

ACER draft amendments to the Network Code on Requirements for Generators

Fields marked with * are mandatory.

Introduction

This consultation aims to present ACER's draft amendments to the Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a **Network Code on Requirements for Grid Connection of Generators** ('NC RfG').

For draft amendments concerning Network Code on Demand Connection ('NC DC'), please go to the respective form: [NC DC](#).

Responses to this consultation should be submitted by 25 September 2023.

Background

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

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



Following the scoping phase, ACER published the Policy Paper on the revision of the network code on requirements for grid connection of generators and the network code on demand connection in September 2022. The Policy Paper aimed to transparently indicate to stakeholders the key policy areas in which amendments were to be expected.

[Access the ACER Policy Paper on the revision of the NC RfG and NC DC.](#)

As a next step, ACER launched the Public Consultation to gather stakeholders' views and concrete amendment proposals regarding the GC NCs. The stakeholders could submit their inputs by 21 November 2022.

[Access the results of the Public Consultation on the amendments to the grid connection network codes.](#)

Additionally, in the preparation of the draft amendment proposals, ACER organised three dedicated public workshops, namely:

- [electromobility, power-to-gas demand units and heat-pumps](#) (held on 17 April 2023);
- [rate of change of frequency and grid forming capabilities](#) (held on 10 May 2023); and
- [electricity storage](#) (held on 11 May 2023).

After the evaluation of stakeholders' inputs, ACER has formulated its own proposal for the amendments of the GC NCs which is subject to this public consultation.

Stakeholder's details

ACER is highly committed in processing personal data in a lawful way.

Find out more how we process your data: <https://www.acer.europa.eu/the-agency/about-acer/data-protection>

* Name of the stakeholder:

Enercon Global GmbH

* Contact person:

[REDACTED]

* Contact person's email address:

[REDACTED]

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

Germany

* Type of the stakeholder:

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

Please, elaborate on your answer above, if necessary:

Since 15a involved in grid codes in numerous countries

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

- ☒ Yes
- ☐ No

* Do you consent to the publication of provided answers?

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

Instructions

Stakeholders are invited to submit their comments to the NC RfG articles amended by ACER in three mandatory steps:

1. by downloading the ACER draft amendments in the Word file provided below. The file can also be accessed on the right panel of the consultation form under the Background Documents;
2. by commenting on the ACER's draft amendments through this online consultation form and adding their alternative text proposals to the table, if any; and
3. by uploading the alternative amendment proposals to the **entire NC RfG** using the Track Changes mode in the ACER draft amendments file downloaded from **Step 1**.

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

The mandatory steps for submitting the comments are listed below.

Step 1

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

[Download ACER draft amendments to the NC RfG here](#)

Step 2

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

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

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

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

 Includes new articles

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 1	1	2
Article 3		
Article 4		
Article 4a [new]		
Article 5		
Article 6		
Article 7		
Article 8		
Article 9		
Article 10		
Article 11		
Article 12		

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

	Text amendment proposal (if applicable)
New article	

3

Please upload figures or tables if necessary

 The maximum file size is 1 MB

Select file to upload

4

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

Step 3

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

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

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

FILE UPLOAD

Please upload your file here

The maximum file size is 1 MB

Only files of the type pdf,doc,docx,odt,txt,rtf are allowed

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

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

Please upload your file

The maximum file size is 1 MB

Please upload your file

The maximum file size is 1 MB

Please upload your file

The maximum file size is 1 MB

Due to the significant length of this survey:

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

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

Whereas Section

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

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
(1)		
(2)		
(3)		
(s1)		
(s2)		
(4)		
(5)		

(6)	<p>The transition from the traditional power system dominated by synchronous generators, towards the future with very high shares of power park modules (=power electronics, volatile generation) physically leads to the need of additional Ancillary Services, which so far had not been thought of.</p> <p>Such additional system needs, and the ways to satisfy them, have to be assessed and organized by the regulator. Neither power facility owners, nor TSOs or DSOs can make that. The system needs and the ways to satisfy them have to be identified, defined, introduced, given a commercial value ... and at the end procured. The obligation to trigger thinking and acting about this is in EU DIRECTIVE 2019/944 of 5 June 2019 under the term "non-frequency ancillary service".</p>	<p>Regulatory authorities should consider the reasonable costs effectively incurred by system operators in the implementation of this Regulation when fixing or approving transmission or distribution tariffs or their methodologies or when approving the terms and conditions for connection and access to national networks in accordance with Article 59(1) and (7) of Directive (EU) 2019/944 and with Article 18 of Regulation (EU) 2019/943.</p> <p>Regulatory authorities should review the concept of Ancillary Services possible in their responsibility area. If the transition from a power system dominated by synchronous generators towards one high shares of power park modules needs additional Ancillary Services to be defined, introduced and procured, the regulatory authorities together with the TSO and the relevant system operator shall start this, having especially in mind EU DIRECTIVE 2019/944 of 5 June 2019.</p>
(7)		
(8)		
	<p>PPMs shall be assessed based on the (contractually) agreed maximum active power export capacity at their connection point, no matter what technologies and primary energy sources they are using inside the PPM.</p>	<p>The significance of power-generating modules should be based on their agreed maximum continuous export capacity at the point of connection and their effect on the overall system.</p> <p>a. Synchronous machines should be classed on the machine size and include all the components of a generating facility that normally run indivisibly. An installation containing a set of</p>

(9)

1. In the future will be more different "technologies" in mixed hybrid PPMs. PV, storage, wind and other technologies we can't even think of today. Assessing them by "the same underlying technology" is impracticable. Would a DFIG wind turbine be the same technology as a full-converter wind turbine? Would a Li-ion-battery be the same technology as a NaS-battery or a fuel cell with associated electrolyzer?

2. Grid connection capacity is a rare resource. It will remain a rare resource for decades. It should be incentivized that an existing grid connection capacity is used as much as possible, which means high power transfer for many hours per year. Therefore it should be up to the owner of the PPM what he installs inside. The minimum required performance of his PPM at the connection point is based on how much grid capacity he wants there for continuous active power infeed.

The TSO shall have a right to require that this agreed P_{max} is not lower than the sum of the synchronous machines and storages in the PPM. The mass market of small PPMs (esp. PV, EV and small scale energy storage) shall allow an aggregation by underlying technology. For this it has to be clarified if storages count in, or not. Please clarify if the part "...used solely for the purpose of meeting the requirements of this Regulation..." refers only to the exhaustive requirements from this RfG2.0, or if also any national implementation of non-exhaustive requirements is covered by this sentence. This

synchronous machines that cannot be operated independently from each other, such as combined-cycle gas turbine installation, should be assessed on the whole capacity of that installation.

b. Non-synchronously connected power-generating units of any underlying technology and any primary energy source, including electricity storage, where they are collected together to form an economic unit and have a single connection point to the relevant system operator, shall be assessed based on the agreed maximum continuous active power export capacity at the point of connection, irrespective of their installed aggregated capacity.

The TSO shall have the right to set a minimum for the agreed maximum capacity at the point of connection, up to the sum of the installed capacity of synchronous machines and energy storage modules in the power park module.

c. Moreover, to ensure an appropriate harmonisation or rules for mass-market products, the capacities of units of Type A, which have the same underlying technology and one single connection point, should be aggregated for the purpose of the determination of significance, instead of referring to the agreed maximum continuous active power export capacity at the point of connection. (for instance, photovoltaic, electricity storage, combined heat and power installations, or V2G electric vehicles)

Electricity storage integrated to a power-

	<p>makes a very big difference.</p> <p>This Whereas (9) is highly interdependent with Def. (16), (33), (66),(67),(78) and Art. 5</p>	<p>generating module of type A, used solely for the purpose of meeting the requirements of this Regulation and its national implementation should be considered as part of such module while its capacity should not count towards the power-generating module capacity.</p>
(10)		
(**)		
(11)		
(12)		
(13)		
(14)		
(15)		
(16)		
(17)		
(x)		
(18)		
(19)		
(**)	<p>"high voltage" is a reserved term and shall not be used in RfG. WHat is referred here to is an "over-voltage".</p>	<p>In order to avoid potential critical system situations caused by overvoltage, it should be possible for power-generating modules to remain connected to the system for a specified over-voltage-against-time profile.</p>
(20)		
(21)		
(22)		
(**)		

(23)	<p>For voltage ranges this is no question, but more critical for system stability is to align frequency determination (see Def. 22) and frequency control requirements.</p>	<p>voltage ranges, frequency ranges and requirements for power-frequency-control should be coordinated between interconnected systems because they are crucial to secure planning and operation of a power system within a synchronous area. Disconnections because of voltage disturbances have an impact on neighbouring systems. Failure to specify voltage ranges could lead to widespread uncertainty in planning and operation of the system with respect to operation beyond normal operating conditions.</p>
(24)		
(25)	<p>It is not the nature of RES to not contribute inherently to system inertia. Please think of hydro power plants with classic synchronous generators.</p> <p>The key is that some technologies are connected through inverters with power electronics. For these no requirement was existing regarding any (synthetic) inertia contribution, they are not paid for anything except producing MWh, hence no (synthetic) inertia was implemented.</p>	<p>Synchronous power-generating modules have an inherent capability to resist or slow down frequency deviations, a characteristic which many converter-based technologies do not have. Therefore countermeasures should be adopted, to avoid a larger rate of change of frequency during times with high shares of converter-based generation. Synthetic inertia could facilitate further expansion of such converter-based generation (especially RES using wind and solar) which do not naturally contribute to inertia.</p>

(**)	<p>There is a EU framework given for advanced capabilities of (amongst others) power-generating modules. The regulator shall consider if such advanced capabilities are set as mandatory requirements, or if its economically and technically better to obtain some of these as ancillary services according to EU DIRECTIVE 2019/944 of 5 June 2019.</p>	<p>Rapidly increasing penetration of dispersed generation and converted-based technologies into European networks has presented new challenges in ensuring overall system security. To the extent that an adequate contribution to the dynamically transforming system depends partly on advanced capabilities, power-generating modules should be able to support the system robustness by fulfilling appropriate grid-forming and rate-of-change-of-frequency withstand requirements. The regulator shall consider if such advanced capabilities are to be provided as mandatory requirements, or if some of these are better provided as ancillary services according to EU DIRECTIVE 2019/944 of 5 June 2019.</p>
(26)	<p>Asking a Type A PGM to pass through the same compliance testing as e.g. a type D would be unacceptable effort for the system operators as well as the PGF owner.</p>	<p>Appropriate and proportionate compliance testing should be introduced so that system operators can ensure operational security, considering different approaches for types A, B, C and D.</p>
(27)		
(28)		
(29)		
(30)		
(31)		
(32)		

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

	Text amendment proposal (if applicable)
New recital	

Definitions (Article 2)

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

Includes new definitions

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 2(1)		
Article 2(2)		
Article 2(3)	The present definition text is ok for anything except grid forming, synthetic inertia and fast-fault-current injections . These 3 phenomena happen on a sub-cycle time scale ($\ll 20\text{ms}$), hence root-mean-square values at fundamental frequency are meaningless. An additional definition has to be established for such transient phenomena, regarding U, I, P, Q, S, f and df/dt (RoCoF).	'voltage' means the difference in electrical potential between two points measured as the root-mean-square value of the positive sequence phase-to-phase voltages at fundamental frequency . For any requirements about grid forming, synthetic inertia and fast-fault-current injections the relevant TSO shall publish a specific definition, which suits the sub-cycle character of these phenomena.
Article 2(4)		
Article 2(5)		
Article 2(6)		
Article 2(7)		
Article 2(8)		

Article 2(9)	<p>The key characteristic of any synchronous PGM is that the gained electrical power is not going through any power electronics, no inverters. Any generating device which uses full-scale or partial-scale power electronics is not a synchronous PGM.</p>	<p>‘synchronous power-generating module’ means a set of one or more physical alternators, which cannot be operated independently from each other, which have a physically rotating mass, converting mechanical power into electrical power having at the terminals of the individual unit(s) the characteristic of a voltage source behind an internal impedance (Thevenin source), and which exchange their electrical power with the AC network at all times without power electronic conversion.</p>
Article 2(10)	<p>PGMD already exist in some countries, such as NL or DE. Key criteria for the PGMD are that specific non-exhaustive criteria from the RfG are met. A PGMD that is only based on the exhaustive criteria from RfG2.0 would help, it would especially not meet the expectations from the RSO.</p> <p>For example: A PGMD has to demonstrate the compliance with P-Q-capability diagram or fault-ride-through capabilities. Both are defined in detail only by the national implementation of the RfG.</p>	<p>‘power-generating module document’ or ‘PGMD’ means a document provided by the power-generating facility owner to the relevant system operator for a type B or C power-generating module which confirms that the power-generating module's compliance with the technical criteria set out in the applicable national implementation of this Regulation has been demonstrated and provides the necessary data and statements, including a statement of compliance;</p>

Article 2(10a)	same reason as Art. 2(10)	supply equipment document or 'SED' means a document provided by the electrical charging park owner to the relevant system operator for a EV3 V2G electric vehicle supply equipment which confirms that the supply equipment's compliance with the technical criteria set out in the applicable national implementation of this Regulation has been demonstrated and provides the necessary data and statements, including a statement of compliance;
Article 2(11)		
Article 2(12)	It is key to define where "network" starts, resp. ends. By clarifying this is not part of the PGF, hence in view of the power inflow from the PGF into the grid behind the connection point, it becomes clear.	'network' means a plant and apparatus connected together in order to transmit or distribute electricity; which are not part of a power generating facility;
Article 2(13)		
Article 2(14)		
Article 2(15)		

Article 2(16)	<p>Stron disagreement with the presented definition!</p> <p>The relevant quantity is what the system operator and the facility owner have agreed to be the maximum active power, which the facility is allowed to inject into the network. How this is done inside the facility, if a higher or lower total nominal active power is installed inside the facility, shall not be relevant for the "Pmax".</p>	<p>'maximum capacity' or 'Pmax' means the maximum continuous active power which a power-generating module is allowed to inject into the network at the connection point, having discounted any demand or losses associated solely with facilitating the operation of that power-generating module as specified in the connection agreement or as agreed between the relevant system operator and the power-generating facility owner, or determined by other appropriate means, where an agreement is not required;</p>
Article 2(17)		
Article 2(18)		
Article 2(19)	<p>'synchronous compensation operation' leads to many more phenomena than only the mentioned voltage control. And such a device can only CONTRIBUTE to regulate voltage, it can never ensure voltage regulation at all circumstances. Some of the other physically contributions are mentioned, which are crucial for the system-stabilizing impact of synchronous compensation devices.</p>	<p>'synchronous compensation operation' means the operation of an alternator without prime mover, to, amongst other phenomena, contribute to voltage regulation dynamically by production or absorption of reactive power, contribute to frequency stabilization by inherent provision of inertia, provision of short circuit current in case of voltage faults in the network;</p>
Article 2(20)		
Article 2(21)		
	<p>The present text is useless, as its not precise and looks only at 50Hz. A general definition of the term "frequency" is needed, and separately and in addition also the term "grid-frequency" has to be defined.</p> <p>The RfG2.0 text also addresses phenomena in</p>	

Article 2(22)	<p>the frequency range 0.2Hz up to 9kHz. In the interest of system stability it is not acceptable that a key electrical value like the frequency remains with such a blurry “definition”.</p> <ol style="list-style-type: none"> 1. Frequency can not be measured, it is always calculated based on measurable physical quantities. Depending on what is measured over what time, and how this is eventually filtered, different values will result for the frequency. 2. In the interest of system stability it is key that the way how the grid- frequency is calculated based on measured values is harmonized across a synchronous area. Therefore the proposal to use by default the 200ms gliding window (state of the art). If the TSOs decide to take a longer or shorter time window this may also be ok. Crucial is that only one is agreed. 3. However, at least for the requirements about RoCoF, Grid Forming and (synthetic) inertia it is crucial to have the possibility to define frequency for a much shorter time interval (e.g. 5ms) in a meaningful way. <p>"Its nominal value is 50Hz" is certainly true for the fundamental frequency to generate and transmit power. But for practical applications also all other frequencies play a key role, as precisely such undesired other frequencies shall be minimized.</p>	<p>‘frequency’ means the inverse of the period of a periodical electrical quantity. It is calculated on the basis of measurable electrical quantities such as current or voltage.</p>
Article 2(23)		

Article 2(24)	Please clarify difference to definition (50). What for is a "minimum regulating level" if it is not "stable"? If there is a timely difference between (24) and (50) this must be quantified.	
Article 2(25)		
Article 2(26)		
Article 2(27)		
Article 2(28)		
Article 2(29)	<p>It is crucial to cover over- and undervoltage. Over-voltage-ride-trough is now introduced with RfG2.0</p> <p>The exact reason why the abnormal voltages occur doesn't matter to the device that shall have FRT-capability, and the device won't "know" these ever. Something has happened in the network (beyond the connection point) and that results in temporary abnormal voltage conditions. Furthermore it is important to specify that the u-t-profile refers to one specific physical point, e.g. the connection point, as the perceived voltage will be different at different locations in the network, and inside the power generating facility.</p>	'fault-ride-through' means the capability of electrical devices to be able to remain connected and operate stable, while the voltage at a defined point remains within a specific voltage-time profile (with significant under-voltage and over-voltages), caused by faults not originating from the device
Article 2(30)		

Article 2(31)	see comment to definition of "voltage", same applies here. For the mentioned very short term phenomena, which are crucial for system stability, a different definition is necessary.	'current' means the rate at which electric charge flows which is measured by the root-mean-square value of the positive sequence of the phase current at fundamental frequency. Regarding fast-fault-current, grid forming, inertia and synthetic inertia the TSO shall publish a specific definition, which suits the sub-cycle character of these phenomena;
Article 2(32)		
Article 2(33)	<p>We are in the electrical context. The mechanical performance doesn't matter. It needs to be defined what the described mechanical aspects mean for voltage, current, power and other electrical quantities at the terminals of e.g. an alternator.</p> <p>The proper definition of 'frequency' is a crucial precondition for any requirement about inertia, or synthetic inertia.</p> <p>This is related to Def. (22) and Art. 15 2 (d) (iv)</p>	'inertia' in the electrical context means the ability of a device to oppose at its electrical terminals any change in the frequency of power exchange between it and the grid, and to inherently change its power exchange, counteracting a change in frequency
Article 2(34)	<p>While definition (34) is not addressing any electrical quantities, also the definition of synthetic inertia is meaningless.</p> <p>If the here presented different definitions of frequency (22) and inertia (33) are accepted, then also the current definition (34) is ok.</p>	

Article 2(35)	A PGM or HVDC-device can by itself never “maintain” the system frequency. The system is way bigger & stronger than the single device. It can only contribute in order that the system frequency is maintained. This makes a big difference when it comes to the success criteria of any frequency control.	‘frequency control’ means the capability of a power-generating module or HVDC system or PPM to adjust its active power output in response to a measured deviation of system frequency from a setpoint, in order to maintain contribute to maintain a stable system frequency;
Article 2(36)		
Article 2(37)		
Article 2(38)		
Article 2(39)		
Article 2(40)	No such feature is "inherent" in any control system. It is always a question of how things are built, resp. implemented e.g. in software. And it depends on how frequency is determined, specifically filtered. This is related to Def. (22)	“frequency response insensitivity’ means the feature of the control system specified as the minimum magnitude of change in the frequency or input signal that results in a change of output power or output signal;
Article 2(41)		
Article 2(42)		
Article 2(43)		
Article 2(44)		
Article 2(45)		
Article 2(46)		
Article 2(47)		

Article 2(48)	As "alternator" is the term used for the classic synchronous generator, it should be here also for consistency.	'excitation control system' means a control system that is assigned to any alternator and its excitation system; "feedback" is not the right term. It should usually be "closed-loop". However, if its closed-loop or open-loop is not relevant here.
Article 2(49)		
Article 2(50)		
Article 2(51)		
Article 2(52)		
Article 2(53)		
Article 2(54)		
Article 2(55)	<p>As far as possible already existing definitions shall be used: (29).</p> <p>The defined FRT event includes with its "voltage-time-profile" already the times during and after the fault.</p> <p>If no reference is made to (29) "voltage deviation" would have to be specified. Also an e. g. 1% change of voltage would be a "voltage deviation" , but not necessarily a FRT event.</p> <p>The fast fault current has many purposes, depending on the type of fault and the specific network. The mentioned ones are some examples, but not applicable under all circumstances and by far not exhaustive.</p> <p>Therefore it is better not to start mention some aims.</p>	'fast fault current' means a current injected by a power park module or HVDC system during a fault-ride-through event caused by an electrical fault in the network
Article 2(56)		

Article 2(57)		
Article 2(58)		
Article 2(59)		
Article 2(60)		
Article 2(61)		
Article 2(62)	<p>The term "using a grid connection" is unspecific. Using it what for? It is crucial that this notification allows to exchange power at the connection point. Power injection plays the dominant role in RfG context, but also power consumption is relevant. Both have to remain within the limits agreed by the parties.</p>	<p>‘final operational notification’ or ‘FON’ means a notification issued by the relevant system operator to a power-generating facility owner, demand facility owner, distribution system operator or HVDC system owner who complies with the relevant specifications and requirements, allowing them to operate respectively a power-generating module, demand facility, distribution system or HVDC system to inject and absorb power at the grid connection point</p>
Article 2(63)	<p>As in the new proposed Def. (63) it is crucial to mention what is allowed with this notification.</p>	<p>‘energisation operational notification’ or ‘EON’ means a notification issued by the relevant system operator to a power-generating facility owner, demand facility owner, distribution system operator or HVDC system owner prior to energisation of its internal network, allowing him to energize this power-generating facility</p>
Article 2(64)		
Article 2(65)		
Article 2(66)		
Article 2(67)		
Article 2(68)		

Article 2(69)	Please consider consistency of terms. (67) mentions "inject" and "consume". If these shall be the terms for the two possible flow directions of power please use them throughout the document.	'V1G electric vehicle' means the vehicle that is powered, fully or in part, with electricity and can only consume electricity from the grid.
Article 2(70)	Please consider consistency of terms. (67) mentions "inject" and "consume". If these shall be the terms for the two possible flow directions of power please use them throughout the document.	V2G electric vehicle' means the vehicle that is powered, fully or in part, with electricity and is equipped with technology enabling the vehicle to provide inject electricity to the grid.
Article 2(71)		
Article 2(72)		
Article 2(73)		
Article 2(74)		
Article 2(75)		

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

	Text amendment proposal (if applicable)
New definition	<p>(76) 'generic model' means a model for the simulation of the electrical performance of a component, based on a generic structure and software modules (e.g. protection and control systems), which may deviate from specific manufacturer system. The models shall easily be parameterized to represent a manufacturer specific system taking into account less accuracy than a user-written model.</p> <p>(77) 'user-written model' means a model made by the manufacturer for the simulation of the electrical performance of a component, based on the algorithms and parameterization used in the component. It reflects the electrical behaviour more accurately than a generic model.</p> <p>Reasoning: As these two types of models have very different properties, and also different levels of accuracy and intellectual property issues, it is crucial to define both terms.</p> <hr/> <p>(78) 'Inherent energy storage' means an energy reserve, expressed in MWs or MWh, available in physical components of a PPM, which can be used as determined by the power-generating facility owner, without causing disproportionate demands on the design or life of the physical components</p> <p>Reasoning:</p> <ul style="list-style-type: none"> • Any definition belongs into the Art 2 Definitions. • the way the definition in Art Y is written so far, it is open to interpretation to the highest degree, and thus arbitrary. • If e.g. the rotational energy of a wind turbine, or the DC capacity in a unit, can be used for something like grid forming and/or synthetic inertia can't be up to the TSO or RSO. Solely the manufacturer can tell if a usage will affect the design, or lifetime, or stability, or any other relevant aspect. • The part "..., but may be used for ...": Who decides if an energy reserve can be used for a purpose? Only the PGF owner in coordination with the manufacturer of the device can decide, if this can be used for certain purposes. Surely not the

TSO or RSO.

(79) 'grid-frequency' means the fundamental frequency of the periodic electrical quantities, especially voltages, which are decisive for the generation, transport and use of electrical energy. Its nominal value is 50 Hz.

Unless otherwise defined by the TSO, the fundamental frequency is to be determined over a gliding time window of 200ms.

For any frequency-related requirements about grid forming, synthetic inertia and fast-fault-current injections the relevant TSO shall publish a specific definition of 'frequency', which suits the sub-cycle character of these phenomena.

(80) 'short circuit capacity at the connection point' means the short circuit contribution that is coming from a part of the network at a given connection point under a specific type of short circuit at the connection point, and is expressed in MVA. It is the product of nominal voltage, short circuit current (1) and square root of three ($U_{nominal} * I_{Short_Circuit} * \sqrt{3}$)

Important: Please clarify which short circuit current is exactly meant here, as there are several possible as by IEC 60909

- The peak short circuit current (sub-cycle)
- Initial symmetrical short-circuit current (I_k)
- Peak short-circuit current (i_p)
- Symmetrical short-circuit breaking current (I_b) at 0.02s, 0.05s, 0.1s and 0.25s
- DC component (i_{dc}) of short circuit-current at breaking times
- Steady-state short-circuit current (I_k)

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE I - General provisions

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

Includes new articles

	Comment on the ACER draft amendments	Alt
Article 1		
Article 3		
Article 4		
Article 4a [new]		
Article 5	Please note: For the definition (16) a change is proposed, which has a significant impact to this Art. 5.: Maximum capacity shall mean the maximum continuous active power which a power-generating module is allowed to inject into the network at the connection point. This is a value agreed between the parties, not necessarily the sum of the nameplate power of the installed devices.	
Article 6		
Article 7		
Article 8		
Article 9		
Article 10		
Article 11		
Article 12		

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

	Text amendment proposal (if applicable)
New article	

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE II CHAPTER 1 - General Requirements

General requirements for type A power-generating modules

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

Includes new paragraphs

	Comment on the ACER draft amendments	
Article 13(1)		
Article 13(2)	(g) "block" is unclear. Shall that mean hindering it from taking action - then please use "disable". Or shall it "Block" once it became active? Moreover, "in real time" is unspecific and leads to endless discussions. What fits here is rather "without intentional delay"	(g) the capability to operate setpoint power generation reactive system power The definition of this
Article 13(3)		
Article 13(4)		
Article 13(5)		
Article 13(6)		
Article 13(7)		
Article 13(8)	<p>(c) Without clear specification what this "observation time" is, this sentence has to be deleted.</p> <p>If its meant to be a delay time during which certain grid-side conditions have to be observed, have to remain above certain thresholds... then this has to be expressed properly.</p> <p>(e) to (g): This only can apply to technologies where the PGM starts up its own voltage, prior to a synchronization and connection to the network. To all PPMs with non-grid-forming behavior (so far all Wind- and PV PPM) the conditions from (e), (f) and (g) cant be applied.</p>	<p>For the term network (e) C mea $\Delta\theta <$ (f) C differ brea (g) C mea $< 0,2$</p>
Article 13(9)	<p>(c) Without clear specification what this "observation time" is, this sentence has to be deleted.</p> <p>See Art. 13 (8) (c)</p>	

Article 13(10)	<p>No device can guarantee constant voltage at its terminals. Think of a solid short circuit at its terminals: 0V. It can only CONTRIBUTE to a more constant voltage. This is a wrong expression appearing several times in this document.</p> <p>The stability does not only depend on the stability of the PGM to be connected, but as much also on the network strength at the connection point. If the network strength becomes too low, it is physically impossible to guarantee the PGM stability, especially not for the entire P-Q-capability chart and under all U-control regimes. Therefore this part of the sentence has to be deleted.</p> <p>With the text proposed by ACER the relevant system operator has the right to require ANY P-Q-capability chart from a type A, while for type C there is a defined outer envelope. Please clarify in which maximum envelope the system operator could require P-Q-capability already for type A and B. My proposal here is "not wider than for type C, but a smaller one would be much more appropriate.</p>	<p>10. The power generating module shall be equipped with voltage control that can contribute to a constant terminal voltage at a selectable setpoint .</p> <p>The relevant system operator shall have the right to specify the capability of a power-generating module to supply or absorb reactive power when exporting active power within a P-Q-capability chart to be defined by the RSO and in no case wider than the inner envelope as by figure 9;</p>
Article 13(11)		
Article 13(12)		
Article 13(13)		
Article 13(14)		

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

[NEW] General requirements for type EV1 and EV2 V2G electric vehicles and associated V2G electric vehicle supply equipment

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 13a(1)		
Article 13a(2)		
Article 13a(3)		
Article 13a(4)		
Article 13a(5)		
Article 13a(6)		
Article 13a(7)		
Article 13a(8)		
Article 13a(9)		
Article 13a(10)		
Article 13a(11)		

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

General requirements for type B power-generating modules

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 14(1)		
Article 14(2)[deleted]		
Article 14(2)	<p>(iii) In general there shall not be such national exceptions in the RfG. Why shall teh TSO in Spain have this right, but the TSO in France, which has similar issues, has not?</p> <p>If REE has a problem with overvoltage, there are technical means to fix it. Investments or different ways for voltage control services should be thought of, instead of giving exceptions.</p>	
Article 14(3)	The right to define any (!) higher and longer times is a blank cheque, which is not acceptable. If wider capabilities are needed in the view of the TSO this would have to be conditional to a CBA.	(c) The power-generating module 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 X at the connection point.
Article 14(4)		
Article 14(5)		

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

[NEW] Requirements for type EV3 electric vehicles and associated V2G electric vehicle supply equipment and V2G electrical charging parks

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 14a(1)		
Article 14a(2)		
Article 14a(3)		
Article 14a(4)		
Article 14a(5)		
Article 14a(6)		
Article 14a(7)		
Article 14a(8)		

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

General requirements for type C power-generating modules

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 15(1)		
	<p>Based on the new proposed definition of the term "grid-frequency" (Def. 79) is here just one example, how the term "frequency" has to be checked throughout the entire document. In most locations it has to be replaced by "grid-frequency", which is the fundamental 50Hz value. Only when explicitly other frequencies are addressed it has to remain with the more general term "frequency" as by Def. (22).</p> <hr/> <p>"block" to be replaced enable/disable and "without intentional delay" instead of the very ambiguous "in real-time"</p> <hr/> <p>(iv) The case in Spain shows in recent years that the expression "PGM without inertia" is very ambiguous. The option to require a shorter time than 2s can apply in this general way only for electric storage modules, which have a charged (e.g. electrochemical) storage inside.</p> <p>If a TSO requests $T1 < 2$ sec he has to respect:</p> <ul style="list-style-type: none"> - the time needed to determine the local frequency based on physical measurements in a reliable way with sufficient accuracy. (See definition 22+79). <p>There has to be a lower limit for the T1. REE asks for 500ms on the mainland, which is reasonable. (But REE also asks for 150ms on the Canary islands, which is conflicting with an accurate frequency determination, and unreasonable for wind power.)</p> <hr/>	
Article 15(2)		

	<p>(v) If a PPM with volatile primary source shall operate in FSM, it is crucial to define a Pref, which takes into consideration that the actual P is permanently changing. In the extreme case of FSM with no deadband and no insensitivity there is no logical reference to a P threshold possible any more. (Reference to the max. capacity makes even less sense, at the PPM is frequently running below it, which leads at first to no FSM response at all) Therefore a reasonable minimum for the sum of deadband and insensitivity has to be defined, so that a Pref can be frozen at the instant that a frequency response starts.</p> <hr/> <p>To Art 15.2. Fig 5 Please see comment in the Word file. Text for Pref with reference to LFSM-O is not correct in FSM context.</p>	<p>2. Type C power-generating modules shall fulfil the following requirements relating to grid-frequency stability:</p> <hr/> <p>(ii) (...)</p> <ul style="list-style-type: none"> - an external signal allowing the relevant system operator to enable or disable the LFSM-U mode without intentional delay. <hr/> <p>(iv) the initial activation of active power frequency response required shall be as short as possible. If the delay in initial activation of active power frequency response is greater than two seconds, the power-generating facility owner shall provide technical evidence demonstrating why a longer time is needed.</p> <p>For electricity storage modules, the relevant TSO may specify a shorter time than two seconds. If the power-generating facility owner cannot meet this requirement they shall provide technical evidence demonstrating why a longer time is needed for the initial activation of active power frequency response;</p> <hr/> <p>(v) For PPM with volatile primary power source the combined effect of frequency response insensitivity and frequency response deadband shall not be smaller than 20mHz.</p>
Article 15(3)[deleted]		
Article 15(3)		

Article 15(4)	<p>(vi) please define "block load". How shall that be understood for storage modules with black start capability?</p> <hr/> <p>(b) (i...vi) In the current ACER text this means at the request of the TSO any Type C PPM has to be able to change from regular network-connected operation into island operation. PPMs based on wind and PV cant go into island operation, except a storage is built in. This is hopefully not intended.</p> <hr/> <p>(c) "quick" is not a defined term. This can be understood as anything from 1 ms to several hours.</p>	<p>(v) the power-generating module control schemes, including FSM, LFSM-O, LFSM-U and voltage control system (synchronous power-generating modules) or voltage control mode (power park modules) shall be able to continuously and stably operate during the transition from interconnected system operation to island operation without relying on information provided by the relevant system operator. Information under which disturbances this island operation is required and on how robustness is achieved during the transition from interconnected system operation to island operation shall be agreed between the PGM owner and the relevant system operator or TSO.</p> <hr/> <p>(c) with regard to re-synchronisation capability: (...)</p>
	<p>"properly" is too unspecific. To clarify better what can be expected from what kind of simulation model, the sentence about different accuracy of generic vs. user-written model is added. This is related to the new definition of both models in Art.2</p> <p>For the different model types (generic, user-</p>	<p>(c) with regard to the simulation models:</p> <p>(i) at the request of the relevant system operator or the relevant TSO, the power-generating facility owner shall provide simulation models which adequately reflect the behaviour of the power-generating module for the relevant study purpose in both steady-state and dynamic simulations (root mean square) or in electromagnetic transient simulations. It is acknowledged that generic models are less accurate than user-written models. The simulation model requirements and data provided shall not violate manufacturers' intellectual property rights and the relevant system operator shall enter an NDA if requested.</p> <p>The power-generating facility owner shall ensure that the models provided have been verified against the results of compliance tests referred to in</p>

Article 15(5)

written...) the required accuracy and clear acceptance criteria have to be defined. Without acceptance criteria any model requirement is useless.

If no exception for technology prototypes are possible, the further technical development is blocked. Specifically all new technology to address "Grid Forming" and "Synthetic Inertia" cant be modelled before a certain technical experience is gained in the field. The size of such prototype doesn't allow to test prototypes fully under laboratory conditions.

As ENTSO-E EG ISSM highlights, EMT simulations apply to a wide range of frequencies and therefore require a very detailed representation of components (for example the high voltage equipment, the control and protection systems, converters switching components, etc.). An accurate representation can be achieved with manufacturer specific models (e.g., DLL based models) These need to be encrypted in order to protect the manufacturers intellectual property.

The TSO may define which interfaces he wants to have available in the model, to see interaction in system studies. Different to that the model structure can't be imposed by any external party.

Also the way how encryption is made is not up to the TSO.

With regard to 15(5) (c) (iv) and (v) please consider the comments submitted by WindEurope.

Chapters 2, 3 and 4 of Title IV, and shall notify the results of the verification to the relevant system operator or relevant TSO. The TSO shall define the verification standard and acceptance criteria, considering international standards. Member States may require that such verification be carried out by an authorised certifier;

The relevant system operator shall define a grace period for the provision of models, which applies to new generation technologies, in order to enable prototypes to be commissioned and operated under a special Limited Operation Notification.

(iii) For the purpose of electromechanical dynamic simulations (RMS simulation studies) the relevant system operator or the relevant TSO shall have the right to specify the power park modules simulation model requirements. Without prejudice to the Member State's rights to introduce additional requirements, the simulation models of the power park modules provided by the power generation facility owner shall:

- be valid for the specified operating range and the required control modes of the power-generating facility;
- include a representation of the converter modules and its control systems (including the synchronization module) that influence the dynamic behaviour of the power-generating module in the specified time frame;
- be generic model for cross border network stability studies;
- in the case that user-written RMS models (e.g. DLL-models) are requested by the relevant TSO,

	<p>(vi) requesting the model structure and block diagrams is a violation of the manufacturers intellectual property. This is not acceptable.</p>	<p>the relevant TSO shall specify the interface requirements (for example the signal interfaces to be observable in the network studies);</p> <ul style="list-style-type: none"> - include the relevant protection function models; <p>(vi) the request by the relevant system operator referred to in points (i) and (ii) shall be coordinated with the relevant TSO. It shall include:</p> <ul style="list-style-type: none"> - the format in which models are to be provided, - the provision of documentation, - an estimate of the minimum and maximum short circuit capacity at the connection point, expressed in MVA, as an equivalent of the network;
--	--	--

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

General requirements for type D power-generating modules

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 16(1)		
Article 16(2)		
Article 16(3)		
Article 16(4)		

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE II CHAPTER 2 - Requirements for synchronous power-generating modules

[NEW] Requirements for type A synchronous power-generating modules

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

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

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Requirements for type B synchronous power-generating modules

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 17(1)		
Article 17(2)		
Article 17(3)		

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Requirements for type C synchronous power-generating modules

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 18(1)		
Article 18(2)		

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Requirements for type D synchronous power-generating modules

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

Includes new paragraphs

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 19(1)		
Article 19(2)		
Article 19(3)		
Article 19(4)		

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE II CHAPTER 3 - Requirements for power park modules

[NEW] Requirements for type A power park modules

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article Y(1)		
Article Y(2)		
Article Y(3)		
Article Y(4)		
Article Y(5)	<p>This sentence will lead to long discussions, as TSO and DSO usually do not agree on the need and application of GFM features. These will happen during the national implementation of the RfG2.0. Hence: It takes years.</p> <p>The industry can only start to develop GFM-products once the requirements and the market (volume) is clear. This could be accelerated if the PPMs are incentivized to provide it, e.g based on the named EU directive.</p> <p>Because it is so tricky to determine if GFM capability is to be achieved at the connection point, or at the terminals of the individual unit (or component), it shall not be mentioned here without context, but only where its defined in detail and with the complete context: in Art. Y (8)</p>	<p>The relevant TSO in coordination with the relevant system operator may specify that type A power park modules shall be capable of providing grid forming capability. The national Regulatory authority shall decide if such grid forming capability is subject to an ancillary service scheme in their responsibility area, especially according to non-frequency ancillary service' from EU DIRECTIVE 2019/944 of 5 June 2019.</p>
Article Y(6)		

Article Y(7)	<p>Any requirement about grid forming and synthetic inertia addresses a time scale significantly shorter than the root-mean-square time (20ms), which is the basis for all the definitions in Art. 2 The existing definitions are hence meaningless.</p> <p>To make meaningful, unequivocal specifications for the sub-cycle time domain additional definitions are compulsory. This affects at least the listed physical quantities.</p>	<p>7. The relevant system operator may specify that the activation of grid forming mode is subject to necessary adaptations to the system operator's network and operating and maintenance procedures. The Member State or the entity designated by the Member State may set the formal and substantive conditions under which the relevant system operator may conduct such specification.</p> <p>Prior to the introduction of any requirement about grid forming or synthetic inertia according to the present article, the relevant system operator in coordination with the TSO and subject to stakeholder consultation, shall publish definitions at least of the following physical quantities, so that these can be used in the sub-cycle time frame (transient) relevant for grid forming or synthetic inertia:</p> <ul style="list-style-type: none"> - voltage - current - phase and phase angle - frequency - active power - reactive power
	Only if specified and required by the system	<p>8. In case specified in accordance with Art Y(5), a power park module shall be capable of providing grid forming capability at the connection point as listed below.</p> <p>(a) Within the power park module's limits (including, but not limited to current, energy, voltage and mechanical limits), the power park module shall be capable of behaving at the terminals of the individual unit(s), or components</p>

operator these GFM capabilities shall exist.

In the text proposed by ACER its not consistent if the GFM capability shall be assessed and achieved at the terminals of the individual units (a term anyway not defined so far, but reasonable, hence should be defined in Art.2), or at the connection point.

The entire Art Y addresses also wind- and PV-based generation. These units operate most of the time below the nominal power. If grid disturbances occur the individual units can come quickly to their above mentioned limits, even though at point of connection these limits are by for not reached. Critical are here the units.

Any GFM requirement shall leave the flexibility that the requirement is met

- either within the individual generation units, giving them ne/additional capabilities,
- or with additional components, which are built in a PPM for this purpose (and possibly also for other purposes)

(ii) Where current limitation is necessary the requirements has to be in regard to a current. The voltage may be zero in extreme cases hence any requirement regarding "power" can not be met. The SO may define his priority for a contribution of active and reactive current.

added for this purpose, as a voltage source behind an internal impedance (Thevenin source), during normal operating conditions (non-disturbed grid conditions) and upon inception of a grid disturbance (including voltage, frequency and voltage phase angle disturbance). The Thevenin source is characterized by its internal voltage amplitude, voltage phase angle, frequency and internal impedance.

(b) Upon inception of a grid disturbance and while the capabilities and current limits of the individual unit(s) are not exceeded, the instantaneous AC voltage characteristics of the internal Thevenin source according to paragraph (a) shall be capable of not changing its amplitude and voltage phase angle while voltage phase angle steps or voltage magnitude steps are occurring at the connection point. The instantaneous current shall flow naturally according to the impedances between the voltage source behind an internal impedance (Thevenin source) of the individual unit(s) and the voltage at the connection point.

(c) After inception of a network disturbance in voltage magnitude, frequency or voltage phase angle, the following shall apply within the power park module's capability, including current limits and inherent energy storage capabilities of each individual unit.

(i) The relevant system operator in coordination with the TSO shall specify the temporal parameters of the dynamic performance regarding voltage control.

The sentence starting with 'Inherent energy storage' means... belongs into the Art. 2 Definitions, see proposed Def. (78)

(d) Shall be deleted. Enabling a generation unit (based on wind or PV) to have GFM capabilities is related to the applied hardware. It is not only a software switch! Hence allowing to switch between GFM- and no-GFM performance would require to install the hardware twice. It was common sense in the EG ACPPM that such double-equipment shall not be enforced by Art. Y.

(ii) Where current limitation is necessary, the relevant system operator may specify additional requirements regarding priority for a contribution of active and reactive current at the point of connection.

(iii) The power park module shall be capable of stable operation when reaching the power park module current limits, without interruption, in a continuous manner and returning to the behaviour described in paragraph (b) as soon as the limitations are no longer active. If reaching the current limit, the grid forming behaviour must be maintained for responses as specified in paragraph (b) for disturbances that require the current to vary in the opposite direction of the current limitation.

'Inherent energy storage' means... belongs into the Art. 2 Definitions.

(d) (to be deleted)

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

	Text amendment proposal (if applicable)
New provision	'Inherent energy storage' means... belongs into the Art. 2 Definitions.

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Requirements for type B power park modules

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

Includes new paragraphs

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 20(1)		
Article 20(2)	<p>Please see equivalent to Art 13 (10):</p> <p>With the wording the SO can ask for any reactive power capability, while for type C there is an outer envelope, in which the required P-Q-capability has to be.</p> <p>It is not coherent, that from type A and B can be required anything, but from type C only within certain limits.</p>	<p>with regard to reactive power capability, the relevant system operator shall have the right to specify the capability of a power park module to supply and absorb reactive power, but in no case wider than as by Art 21 Figure 8 and 9;</p>
Article 20(3)		
Article 20(4)	<p>This wording is under the condition that the modification of Art.2 Def. 33 is accepted, as proposed by ENERCON. So far the “definition” provided for inertia and synthetic inertia is useless.</p>	

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Requirements for type C power park modules

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

Includes new paragraphs

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 21(1)		
Article 21(2) [deleted]		

Article 21(2)	<p>(d) (ii) Stable operation of the U-control cant be guaranteed solely by the PPM. It also depends on the short circuit capacity at the connection point, therefore the RSO has to provide the relevant data.</p> <p>(d) (iv) DSOs usually don't want the U-control of PPMs to react within few seconds. They prefer this – depending on the local conditions – to be soft and slow. Asking for a T1 of 1 to 5s, as done in RfG1.0, is typical for the UK, but very untypical for the rest of Europe.</p> <p>Widening the range from 1 to 60 seconds allows the different DSOs to request what they need.</p> <p>(e) "power" is the wrong reference in FRT context. The residual voltage may be zero, or very close to zero, in consequence any power is then also zero. If preference for active or reactive shall be defined, this has to refer to the active or reactive current. Please note: For PPMs with grid forming capabilities the idea to prefer one or the other is incompatible. When a device is grid forming physics define this. A system operator can not ask for grid forming and define its current preference.</p>	<p>for the purposes of voltage control mode, the power park module shall be capable of contributing to voltage control at the connection point by provision of reactive power exchange with the network with a setpoint voltage covering 0,95 pu to 1,05 pu in steps no greater than 0,01 pu, with a slope having a range of at least 2 % to 7 % in steps no greater than 0,5 %. The reactive power output shall be zero when the grid voltage value at the connection point equals the voltage setpoint. Stable operation in voltage control mode operation shall be ensured based on network characteristics (minimum, normal and maximum short circuit capacity at the connection point) to be provided by the relevant system operator;</p> <p>(d) (iv) following a step change in voltage, the power park module shall be capable of achieving 90 % of the change in reactive power output within a time t1 to be specified by the relevant system operator in the range of 1 to 60 seconds, and must ...</p> <p>(e) with regard to prioritising active or reactive current contribution from PPM without grid forming capability, the relevant TSO shall specify whether active current contribution or reactive current contribution has priority during faults for which fault-ride-through capability is required. If priority is given to active current contribution, this provision has to be established no later than 150 ms from the fault inception</p>
Article 21(3)		

Article 21(4)	<p>(a) Same as commented to Art. 20: The general disagreement of TSOs and DSOs lead to this aspect being unclear, at least until the national implementation of the RfG2.0, potentially even much beyond.</p> <p>The industry cannot develop products while this specification and the expected market volume is open. In consequence this will take many years to ever arrive in the field.</p> <p>Using the term "synthetic inertia" is conditioned to a new and meaningful definition in Art. 2 Def. (33) and (34)</p> <p>With the (old) definitions existing so far in the consulted document any requirement about "inertia" and "synthetic inertia" is not acceptable.</p> <p>The "inherent energy storage" available in wind energy converters and PV plants to contribute to synthetic inertia is in very good approximation zero. Any requirement to contribute also under low frequency conditions will cause design, structure and cost changes in these units, hence leading immediately to (b).</p> <p>If (b) applies it becomes very important if the capacity of an additional storage unit in a PPM is added to the overall capacity or not. See "Whereas (9)".</p>	
---------------	---	--

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

Requirements for type D power park modules

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

Includes new paragraphs

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 22(1)		
Article 22(2)		

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

	Text amendment proposal (if applicable)
New provision	

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE II CHAPTER 4 - Requirements for offshore power park modules

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 23		
Article 24		
Article 25		
Article 26		
Article 27		
Article 28		

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

	Text amendment proposal (if applicable)
New article	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE III - Operational notification procedure for connection

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

Includes new articles

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 29		
Article 30		
Article 30a [new]		
Article 30b [new]		
Article 31	<p>Technology has to be allowed to emerge. The power system and especially the transition to more RES needs new technologies. Prototypes of new technology have to be possible in some way, at least for a limited time. Such prototypes have to meet certain minimum requirements, but not from the very first day all requirements, which would apply regularly, according to the applicable type. Equipment certificates usually can be provided only 2 years after the prototype started operation. Models shall reflect the actual performance of the new technology, hence they cannot be provided prior to all internal tests and developments being completed.</p>	<p>The operational notification procedure for connection of each new type B, C and D power-generating module shall allow the use of equipment certificates issued by an authorised certifier.</p> <p>For emerging technologies the RNA shall define a process, which allows new generation technologies to be commissioned and operated under a special Limited Operation Notification for a limited time. The technical requirements defined by the RNO shall meet at least the ones for Type A in this regulation, but may be less than for other PGM of the applicable type B, C or D respectively. Such limited operation of prototypes shall be possible without an equipment certificate and with limited requirements for the provision of simulation models.</p>

Article 32	<p>(2) (b) In the practice the “itemised statement of compliance” is a very blurry term. Recent years show that neither the RSO, nor the facility owner, know what to document how.</p> <p>To avoid misunderstandings:</p> <ul style="list-style-type: none"> - The SO shall give the format, including the level of detail he expects - The exhaustive requirements have to be met as they are written in RfG2.0 - Compliance with the non-exhaustive requirements can only be proven if they are filled with the relevant numbers by a national implementation of the RfG. <p>Please note: There are SOs in Europe that require an “itemised statement of compliance” for each generating unit with regard to RfG1.0, although most of the requirements apply at the connection point of a PPM, not at the unit.</p>	<p>(2) (b) an itemised statement of compliance in a format as specified by the relevant system operator</p> <p>(i) regarding the exhaustive requirements from this regulation;</p> <p>(ii) regarding the non-exhaustive requirement from this regulation as specified in the national implementation applied by the relevant system operator</p>
Article 33		
Article 34		

Article 35	<p>RSOs like to use generic models, as they are much more convenient for their studies, especially on big scale level (system wide). However, all generic models are less detailed than user-written models. It can be expected that the desired level of detail is not always achievable with generic models. In that case the user-written model is the way out. User-written models are as accurate as a manufacturer can provide a model.</p> <p>By experience such discussions about models and limits of accuracy have a strong tendency to delay the connection. This delay has to be avoided.</p>	<p>(3) (d) simulation models, as specified by point (c) of Article 15(6) and required by the relevant system operator;</p> <p>If generic models are required by the RNO and the accuracy of simulations with these is deemed insufficient, the RNO shall proceed with user-written models, without delaying the connection process.</p>
Article 36		
Article 37		
Article 38		
Article 39		

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

	Text amendment proposal (if applicable)
New article	

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE IV - Compliance

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 40	Especially in DSO-connected PPMs compliance testing is not common throughout the member states. It would be exaggerated for most small PPMs, specifically Type A and B.	4. If tests for compliance verification are required by the relevant system operator, the power-generating facility owner shall notify the relevant system operator of the planned test schedules and procedures to be followed for verifying the compliance of a power-generating module with the requirements of this Regulation, in due time and prior to their launch. The relevant system operator shall approve in advance the planned test schedules and procedures. Such approval by the relevant system operator shall be provided in a timely manner and shall not be unreasonably withheld.

Article 41	<p>Requesting the same level of detail from all types would be exaggerated at least for type A and B. Therefore it shall be differentiated A/B/C /D.</p> <p>(e) such studies frequently lead to long discussions, if exact quantitative compliance criteria for each steady-state and dynamic performance item under consideration are not defined.</p> <p>(6): Lack of wind is a typical reason for delay of compliance tests. This can neither be attributed to the RSO, nor to the power-generating facility owner.</p> <p>With the modified wording such a case is covered and shall not lead to unreasonable withholding of the operational notification.</p>	<p>3. The relevant system operator shall make publicly available a list of information and documents to be provided as well as the requirements to be fulfilled by the power-generating facility owner within the framework of the compliance process. The list shall be differentiated by PPM Type A/B/C/D and for type D cover at least the following information, documents and requirements:</p> <p>(...)</p> <p>(e) studies by the power-generating facility owner to demonstrate the expected steady-state and dynamic performance in accordance with the requirements set out in Chapters 5 and 6 of Title IV, together with exact quantitative compliance criteria for each steady-state and dynamic performance item under consideration of the relevant system operator;</p> <p>(6) If compliance tests or simulations cannot be carried out as required by the relevant system operator due to reasons not attributable to the power-generating facility owner , then the relevant system operator shall not unreasonably withhold the operational notification referred to in Title III.</p>
------------	--	--

Article 42	<p>requesting that "all relevant" signals are recorded is too open. Who shall decide what includes "all"?</p> <p>Why shall the PGF owners representatives be on site in any case for the entire testing period, while the SOs representatives may decide to attend remotely.</p>	<p>4. The relevant system operator may participate in the compliance testing either on site or remotely from the system operator's control centre. The relevant system operator has sole discretion to decide about its participation.</p>
Article 43		
Article 44		
Article 45		
Article 46		
Article 47		
Article 48	<p>DSOs typically don't want PPMs to test the full Q-capability in the field, as this would influence the local voltage too much and consequences for other connected parties are feared.</p> <p>The modified wording allows a RSO to test extreme Q values, but he doesn't has to go to extremes.</p>	<p>(6) (b) it shall be carried out at two reactive power set points defined by the relevant power system operator (within the maximum reactive power ranges,) and shall verify the following parameters:</p>
Article 49		
Article 50		
Article 51		
Article 52		
Article 53		
Article 54		
Article 55		
Article 56		
Article 57		

Article 58		
Article 59		

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

	Text amendment proposal (if applicable)
New article	

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE V - Derogations

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 60		
Article 61		
Article 62		
Article 63		
Article 64		
Article 65		

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

	Text amendment proposal (if applicable)
New article	

Please upload figures or tables if necessary

The maximum file size is 1 MB

[DELETED] TITLE VI - Transitional arrangements for emerging technologies

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Title VI [deleted]		

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

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 70a [new]		

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

	Text amendment proposal (if applicable)
New article	

Please upload figures or tables if necessary

The maximum file size is 1 MB

TITLE VII - Final provisions

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

Includes new articles

	Comment on the ACER draft amendments	Alternative text amendment proposal (if applicable)
Article 71		
Article 71a [new]		
Article 72		

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

	Text amendment proposal (if applicable)
New article	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Other additional provisions

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

	Text amendment proposal (if applicable)
Other new provisions	

Please upload figures or tables if necessary

The maximum file size is 1 MB

Background Documents

[NC_RfG_ACER_draft_amendments_for_PC_2023_E_07.docx](#)

Contact

acer-ele-2022-015@acer.europa.eu