not need to comply with the Regulation. However, it is also important to allow the flexibility/discretion to Member States to apply some or all of the requirements of the NC HVDC according to national rules. Relevant amendments have been introduced to the legal text in Articles 2(8) and 3(7)(b) to allow for this flexibility.	
Energinet, VDE FNN	Article 2(8)	One stakeholder states that the new version is not needed and will generate unnecessary discussion on the understanding and that applicability is covered in Article 3(7)(b). The stakeholder also proposes an alternative definition, i.e. ' <i>isolated AC network</i> ' means an AC network which is not part of a synchronous area, which is connected to a synchronous area via one or more HVDC systems'. Another stakeholder states that this exclusion could lead to problems with already existing AC networks, which belongs to a member state, e. g. Bornholm is connected to Sweden and is planned to be connected to Denmark and Germany via HVDC. There might be an issue with the applicability of the NC HVDC for Bornholm.			
ENTSO-E	Article 2(8)	The stakeholder believes that an isolated AC network could be built on a physical member state island (and not synchronously connected to a synchronous), or on an artificial member state island (like in Belgium case). Up to date there is the case of Danish Island Bornholm which is physical island and which Germany is also connected via HVDC. We may have also the Belgian or future Dutch or Danish artificial islands. For those physical or artificial islands, two or three countries may be tapping via HVDC, and a certain harmonization is required. Therefore, the stakeholder proposes NC HVDC 2.0 to regulate it as these cases would have cross border impact. According to the stakeholder, the proposal of ACER excludes that physical or artificial island will be called isolated AC network. It may create huge issue as stakeholders may not accept NC HVDC 2.0 applicability, advocating that they consider it as member state island possibly according to Article 3(7)(b). On the other hand, a member state island such as Sardinia, which is existing and has significant load, is excluded by Article 3(7). Therefore, the stakeholder proposes to delete this sentence.			
EU DSO ENTITY	Article 2(8)	According to the stakeholder, if an island happened to be connected by a HVDC link, then the AC network on that island would be an isolated AC network.			
WindEurope	Article 2(8)	The stakeholder proposes to add that the isolated AC network could be connected to one or more synchronous areas. They consider that this is a more general text as an isolated AC network could become connected to more than one synchronous area.	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.	

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
National Grid Electricity System Operator - Great Britain	Article 2(9)	As regards 'Interface Point', the stakeholder states that under the new definitions, the HVDC 2.0 Code removes the definition of "HVDC Interface Point" and replaces it with the term "Interface Point". The stakeholder states that in GB they already use the term "Interface Point", which is the boundary between an Offshore Transmission System and Onshore Transmission System. In Europe the new definition of Interface Point is defined as "the AC interface of an isolated AC network at which technical specifications affecting the performance of the relevant equipment can be prescribed as specified by the relevant system operator and as identified in the connection agreement", which in summary is the connection point between an isolated AC network behind an HVDC System. The stakeholder request that the ACER proposal of Interface Point is changed to another term as long as it is not exactly the same as "Interface Point".	Agree	ACER agrees to change the term 'interface point' to avoid confusion. ACER proposes to use the term 'isolated interface point' instead. Relevant amendments have been introduced to the legal text.
CurrENT Europe	Article 2(9)	The stakeholder wonders whether the phrase 'of an isolated AC network' is correct as the stakeholder understands that the interface points are at any point a HVDC system connects to AC network whether isolated or not.	Disagree	The term 'interface point' refers only to the AC buses connected to the remote-end converter station, i.e. the isolated AC network. The point where the converter station is connected to the main transmission system is called 'connection point'. The stakeholder could also refer to the slides presented to the ACER Webinar on amendments to the electricity grid connection network code (NC HVDC) , on 24 June 2024, for a graphical representation of the proposed changes.
WindEurope	Article 2(9)	The stakeholder proposes to bring the language of the definition closer to NC RfG, since no unilateral definition of requirements by the network operator should be specified.	Partly agree	ACER agrees to amend the definition to be closer to the current NC HVDC and to the ACER amendment proposal to NC RfG. Relevant amendments have been introduced to the legal text. For the introduction of the term 'isolated AC network operator' in the definition we refer to ACER's response to the proposed new definition by stakeholders.
WindEurope	Article 2(10)	The stakeholder proposes to add to the definition that the remote-end HVDC converter station is connected to one or more isolated AC networks.	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.
ENTSO-E	Article 2(11)	The stakeholder recommends to introduce all abbreviations in the definitions and then use the abbreviations through the code in order to improve readability	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.
WindEurope	Article 2(11), (12), (13), (14)	The stakeholder proposes to add the term 'isolated AC network' to these definitions.	Disagree	The definitions already include the term 'interface point' which refers to the term 'isolated AC network'.
ENTSO-E	Article 2 NEW definition	The stakeholder proposes a new definition 2(19) (19) A STATic synchronous COMPensator (STATCOM) is a fast-acting device capable of providing or absorbing reactive current and thereby regulating the voltage at the point of connection to a power grid. It is categorized under Flexible AC transmission system (FACTS) devices. The technology is based on VSCs with semi-conductor valves in a modular multi-level configuration. The proposal is justified by the stakeholder as it proposes in subsequent articles the term STATCOM which should be included in the definitions section accordingly.	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
<p>Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN, WindEurope</p>	<p>Article 2 NEW definition</p>	<p>The stakeholders propose the insertion of a definition for relevant isolated AC network operator'. As justification, the stakeholders argue that NC HVDC is based on the terms Relevant System Operators and Relevant Transmission System Operations defined in NC RfG. It is not clear, whether these entities also cover the coordination/operation/ownership of islanded AC networks (requirements, etc.). It is proposed to introduce the neutral term "Relevant Isolated AC Network Operator" for this field of responsibility. Similar approach was already taken for HVDC Systems and the HVDC System Owner.</p> <p>The proposal has as follows: <i>'relevant isolated AC network operator' means the isolated AC network operator to whose system a HVDC system, 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;</i></p>	<p>Disagree</p>	<p>According to Article 59(2) of the Electricity Regulation, <i>'The Commission is empowered to adopt delegated acts in accordance with Article 68 supplementing this Regulation with regard to the establishment of network codes in the following areas....'</i> The delegation of the power to <i>'supplement'</i> a legislative act means that that during the exercise of such power, the authority is limited in compliance with the entirety of the legislative act adopted by the legislature, to develop in detail non-essential elements of the legislation in question. The Electricity Regulation introduces the rules which are essential to the subject matter envisaged. In this framework, Transmission System Operator (TSO) is the term used in EU legislation to refer to any entity responsible for operating, ensuring the maintenance of and developing the transmission system in a given area, its interconnections with other systems and ensuring the long-term ability of the system to meet reasonable demands for the transmission of electricity (Article 2, EU Electricity Directive 2019 ((EU) 2019/944) and Article 2(53) EU Electricity Regulation 2019 ((EU) 2019/943)). As the rules governing the regulated activity of the TSO are set by EU legislative acts, the introduction of a new definition in this framework rather seems to amend the legislature by developing details not defined therein. Besides, it seems that the tasks between the relevant TSO and the proposed <i>'isolated AC network operator'</i> coincide and as a result the introduction of the definition is unavailing.</p>

5. TITLE I – GENERAL PROVISIONS (ARTICLES 1, 3-10)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
CurrENT Europe	Article 1	The stakeholder considers that the Regulation should establish a network code which lays down the requirements for grid connections also of high-capacity DC systems (such as MVDC superconducting systems).	Disagree	As drafted, the NC HVDC applies to HVDC systems regardless of if the MVDC superconducting systems related technologies are used or not. In this respect, the NC HVDC is technology neutral. Furthermore, Article 3(7)(a) of the NC HVDC states that the Regulation can apply to HVDC systems whose connection point is below 110 kV if a cross-border impact is demonstrated by the relevant TSO. For local MVDC systems national requirements may apply.	
WindEurope	Article 1	The stakeholder proposes to add that 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 are connected to synchronous areas and/or isolated AC networks.	Disagree	ACER considers that the proposed additional phrase is not necessary. The relevant provisions of the NC HVDC define where the requirements for each connecting equipment within the scope of the Regulation apply.	
EDF	Article 3	The stakeholder states that precision is needed to avoid the understanding that it could apply on the private owner side of the system. In this regards it proposes paragraph 1 to read: '1. <i>The requirements of this Regulation shall apply to the AC side of HVDC systems on the transmission network.</i> '	Disagree	The NC HVDC provides technical requirements for grid connection that apply either at the connection point, at the interface point or at the terminals of the HVDC system, as specified in the network code. The responsibility for compliance with the requirements lies with the connecting equipment owner.	
WindEurope	Article 3	<p>As regards paragraphs (1) and (2), the stakeholder proposes general improvement by considering the relevance of isolated AC networks in the scope of NC HVDC.</p> <p>As regards paragraphs (4) and (5), the stakeholder proposes that relevance of interface points need to be considered, too.</p> <p>As regards paragraph (6), the stakeholder proposes to add 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.</p> <p>As regards paragraph (7), the stakeholder proposes for clarification to exclude synchronous power-generating modules connected to isolated AC network. It is stated that 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).</p>	Disagree	<p>Paragraph (1) of Article 3 refers to the applicability to HVDC systems, whereas paragraph (2) refers to the applicability to asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules. ACER proposed amendment is in line with the proposal by the Grid Connection European Stakeholder Committee (GC ESC) Expert Group on Connection Requirements for Offshore Systems (EG CROS).</p> <p>The terms '<i>interface point</i>' and '<i>connection point</i>' should not be used interchangeably. Paragraphs (4) and (5) describe where the requirements should apply for HVDC systems and A-PPMs, A-DFs, A-PtG-DUs and A-ESMs.</p> <p>We refer to ACER's response to the proposed new definition by stakeholders on the '<i>isolated AC network operator</i>' (see Section 4 of this Report).</p> <p>It is clear from the scope of the NC HVDC (Article 3) that it provides requirements for grid connection of high voltage direct current systems, asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules (<i>emphasis added</i>).</p>	

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
E-REDES	Article 3(7) (a) and (c)	<p>As regards paragraph 7(a), the stakeholder states that:</p> <p>a) This provision leaves open the applicability of this Regulation to HVDC systems below 110 kV upon decision by the TSO, depending on its assessment of the cross-border impacts, without clarifying the conditions and criteria to be considered in this analysis. This situation creates uncertainty and lack of transparency for grid users below 110 kV on the technical requirements they are obliged to meet. This lack of clarity may lead to a non-discretionality of the options for DSOs, also highlighting the need for involvement of the relevant system operator in this assessment. Finally, it is not clear whether the Regulation applies to HVDC grid users connected to voltages below 110 kV, or only to HVDC systems as defined in Article 2.</p> <p>As regards paragraph 7(c) (new), the stakeholder states that:</p> <p>A provision should be introduced in the Regulation to ensure that it does not serve as a barrier to innovation by operators, namely that excessive and inappropriate rules are not created for innovative and smaller projects that serve as a test of the HVDC technology, especially on the DSO side, where it is still in an initial stage of implementation with few practices in the EU. Thus, these cases should be included in paragraph 7 of Article 3.</p>	Disagree	<p>As regards the applicability to HVDC systems with connection point below 110 kV, according to the NC HVDC, the relevant TSO shall demonstrate a cross-border impact. Therefore, the decision whether these HVDC systems have a cross-border impact lies with the entity designated by the Member State, according to Article 5. Article 5(4)(e) also reads that when applying NC HVDC, Member States, competent entities and system operators shall consult with relevant DSOs and take account of potential impacts on their system.</p> <p>Furthermore, as regards the applicability to grid users connected to HVDC systems that are connected below 110 kV, Article 3(2) reads : <i>'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.'</i></p> <p>By default, the NC HVDC does not apply to small-scale pilot projects of innovative HVDC systems connected to voltages below 110kV, unless a cross-border impact is demonstrated in accordance with Article 3(7)(a).</p>
National Grid Electricity System Operator - Great Britain	Article 3(7)	<p>The stakeholder notes that notwithstanding the requirements of Article 3(7), the requirements of the Regulation apply to the AC side of HVDC Systems. They assume that means both ends of the HVDC System including isolated systems and it would be helpful if this was clarified.</p> <p>It is unclear how the obligations of the NC HVDC apply if one country is a Member State and the remote end HVDC connection point is located in a Non-EU Member State. This could also be challenging where a plant is connected behind an HVDC System in a non – Member State's jurisdiction but will be influenced by the overall design of the HVDC System, in particular requirements such as frequency, voltage and controller requirements.</p> <p>The stakeholder argues that it is also unclear how the requirements apply to HVDC Systems and DC Connected Power Park Modules connected prior to the introduction of the EU Connection Network Codes, HVDC Systems and DC Connected Power Park Modules caught by the requirements of HVDC 1.0 and the requirements applicable to plants caught by HVDC 2.0 – See also comments on Article 85a.</p>	Partly agree	<p>It is correct that requirements apply to both ends of the HVDC system. This is covered by the terms <i>'interface point'</i> and <i>'connection point'</i> that refer to the isolated network for the former and to the interconnected synchronous network for the latter. The relevant provisions specify where specifically the requirements shall applied.</p> <p>When entering into force, the network code becomes binding for EU Member States. In addition, for non-EU countries which are parties of the EEA agreement future network codes will be applicable and binding after decision by the EEA Committee and national implementation. For other non-EU countries not covered by existing agreements, bilateral negotiations and subsequent agreements could clarify the applicability of the network codes.</p> <p>The stakeholder could also refer to Article 85 of NC HVDC on HVDC System, asynchronously connected power park modules, asynchronously connected demand facilities or asynchronously connected electricity storage modules connecting with synchronous areas or control areas not bound by EU legislation, according to which:</p> <p><i>'1. Where an HVDC system to which the requirements of this Regulation apply is connecting synchronous areas or control areas, with at least one synchronous area or one control area not falling under the scope of application of Union legislation, the relevant TSO or, where applicable, the HVDC system owner shall endeavour to implement an agreement to ensure that the owners of HVDC systems with no legal obligation to comply with this Regulation also cooperate to fulfil the requirements.</i></p> <p><i>2. If an agreement as referred to in paragraph 1 cannot be implemented, the relevant TSO or, as the case may be, the HVDC system owner concerned shall use all available means to comply with the requirements of this Regulation.'</i></p> <p>As regards transitional provisions we refer to ACER response on Article 85a.</p>
ENTSO-E	Article 3	<p>The stakeholder emphasizes the importance of using the terms asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity.</p> <p>The stakeholder proposes an editorial change. The term HVDC interface shall be removed from the code and replaced by interface point.</p>	Agree	<p>ACER agrees with stakeholder's proposal.</p> <p>Relevant amendments have been introduced to the legal text.</p>

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
EU DSO ENTITY	Article 3	The stakeholder states that it is not clear from Article 3(1) that the AC components of isolated AC networks are supposed to be included or not. Article 3(5) does help make this clear, but 3(1) in isolation could be easy to interpret.	Disagree	Paragraph (1) of Article 3 should not be read in isolation from other paragraphs of this article. In general, Article 3 provides the scope of application of the NC HVDC. Paragraph (1) refers to the applicability to HVDC systems, whereas paragraph (2) refers to the applicability to asynchronously connected power park modules, asynchronously connected demand facilities, asynchronously connected power-to-gas demand units and asynchronously connected electricity storage modules.
VDE FNN	Article 3(7)	The stakeholder states that this exclusion could lead to problems with already existing AC networks, which belongs to a member state, e.g. Bornholm is connected to Sweden and is planned to be connected to Denmark and Germany via HVDC. There might be an issue with the applicability of the NC HVDC for Bornholm. The stakeholder proposes to add at the end of point (b) the text ' <i>...unless a cross-border impact is demonstrated by the relevant TSO.</i> '	Partly agree	According to Article 3(7)(b) ' <i>HVDC systems, A-PPMs, A-DFs, A-PtG-DUs or A-ESMs 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</i> ' do not need to comply with the Regulation. However, it is also important to allow the flexibility/discretion to Member States to apply some or all of the requirements of the NC HVDC according to national rules. Relevant amendments have been introduced to the legal text in Articles 2(8) and 3(7)(b) to allow for this flexibility.
ENTSO-E	Article 4	The stakeholder proposes to check the wording in Article 4(1) due to the three negations in the same sentence. The stakeholder proposes that this Article shall be split between HVDC and A-PPM, A-DF, A-PtG-DU. For the case of A-PPM and A-ESM the same requirement shall apply in NC RfG 2.0. As in Article 4.a. here, it shall be only referred and made applicable for A-PPM. For A-DF, Article 4.a of NC DC 2.0 shall apply. For A-PtG-DU, the same as Article 4.a of NC DC 2.0. In this case, it shall be for all demand units. The stakeholder believes that the part (c) as in the proposal document should be deleted as it does not fit for the purpose of HVDC systems. Instead, they propose a relevant legal text. HVDC systems are transmission systems and are built with fixed transmission capacity, reactive power capability that cannot be changed during the lifecycle. Therefore, the legal text proposal aims to leave it for national regulations. In stakeholder's view that the terms " <i>a change of the underlying technology of the HVDC system</i> " need more clarification. Therefore, they propose to clearly state a change of LCC to VSC, or MCC as recommended in their legal text proposal.	Partly agree	It is clear from Article 4(1) that Articles 26, 31, 33 and 50 are exempted. As regards significant modernisation, reference should be made to Article 4a of ACER recommendation (03-2023) on proposed amendments to NC RfG (NC RfG 2.0) for A-PPMs and A-ESMs and Article 4a of ACER recommendation (03-2023) on proposed amendments to NC DC (NC DC 2.0) for A-DFs and A-RtG-DUs. However, for HVDC systems it is important that certain criteria be defined, as proposed by the GC ESC Expert Group on Criteria for significant modernisation (EG CSM). Nonetheless, according to ACER, certain flexibility in defining the criteria for significant modernisation could be beneficial. Thus, ACER considers that system operators should be able to define thresholds within ranges and that they should also be able to define additional criteria, in line with the ACER recommendation (03-2023) on proposed amendments to NCs RfG and DC. ACER agrees to clarify further the criteria for change of the underlying technology of the HVDC system. Relevant amendments have been introduced to the legal text with regard Article 4.
National Grid Electricity System Operator - Great Britain	Article 4(1)(c)	The stakeholder states that except for Article 26 (post fault active power recovery), Article 31 (sub-synchronous torsional interaction damping capability), Article 33 (HVDC System Robustness) and Article 50 (Power Quality) the requirements of HVDC 2.0 do not apply to existing HVDC Systems unless the existing HVDC System or plant connected behind an HVDC System has been subject to a substantive modification. The stakeholder argues that these " <i>substantive modification</i> " changes are quite onerous and cover issues such as a percentage increase in the maximum power transmission capability, the percentage change in short circuit capacity at the end of the HVDC System, a percentage change in existing reactive power capability either from the HVDC System itself or plant connected to it, a change in components of the HVDC System or plant connected to it other than for maintenance or repair activities or a change in the underlying technology of the HVDC System. According to the stakeholder, it is unclear, however, what the % change would be which necessitates a change, and, in some cases, this could make the difference between a project being economically unviable.	Partly agree	ACER considers that for HVDC systems it is important for some criteria to be defined, as proposed by the GC ESC Expert Group on Criteria for significant modernisation. Nonetheless, according to ACER, certain flexibility in defining the criteria for significant modernisation could be beneficial. Thus, ACER considers that system operators should be able to define thresholds within ranges and that they should also be able to define additional criteria, in line with the ACER recommendation (03-2023) on proposed amendments to NCs RfG and DC. In general maintenance and repair activities should not count towards significant modernisation in line with the NC RfG 2.0 and DC 2.0. Relevant amendments have been introduced to the legal text with regard Article 4.
Statnett	Article 4	According to the stakeholder, paragraphs (i), (ii), (iii) and (v) create adverse incentives and should be deleted. The text in (iv) should not exclude repair and maintenance activities.		

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
WindEurope	Article 4	<p>As regards paragraph (1)(a)(iii) the stakeholder clarifies that the facility which will be modified is the only facility which will need a new connection agreement and comply with new requirements.</p> <p>As regards paragraph (1)(c)(ii) the stakeholder proposes that 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.</p> <p>As regards paragraph (1)(c)(iii) the stakeholder proposes 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.</p> <p>As regards paragraph (1)(c)(iv) the stakeholder proposes to define a range for Z, following the same approach as the NC RfG.</p>	Partly agree	<p>As regards paragraph 1(a)(iii) it is already stated in paragraph (1)(a) that it refers to the HVDC system or the A-PPM, A-DF, A-PtG-DU, A-ESM.</p> <p>As regards significant modernisation, reference should be made to Article 4a of NC RfG 2.0 for A-PPMs and A-ESMs and to Article 4a of NC DC 2.0 for A-DFs and A-RtG-DUs. For HVDC systems it is important for some criteria to be defined, as proposed by the GC ESC Expert Group on Criteria for significant modernisation. Nonetheless, according to ACER, certain flexibility in defining the criteria for significant modernisation could be beneficial. Thus, ACER considers that system operators should be able to define thresholds within ranges and that they should also be able to define additional criteria in line with the ACER recommendation (03-2023) on proposed amendments to NCs RfG and DC.</p> <p>Relevant amendments have been introduced to the legal text with regard Article 4.</p>
CurrENT Europe	Article 5	<p>The stakeholder proposes that a new point in paragraph 3 should be added stating that: <i>'For HVDC system with more than two alternating current (AC) buses and more than two HVDC converter stations with HVDC circuits in between, the relevant system operator or TSO shall be cognisant of the impact of the requirements being placed on all interface points. Notably the requirements should reflect the reasonableness and practicality of meeting these requirements simultaneously by the HVDC system. For clarity in proving compliance, where the requirements placed on one interface point will directly detract from or risk the compliance of another interface point the relationship and/or priority of meeting these requirements will be provided.'</i></p>	Partly agree	<p>ACER considers that it is important to allow the flexibility for relevant system operators or TSOs to establish topology dependent requirements of general application for multiterminal HVDC systems where HVDC converter stations are connected to different voltage levels or geographical locations. This would allow more efficient use of the network and resources for these topologies.</p> <p>Relevant amendments have been introduced to the legal text with regard Article 5(1).</p>
WindEurope	Article 5	<p>The stakeholder notes that the paragraph included in NC RfG 2.0: "System operators shall ensure that system users' equipment shall offer a cyber-protected data exchange interface where relevant." is missing and proposes to add it to Article 5 of NC HVDC 2.0.</p>	Agree	<p>ACER agrees with stakeholder proposal to add in Article 5 that the 'System operators shall ensure that system users' equipment shall offer a cyber-protected data exchange interface where relevant', in line with the ACER amendment proposal to NC RfG.</p> <p>Relevant amendments have been introduced to the legal text.</p>

6. TITLE II – GENERAL REQUIREMENTS FOR HVDC CONNECTIONS (ARTICLES 11-37)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
WindEurope	Article 11	The stakeholder states that an HVDC System can only react to what's happening at connection points or interface points. It is proposed to replace the phrase 'to the network' with the phrase 'at the connection 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.	Partly agree	ACER agrees that it is important to specify where the technical requirements apply. However, this is already provided in the NC HVDC. As regards requirements provided in Article 11, Article 3(4) reads: 'The connection requirements for HVDC systems provided for in Title II shall apply at the AC connection 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'. Therefore, the proposed amendment by the stakeholder is not necessary.	
EDF	Article 12	The stakeholder suggests realigning the requirements for the RoCoF profile with the one defined in RfG 2.0 for power park modules, with respectively 4 Hz/s during 0.25s then 2 Hz/s during 0.5s, 1,5 Hz/s during 1s, 1,25 Hz during 2s. Further, the stakeholder proposes that the new requirement regarding the 52 Hz-52,5 Hz frequency range should be erased. They argue that it is not justified and was initially only created to take into account the new RoCoF profile in the overfrequency range. They also argue that no real analysis was performed about it. Requirements should be set after a robust justification of system needs, be subject to cost-benefit analysis (as they can imply huge costs for generators and deter investment) and following assessment of alternative network solutions. Finally, the stakeholder proposes to replace with: $\pm 4,0$ Hz/s over a period of 0,25 s, $\pm 2,0$ Hz/s over a period of 0,5 s, $\pm 1,5$ Hz/s over a period of 1 s, and $\pm 1,25$ Hz/s over a period of 2 s.	Disagree	ACER's amendment proposal on NC HVDC for the rate-of-change-of-frequency (RoCoF) capability and frequency ranges requirements is in line with the proposal by the Grid Connection European Stakeholder Committee (GC ESC) Expert Group on Connection Requirements for Offshore Systems (EG CROS). Moreover, members of the Expert Group included system operators and industry stakeholders including HVDC systems' manufacturers. Furthermore, the requirements for RoCoF in the current NC HVDC for HVDC systems is to be able to stably operate at a rate between $- 2,5$ and $+ 2,5$ Hz/s over a period of 1s, which is more onerous than the RoCoF requirements for PPMs in the current NC RfG, where Member States are using values up to 2Hz/s. The RoCoF and frequency ranges requirements for HVDC systems should be wider than the requirements for PPMs, as proposed in the NC RfG 2.0, so that the HVDC system should not trip before the connected A-PPMs trip so that the network is not jeopardised.	
EirGrid plc	Article 12	The stakeholder considers that the proposed RoCoF withstand capacity requirements are extremely high and are significantly more arduous than the existing RoCoF requirements. The stakeholder continues by saying that to the best of their knowledge, existing HVDC technology would not be capable of meeting these requirements. Of particular concern is the " ± 5.0 Hz over 0.25s" which raises significant concerns regarding the feasibility with current HVDC technology. These thresholds are notably more demanding than existing standards, and meeting them could be extremely challenging, if not impossible, with the technology available today. This raises questions about the justification for such high requirements and whether they align with practical capabilities in the field requirement. The stakeholder finally proposes that it would be good for ACER to publish further information on what is driving the need for such requirements. Also refers to the fact that Ireland requirement is currently 1 Hz per 500 msec.			
National Grid Electricity System Operator - Great Britain	Article 12	The stakeholder states that in Article 12 a new section has been added on rate of change of frequency withstand capability. For HVDC Systems these are as follows: - ± 5.0 Hz/s over a period of 0.25 s • ± 2.5 Hz/s over a period of 0.5 s • ± 1.25 Hz/s over a period of 2 s These are quite onerous and more so than RfG 2.0 and DCC 2.0. The stakeholder observes that the rate of change of frequency settings are different between Synchronous Power Generating Modules, Power Park Modules and HVDC Systems. The stakeholder is interested in the rationale for this, because Plant connected behind an HVDC System has a different RoCoF rate than that in RfG. The stakeholder also observes the different RoCoF Settings for different plant types, which means that as soon as one class of technology trips it is then likely to lead to cascade tripping, though it is true to say that certain plant types (e.g. synchronous) will struggle to meet the RoCoF levels proposed for Power Park Modules and HVDC Systems. The stakeholder also notes that in GB they have rate of change of frequency relays fitted to detect loss of mains but they understand the requirements of Article 12 are a plant withstand requirement not a protection setting requirement.			

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
ENTSO-E	Article 13	The stakeholder proposes to include requirement for freeze frequencies for LFSM-O/U. There is a need on EU level to have a regulated approach on how LFSM would work in case that HVDC systems connecting two synchronous areas are both instantaneously saturated given that both sides reach max values of DP. No legal text proposal has been provided.	Partly agree	Article 13(3) already provides that 'If specified by a relevant TSO, in coordination with adjacent TSOs, the control functions of an HVDC system shall be capable of taking automatic remedial actions including, but not limited to, stopping the ramping and blocking FSM, LFSM-O, LFSM-U and frequency control'. Therefore, the coordination of adjacent TSOs is included in the provision along with a non-exhaustive list of automatic remedial actions. Further specifications may be provided nationally.
EU DSO ENTITY	Article 13	The stakeholder states that if a HV DC system is connected to a DSO's network, then that DSO should probably be determining the management of the transmitted active power, with appropriate co-ordination with the relevant TSO.	Agree	ACER agrees with stakeholder's remark. Relevant amendments have been introduced to the legal text.
Energinet	Article 13	The stakeholder proposes to check the wording of 'no adjustment' in Article 13(2). The stakeholder considers that when reading this, it is understood that in case of EPC, FSM etc, the current grid code states NOT to change the ramp rate, while this should exactly be done.	Disagree	Article 13(2), second sentence, refers to no adjustment of ramping rate in case of modification of active power according to points (b) and (c) of paragraph 1. Point (b) refers to modification of active power in case of disturbances and point (c) refers to fast active power reversal. Therefore, it would not be appropriate, during the modification of the active power according to points (b) and (c), the ramping rate be adjusted.
WindEurope	Article 13	The stakeholder states that the requirement of paragraph (1)(a) is not relevant for a radial offshore connection as the active power transmitted is related to the power generated offshore. It is proposed to add the phrase ' <i>dependent on active power availability</i> '.	Disagree	Article 13(1) provides connection requirements regarding the capability of controlling active power. The 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. Operational issues are out of scope of the connection network codes.
ENTSO-E	Article 14	The stakeholder proposes that the use of the term synthetic inertia is done according to the NC RfG 2.0. Indeed, in NC RfG 2.0, synthetic inertia is specified also for grid forming. The stakeholder suggests replacing the term inertial response with synthetic inertia to align it with NC RfG 2.0.	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.
National Grid Electricity System Operator - Great Britain	Article 14	According to the stakeholder, Article 14 – Grid Forming HVDC System only – In general, the technical requirements look pretty similar to RfG 2.0 and further they note that Grid Forming is not mandated on HVDC Systems or plant connected to HVDC Systems above unless specified by the TSO. This is different to RfG 2.0 where it is mandated on all plant of 10MW or above and connected via a feeder or subsidiary feeder of 110kV or above. There is also a requirement for an inertial response to be provided without delay. In this case the contribution to inertia shall be specified in accordance with paragraphs (1)(b)(iv) (the TSO specifies the relevant dynamic performance of the HVDC System) and (1)(c)(iv) (the TSO in agreement with the HVDC System Owner shall specify the relevant dynamic performance of the HVDC System and its associated performance parameters). " <i>The inertia shall be provided with a damped system response 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</i> ". The stakeholder is concerned with this clause. HVDC Links are very fast acting and have the capability to use the remote end System (e.g. Synchronous Area) as the equivalent of an infinite battery. This means that any phase change on one side results in an instantaneous supply of MW from the other, which does present some significant system risks. Potential alternatives to this include the energy storage for inertia being provided by either storage installed within the link itself or by a bespoke third party. According to the stakeholder, the problem is that with multiple Interconnectors, there is a risk that a blackout in one synchronous area could take the remote synchronous area with it as a direct result of this requirement.	Partly agree	Requirements for synthetic inertia response provided in Article 14 for HVDC systems are linked to the requirements for grid forming capabilities for A-PPMs and A-ESMs as provided in Article 40b. Furthermore, as per Article 14(4), coordination with adjacent system users is important for the isolated AC network's design and its operational limits.
Energinet	Article 14	The stakeholder proposes to consider changing the term 'naturally' in Article 14(1)(b)(i) to another term, such as 'dictated by'.	Disagree	The phrase ' <i>flow naturally</i> ' has been used in ACER recommendation (03-2023) on proposed amendments to NC RfG, in Article Y(7). ACER does not consider that is necessary to use another term.
Energinet	Article 14	The stakeholder proposes to consider changing the phrase 'the relevant TSO shall specify' in Article 14(1)(b)(iii) to 'the relevant TSO may specify'. At the current stage, grid forming requirements and functionality are novel and unexplored space for most TSOs'. Therefore, it should be made open with "may" for the relevant TSO to define current curves or other high-level ways of doing it.	Disagree	If grid forming capability of an HVDC system is specified by the relevant system operator, it is important that all relevant specifications should be prescribed.

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
EirGrid plc	Article 14	<p>The stakeholder states that grid forming requirements are non-mandatory and non-exhaustive so can be met. While the stakeholder does not expect the Celtic Interconnector to be bound by this version of the HVDC code (this will be dependent on the publication date), the Celtic Interconnector would be able to meet these requirements. The stakeholder also notes how important it is for ACER to consider the need for systems like the Celtic interconnector, which can switch between Grid Following and grid forming, to operate effectively under these operating modes. As grid forming is a brand-new requirement, the stakeholder wonders if further information will be made available. Previously Implementation Guideline Documents were issued to provide any necessary clarity for HVDC V1.0.</p>	Agree	<p>As stated by the stakeholder, the necessary national flexibility, regarding the grid forming requirements, is provided via non-mandatory and non-exhaustive provisions.</p> <p>Furthermore, according to Article 75 NC HVDC, no later than six months after the entry into force of this Regulation, the ENTSO for Electricity shall prepare and thereafter every two years provide non-binding written guidance to its members and other system operators concerning the elements of this Regulation requiring national decisions. Therefore, it is expected that new or updated IGDs will be prepared and made publicly available.</p>
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 14	<p>As regards paragraph 1(a), the stakeholders state that, the term adjustable, could lead to misunderstanding or it could be understood as an adjustment by the operator. E.g. the internal impedance cannot be adjusted during operation, due to its impact on current limiting and stability. Changing voltage amplitude, voltage phase angle, frequency, and internal impedance are subject to the design of the converter and its controls as well as protection. A vendor will design its system according to the functional requirements specified.</p> <p>As regards paragraph 1(b)(i), the stakeholders argue that, with focus on a designated/prioritized contribution to amplitude and phase of the voltage regarding the internal virtual impedance of the GFM-control, the reaction happens "inherently".</p> <p>As regards paragraph 1(b)(iv), the stakeholders argue that the provision of grid forming functionalities depends on capabilities of the converter and the primary energy source behind the converter, if any. E.g., The maximum amount of inertia depends on the system design (converter and energy source) and the value selected would have an impact on the controller stability. Therefore, the value of synthetic inertia should be selectable by the system operator in a defined range only. Such range needs to be agreed between HVDC system owner and relevant system operator.</p>	Partly agree	<p>As regards Article 14(1)(a), ACER agrees with the proposed amendment, however, the protection response is not needed to be included as it is covered since the capability is within the HVDC system voltage, current and energy limits. Relevant amendments have been introduced to the legal text.</p> <p>As regards Article 14(1)(b)(i), in line with the ACER recommendation (03-2023) on amendments to NC RfG and the proposal by the EG CROS, ACER considers that the appropriate term is '<i>naturally</i>'.</p> <p>As regards Article 14(1)(b)(iv), ACER agrees with the proposed amendment. Relevant amendments have been introduced to the legal text.</p>
WindEurope	Article 14	<p>As regards paragraph (1)(a) the stakeholder proposes to add text as it depends on the disturbance, e.g. solid fault. In such events current needs to be limited quickly and grid forming behaviour will be lost if a voltage source is emulated.</p> <p>As regards paragraph (1)(b)(i) the stakeholder suggests reformulating 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 an 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.</p> <p>As regards paragraph (1)(b)(ii) the stakeholder states that generally, TSO needs to respect the HVDC system owner's contractual timelines. It is proposed that any additional specifications needed shall 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.</p> <p>As regards paragraph (1)(c)(iii) the stakeholder states that bumpless is more or less impossible to achieve for a large disturbance, e.g. a large phase jump at high SCR. Hence, reformulating the sentence.</p> <p>As regards paragraph (2) the stakeholder makes the same argument as for 1.c regarding the word bumpless. Also includes that synchronization conditions must be agreed between the HVDC system owner and the relevant TSOs.</p> <p>As regards paragraph (5) the stakeholder states that 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.</p>	Partly agree	<p>As regards Article 14(1)(a), ACER considers that this is already covered in the beginning of the paragraph as it is stated that the capability is within the HVDC system voltage, current and energy limits.</p> <p>As regards Article 14(1)(b)(i), ACER considers that the wording proposal by the EG CROS and included in the ACER proposed amendments to NC HVDC is more appropriate.</p> <p>The timeline and procedure for the requirements of general application, or the methodology used to calculate or establish them is provided in Article 5.</p> <p>ACER agrees to delete the word 'bumpless' in paragraphs (1)(c)(iii) and 2. Relevant amendments have been introduced in the legal text. The provision in Article 14(2) refers to the transition towards and from island mode without interruption and in a continuous manner. Therefore, the synchronisation conditions are not necessary.</p> <p>As regards Article 14(5), ACER agrees that for this capability 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 (see also ENTSO-E amendment proposal to move Article 14(5) into a new article). Relevant amendments have been introduced to the legal text.</p>

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 14(5) and Article 15	The stakeholders consider that the requirements for cases where grid forming behaviour is not required should be stated in Article 15. The stakeholders propose to move Article 14(5) to Article 15.	Partly agree	Paragraph (5) of Article 14 has been moved into a new Article 14b on fast frequency control capability, based on ENTSO-E proposal. Relevant amendments have been introduced to the legal text.
CENELEC TC 8X/WG 06, VDE FNN	Article 16	The stakeholder proposes to add to following text in paragraph 1: <i>'This control mode shall be coordinated between the relevant TSOs with the HVDC system owner, the owners of the A-PPM, A-PtG-DU, A-ESM and/or A-DF, and the isolated-AC-network operators, if any.'</i> The stakeholder argues that this function requires a proper coordination between the HVDC system and all A-PPMs. There can be more than one relevant TSO.	Partly agree	According to Article 16(2) <i>'The relevant TSO shall specify the operating principle, the associated performance parameters and the activation criteria of the frequency control referred to in paragraph 1'</i> . Furthermore, according to Article 5(3) <i>'When applying this Regulation, ...system operators shall, (a) apply the principles of proportionality and non-discrimination, (b) ensure transparency, (c) apply the principle of optimisation between the highest overall efficiency and lowest total costs for all parties involved.'</i> Therefore, ACER does not consider that there is a need to amend the specific provision.
WindEurope	Article 16	The stakeholder proposes to keep "system frequencies", when the connection points are located in different synchronous areas. Related to offshore connections, the stakeholder proposes that the change in active power needs to be mirrored to offshore.	Partly agree	ACER agrees to keep the phrase "system frequencies". Relevant amendments have been introduced to the legal text. Article 16(1) refers to the capability that an HVDC system should be able to modulate the active power output of the HVDC converter stations depending on the frequencies at all connection points of the HVDC system. Operational issues are out of scope of the connection network codes and should be addressed in the connection agreement.
CurrENT Europe	Article 17	The stakeholder proposes that the requirement in paragraph 1 must not be 'its loss', but 'the resulting loss' and should be limited to not an HVDC system but where multiple connections are made can be higher.	Disagree	Article 17(1) refers to the maximum loss of active power that should be allowed by an HVDC system. ACER does not consider that there is a need to amend the existing provision.
WindEurope	Article 17	The stakeholder proposes to 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. The stakeholder states that for maximizing the value of the HVDC System for the network, a TSO may want to specify multiple values. The stakeholder proposes that 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)	Partly agree	ACER agrees with stakeholder's proposal to include loss of active power when the HVDC system is withdrawing active power from a synchronous area. The relevant amendment has been introduced to the legal text. There is a single value for the loss of active power that the relevant TSOs specify for their respective load frequency control area. How the value is specified by the relevant TSOs is an operational issue and out of scope of the connection network codes.

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 18	<p>-The stakeholders argue that if the HVDC system is requested to operate at maximum current within the ranges of the network voltage, this would mean that the HVDC system power exchange would vary accordingly, resulting in overload operation at increased AC voltages. Thus, the operational definition based on power is preferred. The stakeholder proposes to replace actual wording based on currents by power.</p> <p>- The stakeholders propose that compatibility of Annex III, Table 4 and Table 5 with insulation levels and Um as defined IEC 60071-1 should be established.</p> <p>The AC system voltage at the HVDC connection point is controlled by the HVDC system which allows limiting steady state and temporary voltage excursions (transient voltage excursions are not addressed here).</p> <p>The stakeholders suggest that over dimensioning by choosing equipment from the next higher set of standard insulation levels as defined in IEC 60071-1 shall be avoided by following approach:</p> <ul style="list-style-type: none"> i) Considering the inherent HVDC system voltage control capability, the TSO or relevant system operator is asked to define at the HVDC connection point a voltage in terms of voltage amplitude and duration which is compatible with IEC 60071-1 insulation levels. ii) Furthermore, it is considered that AC substation equipment is selected according to the closest IEC 60071-1 insulation levels and it is fit for purpose. This accordingly shall apply for HVDC AC feeder equipment. The remaining HVDC equipment will comply with the specified voltage band under i). iii) Article 18(2) foresees the possibility to agree on wider voltage ranges anyway, if economically and technically feasible. The phrase "established technical standards" is proposed to comply with typical wording for network code regulations. 	Partly agree	<p>Article 18(1) refers to the capability of an HVDC converter station to operate at HVDC system maximum current, within the ranges of the network voltage at the connection point. Whether the HVDC system will be requested to provide maximum current is an operational issue and out of scope of the grid connection network codes and should be addressed in the connection agreement.</p> <p>Article 5(3)(f) already includes the principle that when applying this Regulation, Member States, competent entities and system operators shall take into consideration agreed European standards.</p>
Energinet	Article 18	The stakeholder wonders whether in Article 18(1) the establishment of 1 p.u seems unnecessary to coordinate with adjacent TSOs when 1 p.u. is defined in Annex for all voltage levels.	Disagree	According to Article 18(1) 'The establishment of the reference 1 pu voltage shall be subject to coordination between the adjacent relevant system operators.'. The flexibility to define different reference 1 pu value by each system operator is also included in NC RfG. Therefore, it is important to retain this flexibility to account for national specificities.
ENTSO-E	Article 19	The stakeholder proposes to either delete the word "converter" or change back to "fast fault current" in the (c). In (b) is also used "fast fault current so maintaining consistency would be good for reader.	Agree	ACER agrees to delete the word 'converter'. Relevant amendments have been introduced to the legal text.
Energinet	Article 19	The stakeholder considers the change in Article 19(1) a good one, but inherent reactive power capability could be mentioned under grid-forming Article 14 which would cover the need for this, and there could be made a reference to a paragraph mentioning inherent reactive power response from grid-forming.	Disagree	The requirement of Article 19(1) refers to the provision of the fast fault current if the grid forming capability is not requested, therefore it cannot be included in Article 14 which refers to grid forming.
WindEurope	Article 19	The stakeholder proposes to clarify that the capability to provide fast fault current at a connection point in case of symmetrical (3-phase) faults shall be within HVDC converter design rating.	Disagree	According to Article 34(2) of the HVDC NC, 'Electrical protection of the HVDC system shall take precedence over operational controls taking into account system security, health and safety of staff and the public and mitigation of the damage to the HVDC system'. Therefore, the electrical protection will ensure that damage to the HVDC system is mitigated.
ENTSO-E	Article 22	The stakeholder states that the interpretation of this Article is not same for all TSOs. Some TSOs interpret that HVDC system shall have the three options as mandatory and other only one or two of them. Therefore, given that the power factor control is not commonly used, they recommend adding the word if applicable.	Disagree	Article 22(1) clearly provides that the relevant system operator in coordination with the relevant TSO shall specify one or more of the three control modes that the HVDC converter station shall be capable of operating in. ('...be capable of operating in one or more of the three following control modes...'). Therefore, the relevant system operator, in coordination with the relevant TSO, can specify how many (minimum one and maximum three) and which of the control modes apply. ACER considers that an amendment in paragraph (1) is not necessary.

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06	Article 22	According to the stakeholders in paragraph 2, this function requires coordination with the HVDC system owner as well, since additional control modes can have significant impact on the HVDC system design.	Agree	ACER agrees with stakeholder's remark. Relevant amendments have been introduced to the legal text.
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 22	According to the stakeholders, the selected reactive power control mode needs to be coordinated with the grid forming mode, as specified in Article 14, in a way that the initial system response is not inhibited.	Agree	ACER agrees with stakeholder's amendment proposal. Relevant amendments have been introduced to the legal text.
Energinet	Article 22	The stakeholder proposes that the requirement of Article 22(3)(d) could be changed to 'If specified by the relevant TSO'. If requested (specified) in the last sentence should still apply.	Disagree	According to Article 22(1), the relevant system operator in coordination with the relevant TSO shall specify one or more of the three control modes that the HVDC converter station shall be capable of operating in. Therefore, the provisions of paragraph (3) apply, if the relevant system operator in coordination with the relevant TSO has specified in accordance with paragraph (1) that the HVDC converter station needs to be capable of operating in the voltage control mode.
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 23	The stakeholders argue that prioritization of active or reactive power contradicts the initial behaviour of grid forming mode (as long as current, voltage or energy limits are not reached).	Disagree	According to Article 35, the grid forming capability within the prescribed operating frequency and voltage limits, if applicable, has a higher priority than other control modes with regard the protection and control. Furthermore, Article 14 states that ' <i>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.</i> '. ACER does not consider that there is a need to amend the legal text.
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06	Article 25(6)	As regards paragraph 6, the stakeholders argue that the specification of fault-ride-through capabilities in case of asymmetrical faults by individual TSOs could potentially lead to customized solutions. The details should be agreed between TSO and HVDC owner.	Disagree	In line with the ACER recommendation (03-2023) on amendments to NC RfG, fault-ride-through capabilities in case of asymmetrical faults shall be specified by the relevant TSO, so that conditions at their local networks can be taken into account.
ENTSO-E	Article 25	The stakeholder proposes to check cross references. They state that there is a need to add NC RfG 2.0 reference. The stakeholder proposes that since the Article 25 applies also to Remote End HVDC station via Article 46, the connection point shall be removed from here, given that for Article 46 refers to the interface point. The stakeholder highlights that in the same way as in NC RfG 2.0. future system needs demand for overvoltage ride through capability of the HVDC system. Therefore, they propose to add a non-exhaustive requirement to be specified by the relevant TSO.	Agree	ACER agrees to introduce a non-exhaustive overvoltage-ride-through requirement for HVDC systems, similar to the high voltage-ride-through profile specified for power park modules according to NC RfG 2.0.
WindEurope	Article 25(4)	The stakeholder states that 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. It is proposed that blocking of the HVDC system should not lead to violating the voltage against time profiles as defined in accordance with NC RfG 2.0 Articles 13 to 22, except Articles 13a and 14a.	Partly agree	According to Article 25(1) ' <i>The relevant TSO shall specify, while respecting Article 18, a voltage-against-time profile as set out in Annex V and having regard to the voltage-against-time-profile specified for power park modules according to Regulation (EU) 2016/631RfG 2.0.</i> '. Therefore, the provision to consider the voltage-against-time-profile specified for power park modules according to Regulation RfG 2.0 is included.
WindEurope	Article 27	The stakeholder proposes an 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".	Disagree	According to Article 34(2), ' <i>Electrical protection of the HVDC system shall take precedence over operational controls taking into account system security, health and safety of staff and the public and mitigation of the damage to the HVDC system</i> '. Therefore, the electrical protection will ensure that damage to the HVDC system is mitigated.
WindEurope	Article 28	The stakeholder proposes to add text that exception to not exceeding 5% of the synchronisation voltage shall be granted when synchronous condition of the connected AC network is beyond reasonable limits, as this level might be exceeded when sync. conditions are not reasonable and to ensure a cost-effective and optimized design.	Disagree	According to Article 18, the HVDC converter station is expected to be able to stay connected to the network and capable of operating at HVDC system maximum current, within the ranges of the network voltage at the connection point, expressed by the voltage at the connection point related to reference 1 pu voltage, and the time periods specified in Tables 4 and 5, Annex III.

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
WindEurope	Article 29	The stakeholder proposes that parties need to agree on schedule considering the process for connecting the new HVDC system. Text added to ensure that the studies are feasible.	Disagree	According to paragraph (1), the relevant TSO may specify the scope and extent of the required study. The relevant studies are required as part of the operational notification procedure for connection of new HVDC systems, pursuant to chapter 1 of NC HVDC as proposed to be amended by ACER, setting also relevant timelines for the procedure.
EDF	Article 29 (1), (2), (4), (5), (6) and (7)	<p>As regards Article 29(1), the stakeholder proposes that the study shall be mandatory and not optional as it is needed to demonstrate that no adverse interaction will occur.</p> <p>As regards Article 29(2), the stakeholder proposes that the TSO should be in charge to carry out the study to ensure its exhaustiveness and its impartiality, and therefore should not be carried out by the HVDC system owner. The TSO has the detail knowledge of the network in the area of the project and of the characteristics and constraints of the users in the vicinity. The stakeholder also considers that the risk that the TSO could be biased in a situation where the TSO is also the owner of the HVDC system is limited. In any case, it would be possible to request the designation of an independent technical expert: - by the NRA, - or by the TSO with the approval of the NRA, in accordance with a TSO process previously approved by the NRA.</p> <p>As regards Article 29(4) (5) (6), the stakeholder argues that as the TSO shall be responsible to carry out the study, there is no need for an assessment, a review or a replication.</p> <p>As regards Article 29(7), the stakeholder argues that as the HVDC system owner is responsible for the possible impacts of its project in the area of "electrical proximity", he should cover the costs associated to the study.</p>	Disagree	<p>ACER considers that it is important to keep the flexibility/discretion of the relevant TSO to specify whether a study is required, taking into consideration the local specificities of the network, such as the strength of the network where the equipment will be connected.</p> <p>The close involvement of the relevant TSO and the participation of relevant parties to the required studies according to Article 29 is important. This is ensured since:</p> <p>a) according to Article 29(2) the studies shall be carried out with the participation of all other relevant parties to each connection point, as identified by the TSOs,</p> <p>b) according to Article 29(2) Member States may provide that the responsibility for undertaking the studies in accordance with this Article lies with the TSO,</p> <p>c) according to Article 29(4) the relevant TSO shall assess the result of the studies based on their scope and extent as specified in accordance with paragraph 1,</p> <p>d) according to Article 29(5) the relevant TSO may review or replicate some or all of the studies, and also,</p> <p>e) according to Article 29(2) all parties shall be informed of the results of the studies.</p> <p>Therefore, based on the above, ACER does not consider there is a need to amend the specific article.</p>
Eurelectric, VGBE	Article 29	The stakeholders would like to insist on the TSO responsibility to perform the studies on possible unintended and unwanted interactions between a new HVDC line and a generator (which in some cases could lead to effects such as shaft cracks), and with costs to be borne by the HVDC developer. The possible conflict of interest if the developer is also the TSO (either alone or in a JV) is in stakeholder's view limited due to the regulatory control exerted by the NRA on the TSO in question.	Disagree	<p>The close involvement of the relevant TSO and the participation of relevant parties to the required studies according to Article 29 is important. This is ensured since:</p> <p>a) according to Article 29(2) the studies shall be carried out with the participation of all other relevant parties to each connection point, as identified by the TSOs,</p> <p>b) according to Article 29(2) Member States may provide that the responsibility for undertaking the studies in accordance with this Article lies with the TSO,</p> <p>c) according to Article 29(4) the relevant TSO shall assess the result of the studies based on their scope and extent as specified in accordance with paragraph 1,</p> <p>d) according to Article 29(5) the relevant TSO may review or replicate some or all of the studies, and also,</p> <p>e) according to Article 29(2) all parties shall be informed of the results of the studies.</p> <p>Therefore, based on the above, ACER does not consider there is a need to amend the specific article.</p>

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 29(5) and (6)	As regards Article 29(5), the stakeholders argue that it is uncertain, whether a HVDC system owner is allowed to distribute models from external sources. In such case, the system owner shall inform details about the external models being used during the interaction study and about the setup of such models in the full AC system representation. According to the stakeholders, "all relevant" is a duplication of the requirement, "relevant" suffice. As regards Article 29(6), the stakeholders argue that in case of detrimental interactions, it is possible, that a single plant cannot mitigate the resulting interaction alone. For the enhancement of system stability similar mitigating actions shall be taken by the other plants.	Disagree	Article 29(5) should be read in combination with paragraph (3) of the same Article, according to which, the relevant TSO shall collect all relevant data and models from all relevant parties and, where applicable, pass it on to the party responsible for the studies in accordance with Article 10, which refers to confidentiality obligations. Therefore, the relevant TSO already possesses data and models from other parties. ACER does not consider there is a need to amend the legal text. Article 29(6) should be read in combination with paragraph (1) of the same Article, according to which: 'if adverse interaction is identified, the studies shall identify possible mitigating actions to be implemented to ensure compliance with the requirements of this Regulation.'. Furthermore, Article 29 is under Title II on general requirements for HVDC systems and specifically chapter 4 on requirements for control. In addition, the identified possible mitigating actions to be implemented are to ensure compliance of the HVDC system with the requirements of the HVDC Regulation. ACER does not consider that there is a need to amend the legal text.
Eurelectric, VGBE, EDF	Article 31	The stakeholders insist on the TSO responsibility to perform the studies on possible unintended and unwanted interactions between a new HVDC line and a generator (which in some cases could lead to effects such as shaft cracks), and with costs to be borne by the HVDC developer. The possible conflict of interest if the developer is also the TSO (either alone or in a JV) is in stakeholder's view limited due to the regulatory control exerted by the NRA on the TSO in question.	Disagree	The close involvement of the relevant TSO and the participation of relevant parties to the required studies is important according to Article 31. This is ensured since: a) according to Article 31(3) all parties identified by the relevant TSO as relevant to each connection point, including the relevant TSO, shall contribute to the studies, b) according to Article 31(2) Member States may provide that the responsibility for undertaking the studies in accordance with this Article lies with the TSO, c) according to Article 31(4) the relevant TSO shall assess the result of the SSTI studies, d) according to Article 31(5) the relevant TSO may review or replicate the study, and also, e) according to Article 31(2) all parties shall be informed of the results of the studies. Therefore, based on the above, ACER does not consider there is a need to amend the specific Article.
ENTSO-E	Article 33	The stakeholder notes that the word 'multi-terminal' is used in Article 33(2). However, this is not properly defined in NC HVDC. In addition, any HVDC system with more than two HVDC stations (therefore multiterminal) is actually included in the definition of the HVDC system as defined in Article 2(1). Therefore, they propose to remove the part 'multiterminal' or 'embedded' since this is covered from Article 2(1) and Article 3. The way it is written today, is understood that if an HVDC system is not multiterminal or not embedded, then this requirement is not relevant which it shall not be the case.	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.
ENTSO-E	Article 33	Future grid development scenarios foresee that HVDC systems with more than two HVDC converter stations, known else as multi-terminal will be developed across Europe. Those systems would be used either for grid connection of GW scale offshore wind power generation or for embedded in one or different control zones. Therefore, DC side disturbances would need, if specified by the relevant TSO, to ensure either continues operation of healthy part of the HVDC system or at least continuously transition to STATCOM mode of the HVDC system. This would limit the impact on the AC voltage stability. The requirement is proposed as non-mandatory.	Agree	ACER agrees with stakeholder's proposal. However, the term 'stable operation' is more appropriate than 'continuously transition'. Relevant amendments have been introduced to the legal text.
ENTSO-E	Article 35	The stakeholder suggests that the references to the Articles should be checked. Article 14 has been changed compared to the EG CROS, hence need to be checked the links. Also, Article 14b is added according to ENTSO-E's proposal. The stakeholder believes there is a typo in the (d) from ACER proposal. This is covered in Article 35 (2)(e).	Agree	ACER has updated the references to Articles 14 and 14b. Article 35(2)(d) refers to active power control for emergency assistance, whereas Article 35(2)(e) refers to automatic remedial actions.
WindEurope	Article 35	The stakeholder states that Article 14(5) doesn't describe synthetic inertia but limiting the transient frequency deviation.	Agree	ACER has updated the references to Articles 14 and new Article 14b.

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
WindEurope	Article 36	The stakeholder proposes to include the relevant isolated AC network operator in these coordination processes.	Disagree	For the introduction of the term ' <i>isolated AC network operator</i> ' in the definition we refer to ACER's response to the proposed new definition by stakeholders (see Section 4 of this Evaluation Report).
National Grid Electricity System Operator - Great Britain	Article 37	As regards Article 37 – Black Start – the stakeholder notes that there is no change to the Black Start requirements between HVDC 1.0 and HVDC 2.0. Further, they note that any updates to the Emergency and Restoration Code should not include technical requirements as these will need to be included in the Connection Network Codes including HVDC 2.0 rather than the revised version of the Emergency and Restoration Code.	Partly agree	When the amendment of the Emergency and Restoration network code takes place, targeted amendments may be also made to other network codes (e.g. NC HVDC 2.0) for consistency purposes, as appropriate.
ENTSO-E	New Article 12 b	The stakeholder proposes the introduction of new Article 12b. As justification, the stakeholder states that the withstand capability of the HVDC system to AC voltage phase angle jumps is not included in the existing version of NC HVDC but it is considered a system need to limit the risks of trips of HVDC systems. Therefore, a new legal text proposal for the immunity of HVDC systems to voltage phase angle jumps is proposed for consideration: Article 12b Voltage phase angle jump withstand capability <i>'1. Without prejudice to Article 12, the relevant TSO may specify that the HVDC system shall be capable of remaining connected without disconnection during voltage phase angle jumps.</i> <i>2. If the capabilities set out in paragraph 1 are set, the relevant TSO shall specify the associated performance parameters and the maximum voltage phase angle jump referred to in paragraph 1'.</i>	Agree	ACER agrees with the proposed changes. However, the associated performance parameters and the maximum voltage phase angle jump should be agreed with the HVDC system owner. Relevant amendments have been introduced to the legal text.
ENTSO-E	NEW Article 14b	The stakeholder proposes the introduction of new Article 14b. As justification, the stakeholder proposes Article 52 to be checked, fast frequency control and Article 35. They propose that Article 14(5) would be a separate article, titled as fast frequency control. Moreover, ENTSO-E proposes the following changes to avoid restricting the ability to implement a Fast Frequency Control that accommodates the Nordic SA needs for damping of frequency oscillations. The proposed changes do not limit the capability initially intended applicable in CE SA, while also allowing Nordic SA to adapt the specification to their system needs. Overall it is a legal text proposal to make it fit for all synchronous areas: Article 14b Fast frequency Control Capability <i>'The relevant TSO may specify that an HVDC system shall be capable of performing fast frequency control to contribute to limiting the transient frequency deviation by adjusting its active power as a function of the measured 24 New article frequency, as specified by the relevant TSO. Fast frequency Control shall be available in both in low and/or high frequency regimes as specified by the relevant TSO. The following shall apply:</i> <i>(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. The Fast Frequency Control shall be provided with a damped system response 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;</i> <i>(b) this active power adjustment shall be performed based on the measured frequency, as specified by the relevant TSO. The measurement method shall be agreed between the relevant TSOs and the HVDC system owner;</i> <i>(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;</i> <i>(d) the requirements regarding measurement of frequency and/or rate-of-change-of-frequency as well as the dynamic performance parameters of rapidly adjusted active power injected to or withdrawn from AC grid shall be agreed between the relevant TSOs and the HVDC system owner.'</i>	Agree	ACER agrees to introduce a new Article with the proposed changes including paragraph 5 of Article 14. Relevant amendments have been introduced to the legal text.

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
ENTSO-E	NEW Article 30b	<p>The stakeholder proposes the introduction of new Article 30b. As justification for new article on HVDC system Passivity (Article 30b), the stakeholder states that future standard HVDC system design trends at the moment in Europe go up to 2GW HVDC system capacity per connection point. This will be including also the potential of meshing on the DC side ending up with more than 3GW of HVDC transmission capacity embedded in a control area, connecting synchronous areas or being used for offshore wind connection of offshore isolated AC networks or energy hubs. Therefore, previously local harmonic stability and resonance stability issues of HVDC systems will in future become a cross-border issue, therefore an EU level regulation is needed. This new article shall aim to ensure that HVDC systems connected across various counties will not put into risk the security of supply of the CE SA while ensuring that evolved parties take the necessary mitigation measures beforehand in the project design and project specification phase following EU wide connection requirement on it. This new article would set the framework in EU level and leaves open for further detail specification either on national or on project specific level. Due to limited time and pending discussions, ENTSO-E has submitted to ACER relevant legal text proposal after the public consultation.</p>	Agree	<p>Following the submission of the legal text proposal by ENTSO-E, ACER has consulted relevant stakeholders to gather feedback on the proposal. Within the framework of the relevant EU legislation, ACER proposes a new Article on the basis of the common proposal for the legal text as agreed between ENTSO-E and the relevant stakeholders.</p>

7. 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 (ARTICLES 38-50)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
RWE, WindEurope	Article 38	<p>The stakeholders state that 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. According to the stakeholders, 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 NC 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 for grid stability without grid forming WTGs are installed (synchronous condenser, energy storage, existing conventional power plants...). A market procurement of ancillary services is the most cost-efficient option from an energy economic perspective. With this, the best and cheapest technologies which are capable to provide these services will be found. According to the stakeholder a mandatory option is not efficient.</p> <p>The stakeholders further argue that 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 at minimum delay the ramp up of installed capacity for years.</p>	Disagree	Article 38 of NC HVDC as proposed to be amended by ACER refers to relevant articles of the NC RfG 2.0, applicable to offshore power park modules, as reflected in ACER Recommendation 03-2023 . For the specific topic of grid forming regarding NC RfG 2.0., we refer to our public consultation Evaluation report . The process for further amendments to the grid connection network codes NC RfG and NC DC and their subsequent adoption is with the European Commission.	
ENTSO-E	Article 38	<p>The stakeholder notes a type error related to power-to-gas demand units; asynchronously connected should be added.</p> <p>The stakeholder also states that the overvoltage ride through requirements need to be specified in NC HVDC separately.</p>	Partly agree	<p>The phrase '<i>The requirements applicable to power-to-gas demand units,...</i>' refers to NC DC 2.0, where the notion of asynchronously connected power-to-gas demand unit is not used. Therefore, ACER does not agree to include the phrase '<i>asynchronously connected</i>'.</p> <p>ACER agrees to include overvoltage ride-through requirements for A-PTG-DUs in a separate article. Relevant amendments have been introduced to the legal text.</p>	
ENTSO-E	Article 39	<p>The stakeholder proposes to check the use of Abbreviations as it would help readability. There is everywhere repetition of same text that with an Abbreviation would be more readable. The stakeholder notes type errors related to power-to-gas demand units and to power-to-gas demand units owners; asynchronously connected should be added.</p> <p>As regards paragraph (8)(c), the stakeholder proposes the inclusion of the Nordic threshold of 49.5 Hz for LFSM-UC activation.</p> <p>As regards paragraph (8)(e), the stakeholder states that for isolated AC networks, there are risks if the limit is a lot higher than 20% or intentionally kept high. This could lead to a high load disconnection and may exceed the ability of the remote End HVDC station to absorb this imbalance. Therefore, they propose some additions in the requirement applicable for PtG DU connected to isolated AC network.</p>	Agree	ACER agrees with stakeholder's proposal. Abbreviations have been used throughout the legal text to improve readability.	
National Grid Electricity System Operator - Great Britain	Article 39(1)(b), (3)	As regards Article 39(3) remote end plant is required to withstand a rate of change of frequency of +/- 2Hz /s as an average of the rate of change of frequency for the previous 1 second – This is different to the proposed wording for RfG 2.0, and the stakeholder considers that it could be a mistake.	Disagree	The requirement refers to the equipment connected to the isolated AC network which have different RoCoF requirements due to the isolated nature of the connection. Therefore, the RoCoF requirement already included in the current NC HVDC is still appropriate.	

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 39(1)	As regards Article 39(1), the stakeholders argue that the specified time of 0,1 second can be interpreted to include the processing time at the A-PPM, A-PTG-U, AESM and remote-end HVDC converter stations as well as the signal transmission from the sending point. The text allows different interpretations, whether or not the signal transmission time is part of the 0,1 seconds. The transmission time should not be part of the 0,1 seconds, because it is not under control of the asynchronously connected system. Requirements for remote end converter stations are addressed in Article 47(2).	Partly agree	According to Article 39(1) the A-PPM, A-PtG-DU, A-ESM shall be capable of receiving a fast signal from a connection point in the synchronous area to which frequency response is being provided and be able to process this signal no later than 0,1 seconds from sending to completion of processing the signal for activation of the response. Therefore, the signal transmission time along with the processing time is included in the specified time of 0,1 seconds. According to Article 47(2) the technical modalities of the fast signal communication in accordance with Article 39(1) shall be agreed with the owners. ACER agrees to delete the remote-end converter stations from Article 39(1) as the requirements for those are addressed in Article 47(2). Relevant amendments have been introduced to the legal text.
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06	Article 39(3)	As regards Article 39(3), the stakeholders argue that the wording " <i>at any point in time as an average of the rate of change of frequency for the previous 1 second</i> " is not in line with the requirements as described in Article 12. The requirements should be phrased identically. They propose to use " <i>measured over a period of 1 second</i> " instead.	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.
WindEurope	Article 39(1), (3) and (8)(f)	As regards paragraph (1)(a), the stakeholder states that 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. As regards paragraph (1)(a) and (b) the stakeholder proposes to clarify (as a location like a connection point cannot provide any signal) and to make 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. As regards paragraph (1)(c), the stakeholder states that unilateral definition by the relevant TSO without aligning with owners and relevant isolated AC network operators is not regarded as appropriate. Safe and stable of the isolated AC network must be considered and ensured. As regards paragraph (3), the stakeholder states that 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). As regards paragraph (8)(f), the stakeholder states that there needs to be well coordinated for maintaining stability in the isolated AC network the asynchronously connected power-to-gas demand unit is connected to.	Disagree	According to Article 39(1) the A-PPM, A-PtG-DU, A-ESM shall be capable of receiving a fast signal from a connection point in the synchronous area to which frequency response is being provided and be able to process this signal no later than 0,1 seconds from sending to completion of processing the signal for activation of the response. Therefore, the signal transmission time along with the processing time is included in the specified time of 0,1 seconds. According to Article 47(2) the technical modalities of the fast signal communication in accordance with Article 39(1) shall be agreed with the owners. The rate-of-change-of-frequency requirements for HVDC systems in accordance with Article 12 refer to the connection point, whereas the rate-of-change-of-frequency requirements for A-PPMs, A-DFs, A-PtG-DUs and A-ESMs in Article 39(3) refer to the remote-end HVDC converter station isolated AC network. ACER does not consider necessary to amend the legal text. For the introduction of the term 'isolated AC network operator' in the definition we refer to ACER's response to the proposed new definition by stakeholders (see Section 4 of this Evaluation Report).
Energinet	Article 39(8)	The stakeholder proposes to delete the word "random" in Article 39(8)(f), as this makes the requirement confusing.	Disagree	The term 'random' refers to the time delay of up to 5 minutes and it is part of the requirement and therefore it is important to be retained.
ENTSO-E	Article 40	Editorial typos in the (1)(d) and in the (4)	Agree	Relevant amendments have been introduced to the legal text.

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 40	<p>-The stakeholders propose to establish compatibility of Annex VII, Table 9 and Table 10 with insulation levels and Um as defined IEC 60071-1. The AC system voltage at the HVDC interface point is controlled by the HVDC system which allows limiting steady state and temporary voltage excursions. This applies to an asynchronously connected power park module, an asynchronously connected power-to-gas demand unit, an asynchronously connected demand facility and an asynchronously connected electricity storage module DC-connected power park module as well.</p> <p>The stakeholders argue that over dimensioning by choosing equipment from the next higher set of standard insulation levels as defined in IEC 60071-1 shall be avoided by following approach:</p> <ul style="list-style-type: none"> i) Considering the inherent HVDC system voltage control capability, the TSO or relevant system operator is asked to define at the HVDC interface point a voltage in terms of voltage amplitude and duration which is compatible with IEC 60071-1 insulation levels. ii) Furthermore, it is considered that AC substation equipment is selected according to the closest IEC 60071-1 insulation levels and it is fit for purpose. This accordingly shall apply for HVDC AC feeder equipment. <p>The remaining HVDC equipment will comply with the specified voltage band under (i).</p> <ul style="list-style-type: none"> iii) Furthermore, Article 40(1)(b) foresees the possibility to agree on wider voltage ranges or longer times anyway, if economically and technically feasible. The phrase "The establishment of the reference 1 pu voltage" was added in consistency with Article 18(1). <p>As regards Article 40(2)(b), the stakeholders argue that if an asynchronous area gets connected to a synchronous zone via AC, the requirements of Article 39 apply without transmission of a frequency signal. The frequency will automatically be coupled with the frequency of the synchronous area.</p>	Partly agree	<p>As regards the use of standards, Article 5(3)(f) already includes the principle that when applying this Regulation, Member States, competent entities and system operators shall take into consideration agreed European standards.</p> <p>Article 40(2)(b)(i) refers to the future connection of an A-PPM and an A-ESM, as specified in the Ten-Year Network Development Plan (TYNDP) or a national plan to the synchronous area and refers to the required capabilities that the A-PPM and A-ESM should have at the time of initial connection or should demonstrate to have once connected to the synchronous area, where in such case NC RFG will apply. Therefore, Article 39 should apply in its entirety.</p>
WindEurope	Article 40	<p>The stakeholder proposes to replace for the entire Article "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.</p> <p>As regards paragraph (2)(b)(ii), the stakeholder wonders what are the asset terminals in this context. In stakeholder's view, with the new topology introduced in NC HVDC, this paragraph does not seem to be needed anymore and should be obsolete. 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.</p> <p>As regards paragraph (3), the stakeholder proposes that the phrase "as prescribed in Article 14" should be added for clarification. Additional language proposed for 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.</p>	Disagree	<p>According to Article 3(5), 'The connection requirements for A-PPMs, A-DFs, A-PtG-DUs, A-ESMs and remote-end HVDC converter stations provided for in Title III shall apply at the isolated interface point of such systems, except the requirements provided for in Article 39(1)(a) and Article 47(2), which apply at the connection point in the synchronous area to which frequency response is being provided.'. Therefore, ACER does not consider necessary to amend the legal text.</p> <p>As regards Article 40(2)(b)(ii), the asset terminals correspond to the main unit terminals of the A-PPM and A-ESM. This provision refers to supplementary reactive power to be provided to compensate the reactive power demand of the high-voltage line or cable between the high-voltage terminals of the step-up transformer of the A-PPM and A-ESM or the assets terminals. This provision is still valid to be included in NC HVDC. ACER does not consider appropriate to remove this provision.</p> <p>In regard to Article 40(3), according to Article 35, the grid forming capability within the prescribed operating frequency and voltage limits, if applicable, has a higher priority than other control modes with regard to protection and control. Furthermore, Article 14 states that '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.'. ACER does not consider necessary to amend the legal text.</p> <p>For the introduction of the term 'isolated AC network operator' in the definition, we refer to ACER's response to the proposed new definition by stakeholders (see Section 4 of this Evaluation Report).</p>
ENTSO-E	Article 40a	The stakeholder proposes editorial changes. Power system should be isolated network.	Agree	Relevant amendments have been introduced to the legal text.

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
National Grid Electricity System Operator - Great Britain	Article 40a	The stakeholder states that here are now new provisions for the fault ride through capability of power to gas units (e.g. Hydrogen Electrolysers) - This is very welcome and necessary from a System perspective though the stakeholder notes that hydrogen electrolysers may have a problem with fault ride through capability which is an issue the industry will need to address.	Partly agree	Requirements for fault-ride-through capability of power-to-gas demand units have already been included in ACER recommendation (03-2023) on proposed amendments to NC DC and in the <u>proposal</u> by the Grid Connection European Stakeholder Committee (GC ESC) Expert Group on Connection Requirements for Offshore Systems (EG CROS).
ENTSO-E	Article 40b	The stakeholder states that the reference should be 14.4 and not 14.5. They propose to make a direct connection to the Article 22 of NC RfG 2.0 and how synthetic inertia is specified by Type D PPM. According to the stakeholder, this text on inherent energy is part of Article Y (7) of NC RfG 2.0 and shall only be referred here. The stakeholder considers that keeping it, would mean that it should be defined in parallel to NC RfG 2.0 in the national implementation.	Agree	Relevant amendments have been introduced to the legal text.
WindEurope	Article 40b	The stakeholder states that 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.	Partly agree	ACER has amended Article 40b to refer to Article 22 of NC RfG 2.0 regarding the provision of synthetic inertia.
WindEurope	Article 40b	The stakeholder proposes an additional sentence for clarification and avoiding contradicting requirements that ' <i>If grid forming capability as set out in Article 14 (4) is requested, Article 40(3) is not applicable</i> '.	Disagree	The reference to Article 40(3) is not necessary as pursuant to Article 35 of NC HVDC, the grid forming capability within the prescribed operating frequency and voltage limits, if applicable, has a higher priority than other control modes with regard to protection and control. Furthermore, Article 14 states that ' <i>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</i> '. ACER does not consider necessary to amend the legal text as there is no contradiction.
ENTSO-E	Article 42	Editorial typo in paragraph (a).	Agree	Relevant amendments have been introduced to the legal text.
ENTSO-E	Article 45	The stakeholder considers that it is important to have in Article 45 the inclusion of A-PtG-DU.	Agree	Relevant amendments have been introduced to the legal text.
WindEurope	Article 46	The stakeholder proposes to clarify that connection related requirements in Articles 11 to 39 shall become applicable at the interface point of the remote-end HVDC converter station.	Partly agree	This is already stated in Article 3(5).
ENTSO-E	Article 47	The stakeholder states that it should be checked if legally this accounts for configurations with more than one HVDC systems connected to the isolated AC network. And if so, should the other HVDC stations also contribute to the inertial response or is this allowed but not mandatory. Also, they recommend checking Article 14(4), for wrong reference.	Agree	Relevant amendments have been introduced to the legal text.
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 47(2) and (5)	As regards Article 47(2), the stakeholders suggest that the present draft regulation should be clear as to how the frequency signal is provided to the A-PPMs, A-DF-U's, A-PtG-U's, A-ESMs. This signal could be provided in a cost-effective manner via the HVDC system with the frequency measured at the HVDC system's connection point. The signal transmission from the interface point to the A-PPMs, A-DF-U's, A-PtG-U's, A-ESMs should be in the responsibility of the relevant isolated AC network operator. There can be more than one remote-end HVDC converter stations, A-PPMs, A-DF-U's, A-PtG-U's, A-ESMs. Thus, the text should use the word 'owners' instead of 'owner'. The following sentence does not seem to be clear. It does not appear to be related to the technical modalities of the fast signal communication. According to the stakeholders the sentence should be deleted: " <i>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.</i> " As regards Article 47(5), the stakeholders argue that grid forming capability in this context is still under development. The modality of the coordination between the HVDC system and the asynchronously connected PPM should be coordinated by the relevant TSO with the HVDC system owner and the owner of the asynchronously connected PPM.	Disagree	For the introduction of the term 'isolated AC network operator' in the definition please refer to ACER's response to the proposed new definition by stakeholders (<i>see section 4 of this Evaluation Report</i>). Article 47(2) refers to the capability of the HVDC system, if requested, to provide the network frequency at the connection point as a signal to the remote-end HVDC converter station. Furthermore, the technical modalities of the fast signal communication in accordance with Article 39(1) shall be agreed between the remote-end HVDC converter station owner, the A-PPM owner(s), the A-DF owner(s), the A-PtG-DU owner(s) and the A-ESM owner(s).

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
WindEurope	Article 47	<p>As regards paragraph (1) the stakeholder states that what is relevant for design and operation of an isolated AC Network should be decided by the relevant isolated AC Network operator.</p> <p>As regards paragraph (2) the stakeholder states that the relevant isolated AC network operator needs to be added here. In addition, 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.</p> <p>As regards paragraph (3) the stakeholder proposes to clarify that frequency stability of the isolated AC network needs to be maintained.</p> <p>As regards paragraph (4) the stakeholder proposes to replace the '<i>relevant TSO</i>' with the '<i>relevant isolated AC network operator</i>' as frequency stability of the isolated AC network needs to be maintained.</p> <p>As regards paragraph (5) the stakeholder proposes to clarify that frequency stability of the isolated AC network needs to be maintained. That's why there is close coordination needed between the isolated AC network operator and the relevant TSO, especially if an isolated AC network is connected via different HVDC Systems to different synchronous areas.</p>	Disagree	<p>For the introduction of the term 'isolated AC network operator' in the definition please refer to ACER's response to the proposed new definition by stakeholders (<i>see section 4 of this Evaluation Report</i>).</p> <p>Article 47(2) refers to the capability of the HVDC system, if requested, to provide the network frequency at the connection point as a signal to the remote-end HVDC converter station. Furthermore, the technical modalities of the fast signal communication in accordance with Article 39(1) shall be agreed between the remote-end HVDC converter station owner, the A-PPM owner(s), the A-DF owner(s), the A-PtG-DU owner(s) and the A-ESM owner(s).</p>
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06	Article 48	<p>The stakeholders suggest establishing compatibility of Annex VIII, Table 12 and Table 13 with insulation levels and Um as defined IEC 60071-1. The AC system voltage at the HVDC interface point is controlled by the HVDC system which allows limiting steady state and temporary voltage excursions (transient voltage excursions are not addressed here).</p> <p>The stakeholders suggest that over dimensioning by choosing equipment from the next higher set of standard insulation levels as defined in IEC 60071-1 shall be avoided by following approach:</p> <ul style="list-style-type: none"> i) Considering the inherent HVDC system voltage control capability, the isolated AC network operator is asked to define at the HVDC interface point a voltage in terms of voltage amplitude and duration which is compatible with IEC 60071-1 insulation levels. ii) it is considered that AC substation equipment is selected according to the closest IEC 60071-1 insulation levels and it is fit for purpose. This accordingly shall apply for HVDC AC feeder equipment. The remaining HVDC equipment will comply with the specified voltage band under i). iii) Article 48(1)(b) foresees the possibility to agree on wider voltage ranges anyway, if economically and technically feasible. <p>The phrase "<i>established technical standards</i>" is proposed to comply with typical wording for network code regulations.</p>	Partly agree	<p>As regards the use of standards, Article 5(3)(f) already includes the principle that when applying this Regulation, Member States, competent entities and system operators shall take into consideration agreed European standards.</p>
WindEurope	Article 48	<p>The stakeholder proposes for simplification to follow the general principle that remote end HVDC stations get connected to an isolated AC network at an interface point.</p> <p>The stakeholder proposes for simplification to merge Table 12 and 13 into Table 12 of Annex VIII.</p> <p>The stakeholder states that as this Article deals the voltage ranges in isolated AC networks, the relevant isolated AC network operator should be in charge.</p>	Partly agree	<p>The clarity on whether the requirements apply at the connection point or at the isolated interface point is already provided in Article 48.</p> <p>ACER agrees to merge the Tables 12 and 13 of Annex VIII. Relevant amendments have been introduced to the legal text.</p> <p>For the introduction of the term 'isolated AC network operator' in the definition we refer to ACER's response to the proposed new definition by stakeholders (<i>see Section 4 of this Evaluation Report</i>).</p>
WindEurope	Article 49	<p>The stakeholder proposes that with regard to the network characteristics, the remote-end HVDC converter station owner shall also provide relevant data to the relevant isolated AC network operator.</p>	Disagree	<p>For the introduction of the term 'isolated AC network operator' in the definition we refer to ACER's response to the proposed new definition by stakeholders (<i>see Section 4 of this Evaluation Report</i>).</p>

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
EDF	Article 50	The stakeholder states that according to their understanding of this article, the topic of frequency harmonics is embedded, with coordination performed at the national level.	Agree	<p>The term 'power quality' is related to the degree of the distortion of the ideal sinusoidal waveform. This waveform distortion can be mathematically analysed to show that it is equivalent to superimposing additional frequency components onto a pure sine wave. These frequencies are harmonics (integer multiples) of the fundamental power system frequency (50Hz) which starts with the fundamental frequency, and can sometimes propagate outwards from nonlinear loads, causing problems elsewhere on the power system.</p> <p>According to Article 50 of NC HVDC, the HVDC System and any associated equipment thereof shall not introduce voltage distortion or fluctuation onto the supply system to which it is connected, beyond the value(s) allowed by the relevant TSO. It is the TSO's responsibility to ensure that the harmonic level is not infringed when power electronic devices are connected with consequences on the stability of users connected to system.</p> <p>As Article 50 is already included in NC HVDC as in force, for more information the stakeholder may refer to the ENTSO-E document 'Network Code for HVDC Connections and DC-connected Power Park Modules Frequently Asked Questions' of 30 April 2014 and specifically answer to FAQ 27.</p>
WindEurope	New Article 40c	The stakeholder proposes a new Article for referring to the voltage operation ranges defined in Table 9, Annex II instead of Tables in the NC 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.	Partly agree	According to ACER proposed amendment of Article 38 NC HVDC, ' <i>The requirements applicable to offshore power park modules under Articles 13 to 22, except Articles 13a and 14a, of RfG 2.0 shall apply to A-PPMs and A-ESMs...</i> '. For the fault-ride-through capability for PPMs the provisions are included in Article 16(3)(a) of ACER recommendation (03-2023) on amendment proposal to NC RfG which in turn refers to Article 14(2) of NC RfG 2.0 regarding the minimum voltage for Urec2. The minimum voltage in Article 14(2) corresponds to the minimum voltage provided in Annex VII NC HVDC as proposed to be amended by ACER, for A-PPMs and A-ESMs. Therefore, ACER does not consider that it is necessary to introduce a new article on fault-ride-through requirements for A-PPMs and A-ESMs.
ENTSO-E	NEW Article 40c	<p>The stakeholder proposes the introduction of new Article 14b. As justification, the stakeholder proposes an overvoltage ride through profile for A-PtG DU, as it is important that A-PtG-U have a clear requirement:</p> <p style="text-align: center;">Article 40c</p> <p><i>'Overvoltage ride through capability of power-to-gas demand units.</i></p> <p><i>The asynchronously connected power to gas demand unit shall be capable of operating stably without disconnecting from the network, if none of the phase -to -phase voltages exceeds the voltage-against-time-profile defined in Figure YV at the interface point. The relevant system operator, in coordination with the relevant TSO, may define longer times for operation, if it is required to preserve or to restore system security. The power to gas demand unit owner shall not unreasonably withhold consent to apply longer times for operation, taking account of their economic and technical feasibility.</i></p> <p><i>Figure YV The diagram represents the higher limit of a voltage-against-time profile of the voltage at the interface point, expressed as the ratio of its actual value and its reference 1 pu value, before, during and after a fault. Urecf is the maximum voltage as specified by the relevant TSO'.</i></p>	Agree	ACER agrees to include overvoltage ride-through requirements for A-PtG-DUs in a separate article. Relevant amendments have been introduced to the legal text.

8. TITLE IV - INFORMATION EXCHANGE AND COORDINATION (ARTICLES 51-54)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
ENTSO-E	Article 51	As regards paragraph (3), the stakeholder states that it should be checked on project level and it may not be applicable. By adding the term 'if applicable', derogations can be avoided. As a proposal, they have added 'if specified by the relevant TSO'. As regards paragraph (3)(b), the stakeholder states that that it should be checked on project level and it may not be applicable. By adding the term 'if applicable', derogations can be avoided.	Disagree	Article 51(2), (3) refers to the capability of the HVDC system to send to and receive from the relevant system operator operational and alarm signals. Also paragraph 1 requires that each HVDC converter unit of an HVDC system shall be equipped with an automatic controller capable of receiving instructions from the relevant system operator and from the relevant TSO. The use of this capability is an operational issue and out of scope of the connection codes and subject to connection agreement.	
Energinet	Article 51	As regards point (i) of paragraph 3(b) the stakeholder wonders what is the function of this blocking signal? What is being blocked here? Is it Emergency Stop command where the converter is tripped? Be careful of using "blocking" as this has different meanings in the HVDC world. As regards point (iii) of paragraph 3(b) the stakeholder considers that this signal should be an operational signal instead of an alarm.	Partly agree	According to Article 25(4) 'The relevant TSO may specify voltages (Ublock) at the connection points under specific network conditions whereby the HVDC system is allowed to block. 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.' ACER agrees that the active power flow direction should be an operational signal. Relevant amendments have been introduced to the legal text.	
WindEurope	Article 51	The stakeholder proposes to further specify that in paragraph (3), point (v) refers to changes of reactive power control mode and points (vi) and (vii) refer to ON/OFF signals.	Disagree	These signals do not necessarily refer to only on/off states. ACER does not consider there is a need to amend the legal text.	
ENTSO-E	Article 52	The stakeholder states that the term <i>fast frequency control</i> is not defined in the NC HVDC 1.0. Therefore, they propose to have Article 14b with name fast frequency control.	Agree	ACER agrees to refer to the new Article 14b on fast frequency control. Relevant amendments have been introduced to the legal text.	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 52	The stakeholders argue that grid forming capability is an internal control function and its modification shall only be done in coordination with the HVDC system owner. They further argue that all the defined functions require a suitable coordination and therefore modifications in the settings and the hierarchy can jeopardize the system stability and should be agreed between HVDC system owner and relevant TSO.	Disagree	According to Article 52 '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.'. Furthermore, it is stated that the capability to modify the parameters and settings should be provided, if necessary. It is obvious that if the relevant TSO requests modification of parameters and settings, the responsibility lies with the system operator. Therefore, ACER does not consider there is a need to introduce the proposed amendment.	
WindEurope	Article 52	The stakeholder argues that 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, relevant text is proposed. The stakeholder wonders what is the difference between points (a) and (b). Fast frequency control is 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;".	Partly agree	According to Article 52 '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.'. Furthermore, it is stated that the capability to modify the parameters and settings should be provided if necessary. It is obvious that if the relevant TSO requests modification of parameters and settings the responsibility lies with the system operator. Therefore, ACER does not consider that there is a need to introduce the proposed amendment. With regard to fast frequency control, a new Article 14b has been introduced on fast frequency control capability, based on ENTSO-E proposal.	

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
ENTSO-E	Article 54	<p>The stakeholder proposes an amendment in paragraph (2)(d) for clarity and avoidance of doubt.</p> <p>As regards paragraph (3)(c), stakeholder proposes to add DC network disturbance into the requirement 3(c). The reason is that future HVDC systems with more than two HVDC stations, hence multi-terminal would need to show by simulations response to DC network disturbance and how DC faults protection selectivity functions.</p> <p>As regards paragraph (3)(e), there is a need to cover all subsystems so that no components are lost. Also mind the plural at the end.</p> <p>As regards paragraph (3)(g), the stakeholder proposes to add the term <i>DC side</i>. This is important for the case of multi-terminal HVDC systems and for ensuring that the EMT model is capable to simulate DC faults as well as protection operation, for example DC protection relays and algorithms, ensuring proper encryption.</p> <p>As regards paragraph (4), the stakeholder proposes to add the term <i>DC side</i>. This is important for the case of multi-terminal HVDC systems and for ensuring that the EMT model is capable to simulate DC faults as well as protection operation, for example DC protection relays and algorithms, ensuring proper encryption.</p> <p>Stakeholder's proposal is to add new sentence in paragraph 5. The need of obtaining harmonic emissions data has been specified in Expert Group Interaction Studies and Simulation Models (EG ISSM) FINAL REPORT 01.10.2021, however only in the section regarding PPMs (page 34). It is commonly known that HVDC converter stations as Power Electronic Devices (PED) can distort the line voltage by injecting additional harmonic voltages /currents into the grid (see e.g. CIGRE TB 754 AC side harmonics and appropriate harmonic limits for VSC HVDC). Therefore, TSO should have the right to request from the HVDC system owner the model of harmonic component emissions (Norton currents or Thevenin voltages). The stakeholder proposes that this requirement applies also to A-PPM; A-ESM and ADF. Ideally, it should be written also in Article 15(4)(c) of the NC RfG 2.0 and referred by NC HVDC in Article 38.</p>	Partly agree	<p>ACER agrees to include the encrypted models in Article 54(2)(d). Relevant amendments have been introduced to the legal text.</p> <p>As regards Article 54(3)(c) ACER agrees to include DC network disturbances. Relevant amendments have been introduced to the legal text.</p> <p>As regards Article 54(3)(e) ACER agrees with the proposed amendment. Relevant amendments have been introduced to the legal text.</p> <p>As regards Articles 54(3)(g) and 54(4) ACER agrees to include the term '<i>DC side</i>'. Relevant amendments have been introduced to the legal text.</p> <p>As regards a new paragraph in Article 54 on obtaining harmonic emissions data, this is already covered in Article 24 on power quality. According to Article 24, '<i>An HVDC system owner shall ensure that its HVDC system connection to the network does not result in a level of distortion or fluctuation of the supply voltage on the network, at the connection point, exceeding the level specified by the relevant system operator in coordination with the relevant TSO. The process for necessary studies 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.</i>'. For A-PPMs, A-DFs and A-ESMs the relevant article is Article 44 on power quality. Therefore, ACER does not consider there is a need to include this proposed amendment.</p>
EU DSO ENTITY	Article 54	<p>The stakeholder notes that the rest of Article 54 makes provision for the RSO if the HVDC system is connected to a DSO, so the suggestions is just to align the text to allow for that possibility.</p>	Agree	<p>ACER agrees with stakeholder's proposal.</p> <p>Relevant amendments have been introduced to the legal text.</p>
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 54(2)(d), (3), (3)(d), (4)(a), (7)	<p>As regards 54(2)(d), the stakeholders state that encrypted models are typically more detailed and representative of a solution than open-source models. For example, generic models for grid forming are not yet fully developed. Therefore, encrypted models should be preferred and only in case that appropriate sharing agreements are not in place, generic models can be used.</p> <p>As regards Article 54(3), as according to the stakeholders it seems that the requirements are for HVDC models, they suggest that this should be specified.</p> <p>As regards Article 54(3)(d), the stakeholders argue that the word "<i>accurate</i>" is not clear and should be deleted. According to the stakeholders, the representation should allow to address module balancing dynamics and related protection. The representation detail and acceptable simplifications should be agreed between HVDC system owner and relevant TSO according to the scope of the studies where the model is used.</p> <p>As regards Article 54(4)(a), the stakeholders argue that the upper limit of the frequency range is limited by the classical representation of passive components in EMT-Tools, e.g. transformers and reactors. The character of the model may have to change in the frequency range above 2500 Hz. Therefore, details of the model in this frequency range shall be coordinated.</p> <p>As regards Article 54(7), the stakeholders consider that the model requirements for this purpose are already defined in Article 54(4).</p>	Partly agree	<p>ACER agrees to also include the encrypted models in Article 54(2)(d). Relevant amendments have been introduced to the legal text.</p> <p>As regards Article 54(3) ACER agrees with the amendment proposal to clarify that the requirements are for HVDC models. Relevant amendments have been introduced to the legal text.</p> <p>As regards Article 54(3)(d) ACER agrees to clarify that the representation should be appropriate for the study purpose. Relevant amendments have been introduced to the legal text.</p> <p>As regards Article 54(4)(a) ACER considers that extended frequency range should be agreed with the HVDC system owner. Relevant amendments have been introduced to the legal text.</p> <p>Article 54(7) refers to an equivalent model of the control system in connection with adverse control interactions that may result with HVDC converter stations and other connections in close electrical proximity and it is not confined to frequency dependent impedance model. ACER does not consider there is a need to amend the specific article.</p>

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
Energinet	Article 54(2)	The stakeholder proposes to change RMS to PDT, as Cigre have gone towards using PDT instead of RMS - as it says more about the simulation environment – it is proposed to follow the Cigre standard and use PDT.	Disagree	ACER amendment proposal to NC HVDC is in line with the ACER recommendation (03-2023) on amendment proposal to NCs RfG and DC and also in line with the proposal by the GC ESC Expert Group on Interaction Studies and Simulation Models for PGM/HVDC. Furthermore, other types of studies are not excluded by the network code on a national level.
WindEurope	Article 54(2) and (3)	<p>As regards paragraph (2), the stakeholder proposes 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.</p> <p>As regards paragraph (3) the stakeholder proposes to specify that the requirements are for HVDC models.</p>	Partly agree	<p>ACER amendment proposal to NC HVDC already follows the wording of ACER amendment proposal to NC RfG with regard to paragraph (2). Therefore, ACER does not consider there is a need to amend this article any further.</p> <p>ACER agrees with the amendment proposal to clarify that the requirements are for HVDC models. Relevant amendments have been introduced to the legal text.</p>

9. TITLE V - OPERATIONAL NOTIFICATION PROCEDURE FOR CONNECTION (ARTICLES 55-66)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
WindEurope	Article 62(3)(d)	As regards paragraph (3)(d), the stakeholder states that draft regulation is referring to Article 54, HVDC System modelling requirements, which is not well matching with A-PPM technology. Proposal for improvement and achieving higher clarity to refer to NC RfG 2.0.	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.	

10. TITLE VI – COMPLIANCE (ARTICLES 67-76)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
National Grid Electricity System Operator - Great Britain	Article 71	The stakeholder states that there are no specific tests for grid forming on HVDC Systems if specified by the TSO. The same comments were noted as part of the RfG 2.0 consultation. The stakeholder states that they understand there is a group in Europe looking at this issue, but it is worth noting as part of this consultation.	Partly agree	Relevant provisions for compliance simulations for HVDC systems for grid forming have been introduced in Article 73, based on an amendment proposal by ENTSO-E.	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Article 71(6)(a)	The stakeholders argue that the modalities to modulate active power by the HVDC system should be limited to the capabilities of the surrounding AC systems.	Partly agree	According to Article 69(5) of NC HVDC as proposed to be amended by ACER: <i>'Any foreseen test schedules and procedures to verify compliance of an HVDC system, HVDC converter station, A-PPM, A-DF, A-PtG-DU or A-ESM with the requirements of this Regulation shall be notified to the relevant system operator by the HVDC system owner, A-PPM owner, A-DF owner, A-PtG-DU owner or A-ESM owner in due time and prior to their launch and shall be approved by the relevant system operator.'</i> Furthermore, Article 70(6) of NC HVDC, as proposed to be amended by ACER, states that <i>'The relevant system operator shall not unreasonably withhold any operational notification in accordance with Title V, if compliance tests or simulations cannot be performed as agreed between the relevant system operator and the HVDC system owner, or A-PPM owner, A-DF owner, A-PtG-DU owner or A-ESM owner due to reasons which are in the sole control of the relevant system operator.'</i> Therefore, it is the responsibility of the relevant system operator to consider the capabilities of the AC transmission system. ACER does not consider that there is a need to include the proposed amendment.	
National Grid Electricity System Operator - Great Britain	Article 72	The stakeholder states that most of this section refers to compliance testing for asynchronous power park modules and asynchronous electricity storage modules, which then refers back to RfG 2.0. It should be noted that under RfG 2.0 there are no specific compliance tests for grid forming even though it is mandated in RfG 2.0. There is very little detail on compliance testing for asynchronously connected demand and the stakeholder questions whether that is the intention of the drafting. According to stakeholder's understanding there is a group in Europe looking at this issue, but it is worth noting as part of this consultation.	Partly agree	Relevant provisions for compliance simulations for A-PPMs and A-ESMs have been introduced in Article 74, based on an amendment proposal by ENTSO-E.	
ENTSO-E	Article 72	The stakeholder proposes the inclusion of a test for A-PtG DU, as it is in line with NC RfG 2.0 requirements.	Agree	ACER agrees with the stakeholder's proposal. Relevant amendment has been introduced to the legal text.	
ENTSO-E	Article 73	The stakeholder states that there is no grid forming simulation requirement for the PPMs, in RfG 2.0 on the compliance part. According to the stakeholder, this should be in the simulations section and it is an important article. The stakeholder also states that there is a need for compliance article for Article 14b (fast frequency control). Also there is a need for compliance article for Article 12. ENTSO-E believes that the current regulation is applicable to HVDC systems with more than two HVDC converter stations (multiterminal). Therefore, for future applicability ENTSO-E would need to require compliance by simulations from fast recovery after DC faults. The stakeholder states that there is a need for compliance article for Article 12b.	Agree	ACER agrees with the inclusion of compliance simulations provisions for HVDC systems regarding grid forming, fast frequency control, RoCoF, fast recovery from DC faults capabilities and voltage phase jump capabilities. Relevant amendments have been introduced to the legal text.	
National Grid Electricity System Operator - Great Britain	Article 73	The stakeholder states that if grid forming has been specified there are no specific simulation tests for simulating grid forming capability. The stakeholder states that they understand there is a group in Europe looking at this issue, but it is worth noting as part of this consultation.	Partly agree	Relevant provisions for compliance simulations have been introduced in Article 73 based on an amendment proposal by ENTSO-E.	

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
ENTSO-E	Article 74	<p>Apart from editorial changes proposals, the stakeholder proposes a legal text to ensure the simulation of the post fault active power recovery and FRT capability of the A-PtG-DU.</p> <p>ENTSO-E highlights that there is no requirement in NC HVDC on compliance. EG CROS did not touch neither discuss this. Therefore, they propose a legal text to simulate the capability to demonstrate compliance.</p>	Agree	<p>ACER agrees with stakeholder's proposal.</p> <p>Relevant amendments have been introduced to the legal text.</p>
National Grid Electricity System Operator - Great Britain	Article 74	<p>The stakeholder states that most of this section refers to compliance simulations for asynchronous power park modules and asynchronous electricity storage modules, which then refers back to RfG 2.0. It should be noted that under RfG 2.0 there are no specific compliance simulations for Grid Forming even though it is mandated in RfG 2.0. There are no requirements for compliance simulations for asynchronously connected demand and the stakeholder questions whether this is the intention of the drafting. The stakeholder states that they understand there is a group in Europe looking at this issue, but it is worth noting as part of this consultation.</p>	Agree	<p>Relevant amendments for compliance simulations have been introduced to the legal text.</p>
WindEurope	Article 75	<p>As regards paragraph (3) the stakeholder proposes to add that the non-binding guidance shall explain the technical issues, conditions and interdependencies, <i>especially with other connection network codes</i>. Proposal for clarification by putting some emphasis on the NCs RfG and DC for avoiding conflicts or non-harmonized approaches.</p>	Partly agree	<p>Similar provisions are also included in NCs RfG and DC, ensuring that all aspects shall be examined as well as any possible interactions. It is further noted that the term 'interdependencies' covers not only the various requirements of the same NC, but also interdependencies with requirements of the other NCs. Therefore, ACER does not consider that there is a need to amend the existing legal provision.</p>
National Grid Electricity System Operator - Great Britain	Article 76	<p>The stakeholder states that in GB they are not bound by monitoring requirements, which is a process by which TSOs need to demonstrate they have complied with the requirements of the Regulation. They note that a new clause has been added which states "ACER, in cooperation with ENTSO for Electricity, shall maintain a public online repository where relevant national information regarding the progress of implementation of this Regulation shall be made available. The information to be made available shall 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". The stakeholder considers that it is not clear to what level of detail the information should be supplied noting this is quite an onerous requirement and whether or not issues of confidentiality have been considered, bearing in mind generators will supply confidential data to them as the GB TSO, which is not permitted to be released to other parties and especially not in the public domain.</p>	Partly agree	<p>From the express wording of the provision, it derives that the online repository will include mainly the national legislation implementing the NC, stages of implementation in practice as well as the proposal of the relevant entities on the requirements of the NC as well as links to the national website. This information is already public for some Member States (MS), for example ENTSO-E already publishes on their website information related to MS proposals on non-exhaustive requirements (see https://www.entsoe.eu/active-library/codes/cnc/). In any case, if confidentiality issues arise regarding this kind of information, it is a condition <i>sine qua non</i> that confidentiality requirements will be observed, where necessary.</p>
ENTSO-E	Article 76	<p>It is not clear for the stakeholder what is the purpose of the Article related to the GC ESC and how the GC ESC is engaged in this scope of monitoring and they like ask for clarification. The stakeholder states that DSOs are not responsible for HVDC systems and connection to isolated AC systems. The stakeholder recommends the related sentence be removed.</p>	Disagree	<p>The involvement of the European Stakeholder Committee where relevant is in line with ACER recommendation (03-2023) of amendment proposal on NCs RfG and DC. DSOs may be the relevant system operator in case of HVDC system connected at the distribution system when a cross-border issue is demonstrated. ACER does not consider that there is a need to remove the concerned sentence.</p>

11. TITLE VII – DEROGATIONS (ARTICLES 77-83)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
ENTSO-E	Article 77	The stakeholder considers that it is important to add all relevant grid users here for case of derogations.	Agree	ACER agrees with stakeholder's proposal. Relevant amendments have been introduced to the legal text.	

12. TITLE VIII – FINAL PROVISIONS (ARTICLES 84-86)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
ENTSO-E	Article 84	The stakeholder states that it is not clear what is meant by national agreements and requests for clarification.	-	The term ' <i>national agreements</i> ' in paragraph (3) is the same as in the current NC HVDC and also in the current NC RfG. In our understanding, the term refers to agreements at a national level between system operators and concerned asset owners where the network code allows for the conclusion of such an agreement between the two parties.	
National Grid Electricity System Operator - Great Britain	Article 85a	It is still unclear to the stakeholder what requirements apply to pre HVDC 1.0 Systems, HVDC Systems caught by HVDC 1.0 and HVDC Systems caught by HVDC 2.0 especially noting that some projects have a 7-year build period. According to the stakeholder, this could be difficult for developers and TSOs to follow and further clarity is required in this regard.	Partly agree	A recital has been included in ACER's proposal to provide the context as to the need for transitional or repeal provisions in the Regulation, in line with ACER proposed amendments to NC RfG. However, the European Commission will define the final approach as to the content of these provisions.	

13. ANNEX I – FREQUENCY RANGES REFERRED TO IN ARTICLE 11

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
EDF	Annex I	The stakeholder proposes to erase the new requirement regarding the 52 Hz-52,5 Hz frequency range. They argue that it is not justified and was initially only created to take into account the new RoCoF profile in the overfrequency range. The stakeholder argues that no real analysis was performed about it and that requirements should be set after a robust justification of system needs, be subject to cost-benefit analysis (as they can imply huge costs for generators and deter investment) and after assessment of alternative network solutions.	Disagree	ACER's amendment proposal on NC HVDC for the rate-of-change-of-frequency (RoCoF) capability and frequency ranges requirements is in line with the proposal by the GC ESC's Expert Group on Connection Requirements for Offshore Systems (EG CROS). Members of the Expert Group included system operators and industry stakeholders. Furthermore, the requirements for RoCoF in the current NC HVDC for HVDC systems relate to the capability to stably operate at a rate between – 2,5 and + 2,5 Hz/s over a period of 1s, which is more onerous than the RoCoF requirements for PPMs in the current NC RfG, where Member States are using values up to 2Hz/s. The RoCoF and frequency ranges requirements for HVDC systems should be wider than the requirements for PPMs, as proposed in the NC RfG 2.0, so that the HVDC system do not trip before the connected A-PPMs trip so that the network is not jeopardised. Therefore, ACER does not consider that there is a need to erase the concerned requirement.	
ENTSO-E	Annex I	The stakeholder suggests checking the references to the Regulation in Table 1.	Agree	The references have been amended.	

14. ANNEX II - REQUIREMENTS APPLYING TO FREQUENCY SENSITIVE MODE, LIMITED FREQUENCY SENSITIVE MODE OVERFREQUENCY AND LIMITED FREQUENCY SENSITIVE MODE UNDERFREQUENCY

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
ENTSO-E	Annex II	<p>As regards Figure 1, the stakeholder considers that the caption of Figure 1 uses incorrect terminology. dP1 is labelled "power change", whereas dP and dP2 are labelled "power exchange", which has a different (and incorrect) meaning. Consistently they suggest to use "change" instead of "exchange".</p> <p>As regards Table 2, the stakeholder considers that the values of df1/fn, df2/fn and dfb/fn given in table 2 are not plausible. The percent-symbol seems to be not needed here. They propose to remove as it is not correct.</p>	Agree	Relevant amendments have been introduced to the legal text.	
WindEurope	Annex II	<p>As regards paragraph (1)(a) the stakeholder proposes to add that also the isolated AC network operator should decide on these parameters.</p> <p>As regards Table 2 the stakeholder states that no ranges are given for droop s1 and s2 and wonders how this shall be interpreted.</p>	Disagree	<p>For the introduction of the term '<i>isolated AC network operator</i>' in the definition we refer to ACER's response to the proposed new definition by stakeholders (<i>see Section 4 of this Evaluation Report</i>).</p> <p>The range for droop s1 and s2 in Table 2 is more than or equal to 0,1 %.</p> <p>Therefore, ACER does not consider that there is a need to amend the concerned requirements.</p>	

15. ANNEX III - VOLTAGE RANGES REFERRED TO IN ARTICLE 18

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Tables 4 and 5	<p>As regards Tables 4 and 5, according to some stakeholders, in IEC standards, the term "<i>rated voltage</i>" is used for voltages that are assigned by a manufacturer or other entity to a component, device, equipment, or system to state the maximum value for defined operating conditions. The meaning of the term in tables 4 and 5 appears to be different. The term "<i>nominal voltage</i>" should be used instead. In IEC 601-01-21 "<i>nominal voltage of a system</i>" is defined as "<i>a suitable approximate value of voltage used to designate or identify a system</i>".</p> <p>As regards Table 4, the stakeholders argue that without defining the reference voltage value in kV, the table can be interpreted in different ways leading to different voltage ranges. Deviations from established standards should be justified in the cost benefit analysis as proposed in the comment to Article 18(1).</p> <p>As regards Table 5, the stakeholders argue that without defining the reference voltage value in kV, the table can be interpreted in different ways leading to different voltage ranges. Deviations from established standards should be justified in the cost benefit analysis as proposed in the comment to Article 18(1).</p>	Disagree	<p>The term 'rated voltage' is used in ACER recommendation (03-2023) on amendment proposal of NCs RfG 2.0. and DC 2.0.</p> <p>As regards Tables 4 and 5, according to Article 18(1) '<i>The establishment of the reference 1 pu voltage shall be subject to coordination between the adjacent relevant system operators.</i>'. The flexibility to define different reference 1 pu value by each system operator is also included in current version of NC RfG. Therefore, it is important to retain this flexibility to account for national specificities. Article 5(3)(f) NC HVDC already includes the principle that when applying this Regulation, Member States, competent entities and system operators shall take into consideration agreed European standards.</p> <p>Therefore, ACER does not consider that there is a need to amend the concerned requirements.</p>	

16. ANNEX IV - REQUIREMENTS FOR U-Q/PMAX-PROFILE REFERRED TO IN ARTICLE 20

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
-	-	-	-	-	-

17. ANNEX V - VOLTAGE-AGAINST-TIME-PROFILE REFERRED TO IN ARTICLE 25

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
ENTSO-E	Annex V	As regards Table 7.2, the stakeholder proposes a change for Trec1.	Agree	Relevant amendments have been introduced to the legal text.	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Annex V	The stakeholders propose new text related to Urec2 and Urec3 and the times proposed in Tables 7.1 and 7.2 for having a correct reference to the changes proposed on Annexes III and VII.	Disagree	The voltage ranges specified in Table 7.1 already take into consideration the minimum voltages in accordance with Articles 18 and 48. As regards the term ' <i>isolated AC network operator</i> ' we refer to ACER's response to the proposed new definition by stakeholders (<i>see Section 4 of this Evaluation Report</i>). Therefore, ACER does not consider that there is a need to amend the concerned requirement.	
WindEurope	Annex V	The stakeholder proposes new text related to Urec2 and Urec3 and the times proposed for having a correct reference to the changes proposed on Annex VIII. It is also proposed to 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.	Partly agree	The voltage ranges specified in Table 7.1 already take in consideration the minimum voltages in accordance with Articles 18 and 48. The phrase 'fault-ride-through profile' in Figure 6 has been changed to 'voltage-against-time-profile' to be consistent with Article 25.	

18. ANNEX VI – FREQUENCY RANGES AND TIME PERIODS REFERRED TO IN ARTICLE 39(2)(A)

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
ENTSO-E	Annex VI	As regards Table 8, the stakeholder proposes to increase the duration up to 60s. This should be the same as Annex I. There was a mistake in NC HVDC 1.0. The remote End Station requirement should be the same with the A-PPM, A-ESM; A-DF and A-PtG -DU. 60s is the right value. Also, the stakeholder proposes to pay attention to the scope extension in the Table 8 label.	Agree	Relevant amendments have been introduced to the legal text.	

19. ANNEX VII – VOLTAGE RANGES AND TIME PERIODS REFERRED TO IN ARTICLE 40

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
ENTSO-E	Annex VII	<p>The stakeholder has discussed the change in the voltage ranges for A-PPM, A-ESM, A-DF and A-PtG DU. In the NC HVDC 1.0, the voltage ranges were coupled to the same ranges as in NC RfG. In future, isolated AC networks would need to have more flexibility in order to optimise costs while preserve as much as possible a harmonisation needed.</p> <p>As regards Table 10, Rated Voltage 400 kV, 1,05 pu, 1,15 pu, in NC RfG 2.0, it is 1.1 p.u. They proposed to add the sentence: '<i>Various sub-ranges of voltage withstand capability may be specified by the relevant TSO</i>'. This gives the option to have a subrange, 1,05-1,1 and 1,1-1,15 (with the even zero seconds duration).</p> <p>As regards Figure 7, the stakeholder notes a mistake that needs to be corrected. The proposed change has as follows: '<i>the position, size and shape of the inner envelope are indicative and other than rectangular may be used within the outer envelope</i>'.</p>	Agree	ACER agrees with the proposed amendments. Relevant amendments have been introduced to the legal text.	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Tables 9 and 10	<p>-As regards Tables 9 and 10, according to some stakeholders, in IEC standards, the term "rated voltage" is used for voltages that are assigned by a manufacturer or other entity to a component, device, equipment, or system to state the maximum value for defined operating conditions. The meaning of the term in tables 4 and 5 appears to be different. The term "nominal voltage" should be used instead. In IEC 601-01-21 "nominal voltage of a system" is defined as "a suitable approximate value of voltage used to designate or identify a system".</p> <p>-As regards Table 9, the stakeholders argue that without defining the reference voltage value in kV, the table can be interpreted in different ways leading to different voltage ranges. Deviations from established standards should be justified in the cost benefit analysis as proposed in the comment to Article 40(1). The word "different" appears to be obsolete.</p> <p>-As regards Table 10, the stakeholders argue that without defining the reference voltage value in kV, the table can be interpreted in different ways leading to different voltage ranges. Deviations from established standards should be justified in the cost benefit analysis as proposed in the comment to Article 40(1). The word "different" appears to be obsolete.</p> <p>-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.</p> <p>-According to the stakeholders, it should be the isolated AC network owner who shall make the choices for their system design. This could be the relevant TSO, but it is not necessarily the relevant TSO. That's why here again neutral language is proposed.</p>	Partly agree	<p>The term 'rated voltage' is used in ACER recommendation (03-2023) on amendment proposal of NCs RfG 2.0. and DC 2.0.</p> <p>As regards Tables 9 and 10, according to Article 18(1) '<i>The establishment of the reference 1 pu voltage shall be subject to coordination between the adjacent relevant system operators</i>'. The flexibility to define different reference 1 pu value by each system operator is also included in NC RfG. Therefore, it is important to retain this flexibility to account for national specificities. Article 5(3)(f) already includes the principle according to which, when applying this Regulation, Member States, competent entities and system operators shall take into consideration agreed European standards.</p> <p>ACER agrees to include voltage ranges for 275 kV rated voltage. Relevant amendments have been introduced to the legal text.</p> <p>As regards the term '<i>isolated AC network operator</i>' we refer to ACER's response to the proposed new definition by stakeholders (see Section 4 of this Evaluation Report).</p>	

Respondents	Section of proposed amendment	Summary of respondents' response	ACER views	
WindEurope	Annex VII	<p>The stakeholder proposes to merge Table 9 and 10 to Table 9 as there is no obvious need to separate nominal voltages.</p> <p>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.</p> <p>The stakeholder states that for voltages between 0,85 pu – 0,9 pu the 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.</p> <p>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.</p> <p>Finally, the stakeholder states that it should be the isolated AC network operator who makes the choices for their system 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.</p>	Partly agree	<p>ACER agrees to merge Tables 9 and 10. Relevant amendments have been introduced to the legal text.</p> <p>ACER agrees to include voltage ranges for 275 kV rated voltage. Relevant amendments have been introduced to the legal text.</p> <p>ACER agrees to allow flexibility when defining time periods for operation for voltage range 0,85 pu-0,90 pu. Relevant amendments have been introduced to the legal text.</p> <p>Article 5(3)(f) already includes the principle that when applying this Regulation, Member States, competent entities and system operators shall take into consideration agreed European standards.</p> <p>As regards the term '<i>isolated AC network operator</i>' we refer to ACER's response to the proposed new definition by stakeholders (see <i>Section 4 of this Evaluation Report</i>).</p>

20. ANNEX VIII – REACTIVE POWER AND VOLTAGE REQUIREMENTS REFERRED TO IN ARTICLE 48

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
ENTSO-E	Annex VIII	<p>The stakeholder proposes changes in table 12 in order to fix issues with material standards, especially of 132 kV.</p> <p>As regards Table 12, Rated Voltage 132 kV, 0,9 pu - 1,0 pu, the stakeholder states that 1,0 pu should be corrected to 1.098pu. This is also a comment in the EG CROS that has not been implemented.</p>	Agree	Relevant amendments have been introduced to the legal text.	
Siemens Energy Global GmbH & Co. KG, CENELEC TC 8X/WG 06, VDE FNN	Tables 12 and 13	<p>-As regards Tables 12 and 13, according to some stakeholders, in IEC standards, the term "<i>rated voltage</i>" is used for voltages that are assigned by a manufacturer or other entity to a component, device, equipment, or system to state the maximum value for defined operating conditions. The meaning of the term in tables 4 and 5 appears to be different. The term "<i>nominal voltage</i>" should be used instead. In IEC 601-01-21 "nominal voltage of a system" is defined as "<i>a suitable approximate value of voltage used to designate or identify a system</i>".</p> <p>-As regards Table 12, the stakeholders argue that without defining the reference voltage value in kV, the table can be interpreted in different ways leading to different voltage ranges. Deviations from established standards should be justified in the cost benefit analysis as proposed in the comment to Article 48(1)(a).</p> <p>-As regards Table 13, the stakeholders argue that without defining the reference voltage value in kV, the table can be interpreted in different ways leading to different voltage ranges. Deviations from established standards should be justified in the cost benefit analysis as proposed in the comment to Article 48(1)(a).</p> <p>-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.</p> <p>-According to the stakeholders, it should be the isolated AC network owner who shall make the choices for their system design. This could be the relevant TSO, but it is not necessarily the relevant TSO. That's why here again neutral language is proposed.</p>	Partly agree	<p>The term 'rated voltage' is used in ACER recommendation (03-2023) on amendment proposal of NCs RfG 2.0 and DC 2.0.</p> <p>As regards Tables 12 and 13, according to Article 18(1) 'The establishment of the reference 1 pu voltage shall be subject to coordination between the adjacent relevant system operators.'. The flexibility to define different reference 1 pu value by each system operator is also included in NC RfG. Therefore, it is important to retain this flexibility to account for national specificities. Article 5(3)(f) NC HVDC already includes the principle according to which when applying this Regulation, Member States, competent entities and system operators shall take into consideration agreed European standards.</p> <p>ACER agrees to include voltage ranges for 275 kV rated voltage. Relevant amendments have been introduced to the legal text.</p> <p>As regards the term '<i>isolated AC network operator</i>' please refer to ACER's response to the proposed new definition by stakeholders (see Section 4 of this Evaluation Report).</p>	
WindEurope	Annex VIII	<p>The stakeholder proposes to merge Table 12 and 13 to Table 12 as there is no obvious need to separate nominal voltages.</p> <p>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.</p> <p>The stakeholder states that for voltages between 0,85 pu – 0,9 pu the 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.</p> <p>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.</p> <p>Finally, the stakeholder states that it should be the isolated AC network operator who makes the choices for their system 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.</p>	Partly agree	<p>ACER agrees to merge Tables 12 and 13. Relevant amendments have been introduced to the legal text.</p> <p>ACER agrees to include voltage ranges for 275 kV rated voltage. Relevant amendments have been introduced to the legal text.</p> <p>ACER agrees to allow flexibility when defining time periods for operation for voltage range 0,85 pu-0,90 pu. Relevant amendments have been introduced to the legal text.</p> <p>Article 5(3)(f) of NC HVDC already includes the principle according to which, when applying this Regulation, Member States, competent entities and system operators shall take into consideration agreed European standards.</p> <p>As regards the term '<i>isolated AC network operator</i>' please refer to ACER's response to the proposed new definition by stakeholders (see Section 4 of this Evaluation Report).</p>	

21. OTHER ADDITIONAL PROVISIONS

Respondents		Section of proposed amendment	Summary of respondents' response	ACER views	
Name of stakeholder(s)	Reference to Article(s) / paragraph(s) corresponding to ACER's draft NC proposed amendments	Summary of stakeholders' response	ACER position	Reasoning	
EirGrid plc	-	The stakeholder asks if ACER will publish a new series of Implementation Guideline documents in relation to any revised or new requirements / articles. The stakeholder considers that these documents were vital to the implementation of the HVDC V1.0.	-	<p>According to Article 75 of the NC HVDC:</p> <p><i>'1. No later than six months after the entry into force of this Regulation, the ENTSO for Electricity shall prepare and thereafter every two years provide non-binding written guidance to its members and other system operators concerning the elements of this Regulation requiring national decisions. The ENTSO for Electricity shall publish this guidance on its website.</i></p> <p><i>2. ENTSO for Electricity shall consult stakeholders when providing non-binding guidance.</i></p> <p><i>3. The non-binding guidance shall explain the technical issues, conditions and interdependencies which need to be considered when complying with the requirements of this Regulation at national level.'</i></p> <p>As it derives from the above provisions, ENTSO-E shall prepare written guidance.</p>	

22. NEXT STEPS

Following the evaluation of the stakeholders' responses to the 2024 public consultation, ACER plans to submit recommendation for the amendments of the NC HVDC to the Commission by the end of 2024.