

Network Codes: Consultation on Requirements for Generators (RfG) Banding Thresholds in Northern Ireland

07 April 2017



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Executive Summary

The Network Code Requirements for Generators (RfG)¹ is one of three Connection Codes which form part of the European Network Codes. It seeks to provide a clear legal framework for grid connections and facilitate electricity trading whilst ensuring system security, facilitating the integration of renewable energy and ensuring a more efficient use of the network.

The RfG ‘entered into force’ on 17 May 2016, however an implementation period is allowed for. The RfG only applies to generators that have concluded a final and binding contract for the purchase of their main generating plant after 17 May 2018. Article 4(3) allows TSOs to consider retrospection subject to a Cost Benefit Analysis (CBA), however SONI does not intend to seek retrospection at this time.

The RfG defines the requirements applicable to new generators with a Maximum Capacity² of 800 W or greater. Generators are placed into one of four ‘type’ categories A-D which provide for a sliding scale of technical capabilities to support System Operators. These categories are as defined in Article 5 (see Appendix 1) and are based on:

- the synchronous area;
- the maximum capacity of the power generating module (PGM); and
- the connection point voltage level.

As part of the national implementation of RfG, the relevant TSO of each member state needs to set banding thresholds within these maximum values. TSOs can either apply the maximum MW boundaries as defined in Table 1 of Article 5 or, where it is reasonable (e.g. for reasons of system security), choose lower values.

Article 5 (3) requires the TSO to carry out a public consultation on these thresholds. This consultation is required to last for a period of at least one month (see Article 10 in Appendix 2).

This document contains SONI’s proposals for the banding thresholds for Ireland/Northern Ireland. Due to its system size, the threshold limits as set in Article 5 of the RfG for Ireland and Northern Ireland are significantly smaller than for the other four synchronous areas. SONI considers the limits provided in Article 5 to be adequate. In summary, at this time SONI does not propose to reduce the lower boundary of the bands below the maximum limits allowed for in Article 5.

¹ <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0631&from=EN>

² Maximum Capacity is the maximum continuous active power which a power generating module can produce, less any demand associated solely with facilitating the operation of that power generating module and not fed into the network. This is not the same as Maximum Export Capacity.

SONI is seeking and welcomes industry views on these proposals. Consultation responses shall be submitted to gridcode@soni.ltd.uk by **15/05/2017** with the subject title “RfG Banding Threshold Consultation”.

Following this consultation SONI shall take into account the stakeholder inputs and update the proposals as appropriate. The updated proposals shall then support national discussion on the RfG requirements that have parameters that are non-exhaustive. This means that while the requirement is in the RfG, the specific parameters relating to that requirement are left up to individual system operators to set. These parameters tend to be different across the generation types and so may require revisiting the threshold levels. Following this discussion, a final submission shall be made to the regulatory authority (UREGNI) for approval.

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1. Background

A high level summary of the technical requirements for each Type are shown in figure 1 below. This is for illustrative purposes only and the precise details are set out in Articles 13-28 of the RfG.

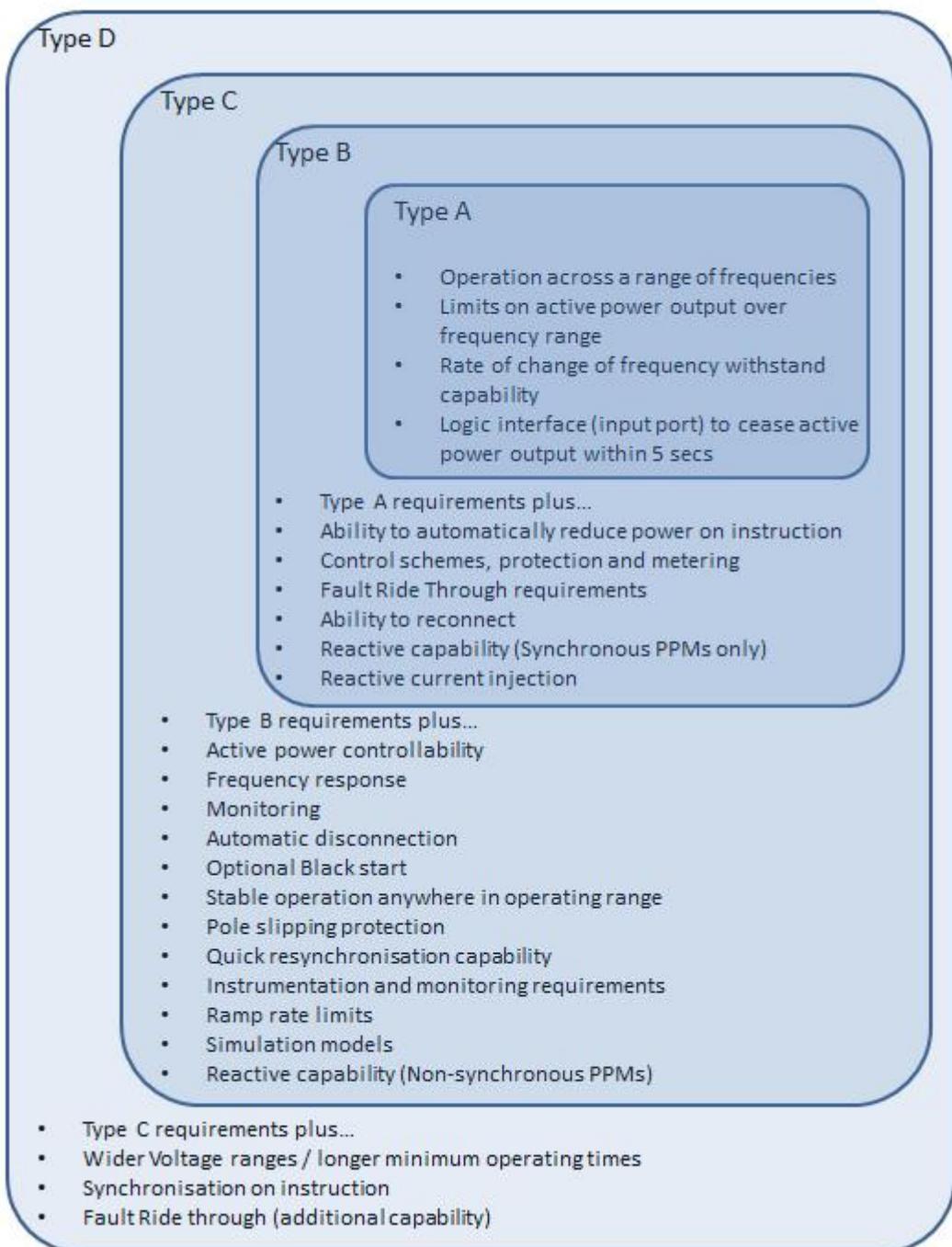


Figure 1 Requirements by type

Further detail is shown in Appendix 3.

As per Article 23, ‘offshore power park modules’ are power park modules that are offshore and have an AC offshore connection point. In that case they will not be designated with a type A-D band.

Besides the type A-D classification, the requirements are further categorized as follows:

- requirements applicable to all PGMs;
- requirements applicable to synchronously connected PGMs;
- requirements applicable to Power Park Modules (PPMs), which are PGM either non-synchronously connected to the network or connected through power electronics; and
- requirements applicable to AC connected offshore Generation.

For example, the Fault Ride Through (FRT) capability requirement defined by RfG is different for PPM and synchronously connected PGM.

Interaction with other Network Codes

It should be noted that the bands are not only applicable to the RfG. The Emergency and Restoration Network Code and the System Operation Guidelines refer to Significant Grid Users. These are composed of both generation and demand users, where the relevant generation users are

- Existing PGMs of Type B, C, D (as per bands pursuant to RfG)
- New PGMs of Type B,C, and D

Collaboration

As required under Article 5(3) SONI and EirGrid together have liaised with the Distribution System Operator (DSO) in Ireland (ESB Networks) and the Distribution Network Operator (DNO) in Northern Ireland (NIE Networks) in the preparation of the banding threshold proposals and this consultation document. Both EirGrid and SONI are proposing identical threshold values for Ireland and Northern Ireland respectively. ESB Networks and NIE Networks have indicated to EirGrid and SONI that they are in agreement with the proposals.

Periodic Review

In order to take into consideration of the evolution of power supply systems and the corresponding change of system characteristics and performance, the RfG allows for the periodic review of the threshold points between the types of generators.

The threshold points may be changed based on the evolution of the system due to different reasons. These include but are not limited to:

- increasing penetration of renewable energy sources usually combined with a change from bulk generation by synchronous generators at transmission level towards embedded generation at distribution level (often connected through power electronics), and
- increased cross border reliance.

The RfG sets out in Article 5(3) that the thresholds cannot be changed more frequently than every three years after the previous proposal. Any proposed changes would be subject to consultation and would apply by default to new generators going forward from a specific date. Banding changes can also apply retrospectively but only where the process for retrospective application (Article 4.3 of RfG) is followed. In this case only, and in accordance with Article 4.3, a CBA would be required, but only to apply any requirements from a more onerous band to existing generators that now fall into that band.

The TSOs on the island of Ireland in conjunction with the distribution system operators (DSOs) on the island of Ireland will continually monitor the expected future energy mix. If appropriate, the TSOs may propose to amend the banding following the three year period.

Definition of Maximum Capacity

In the context of consideration of the banding threshold, it is important to note the definition of Maximum Capacity in the RfG:

'maximum capacity' or 'Pmax' means the maximum continuous active power which a power-generating module can produce, less any demand associated solely with facilitating the operation of that power-generating module and not fed into the network as specified in the connection agreement or as agreed between the relevant system operator and the power-generating facility owner;

The RfG requirements and the band into which generators will fall will be based on Maximum Capacity as per the definition above. Currently requirements are applied based on Maximum Export Capacity (MEC) or Registered Capacity.

All generation subject to the RfG will be considered based on the actual installed capacity less house load. **This represents a fundamental change to how requirements are applied to generators and should be fully understood by users.**

The new definition of Maximum Capacity or Pmax, as defined in RfG, will need to be included in both the Grid Code and Distribution Code.

2. Future Capacity Mix

SONI has reviewed the mix of Power Generating Modules (PGMs) by capacity that have are contracted to connect or have offers to connect and have energisation dates from 2019 onwards. With the closure of the Northern Ireland Renewables Obligation (NIRO) it is expected that the majority of small scale onshore wind generation that is expected to connect will have procured their plant prior to May 2018. New generation expected to procure plant post May 2018 is primarily over 10 MW in size.

3. Grid and Distribution Codes applicability levels and reconciliation of new and old “Types” in the Distribution Code

The existing Grid Code is applicable to all centrally dispatched generating units and all transmission connected generating units. The existing Distribution Code is applicable to all generators connecting to the distribution system. The applicability of different sections of the codes depends on different generator technologies and registered capacity MW thresholds.

The current Distribution Code refers to Types A, B & C:

- Type A – All Induction Generating Units;
- Type B – Synchronous Generating Units with a Registered Capacity from 100 kW to under 5 MW; and Generating Units of all types connected in part or in total through convertor technology with a Registered Capacity from 100kW to under 5 MW;
- Type C – Generating Units with a Registered Capacity of 5 MW and above.

SONI and NIE Networks are minded to replace the three Types described in the existing Distribution Code with the four new Types as described in the RfG. The WFPS settings schedule will also require an update to align with the RfG.

4. Banding Proposals

Article 5 of the RfG defines the application of the thresholds contained in Table 1 of that Article based on the capacity of PGMs. Article 5 is reproduced in Appendix 1 below.

Article 5 (2) (d) states that any generator connected at or above 110 kV is automatically a Type D generator irrespective of its size.

Generators connected below 110 kV and with maximum capacity (Pmax) of 800 W or more (0.8 kW) are split into Types A, B, C and D depending on their size. Each type has a lower boundary and an upper boundary. The RfG provides the range within which these boundaries can be set. It defines the maximum MW value for the lower boundary of the MW range for each ‘Type’. Different maximum limits are provided for each of the five synchronous areas in Europe.

For Ireland and Northern Ireland the limits for connection at voltage levels less than 110 kV are as follows

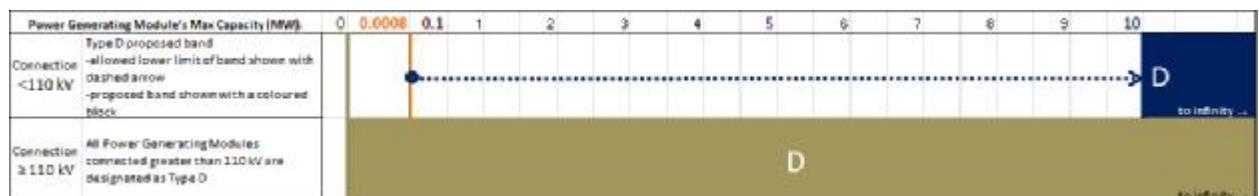
<i>Synchronous areas</i>	<i>Limit for maximum capacity threshold from which a power generating module is of type B</i>	<i>Limit for maximum capacity threshold from which a power generating module is of type C</i>	<i>Limit for maximum capacity threshold from which a power generating module is of type D</i>
<i>Ireland and Northern Ireland</i>	<i>0.1 MW</i>	<i>5 MW</i>	<i>10 MW</i>

This table is explained in further detail below, along with the SONI proposal for Northern Ireland.

TYPE D

PGMs connected at 110 kV or higher are automatically categorised as Type D regardless of size. For generation connected at voltage levels less than 110 kV the Type D band has no upper limit. Its lower limit can be anywhere between 800 W and 10 MW.

SONI proposes to set this lower limit of the band to 10 MW in order not to impose the more onerous Type D requirements on generators with a Maximum Capacity of less than 10 MW.



TYPE C

For PGMs connected at voltage levels less than 110 kV the upper limit of the Type C band is automatically set by the lower limit of the band for Type D, in this case 10 MW. Its lower limit can be anywhere between 800 W and 5 MW.

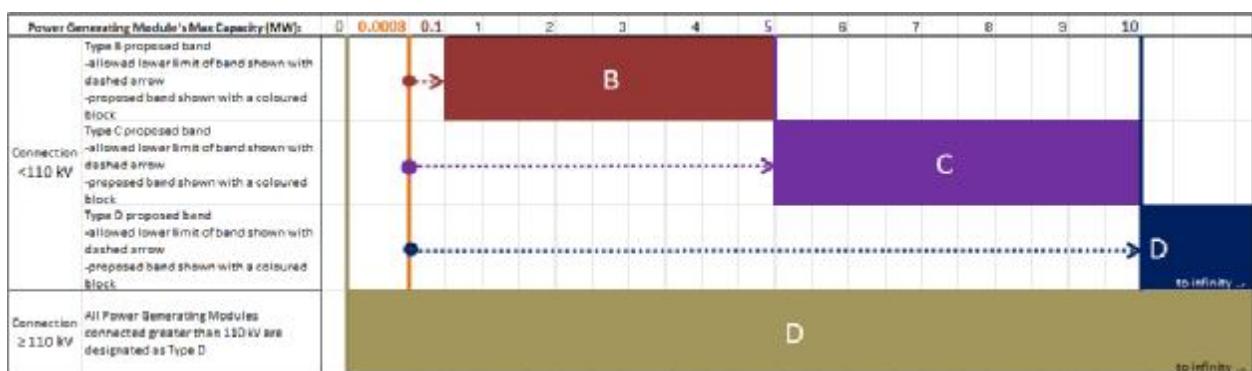
SONI proposes to set this lower limit of the band to 5 MW in order not to impose the Type C requirements on generators with a Maximum Capacity of less than 5 MW.



TYPE B

For PGMs connected at voltage levels less than 110 kV the upper limit of the Type B band is automatically set by the lower limit of the band for Type C, in this case 5 MW. Its lower limit can be anywhere between 800 W and 0.1 MW.

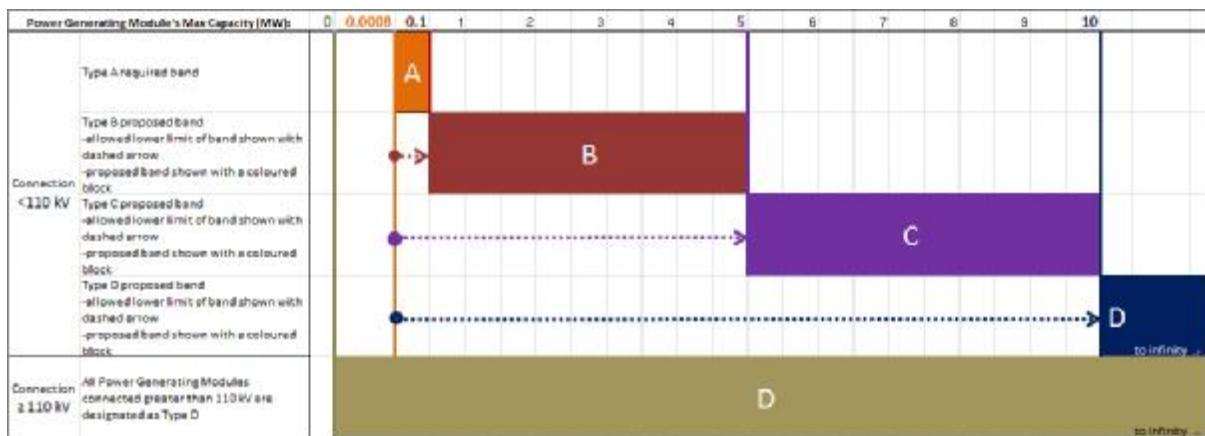
SONI proposes to set this lower limit of the band to 0.1 MW in order not to impose the Type B requirements on generators with a Maximum Capacity of less than 0.1 MW.



TYPE A

For PGMs connected at voltage levels less than 110 kV the upper limit of the Type A band is automatically set by the lower limit of the Type B, in this case 0.1 MW. Its lower limit is set as per Article 5(2)(a) at 800 W (or 0.8 kW or 0.0008 MW).

Hence there is no proposal in this consultation for type A, as the lower limit is set by the RfG, and the upper limit is automatically set by the lower limit of Type B.



5. Discussion

In considering the thresholds to be applied SONI observed the advice contained in the European Network of Transmission System Operators – Electricity (ENTSO-E) implementation guidelines for RfG³. The guidelines recommend the following factors be considered when determining the thresholds

- Maintaining requirements which already exist from previous national regulations and have proven their need and benefit through operational experience in normal and emergency network situations.
- Taking into consideration the national generation portfolio characteristics and its evolution (e.g. level of penetration of renewable energy sources)
- Taking into consideration national system characteristics and its evolution (e.g. rural/urban conditions, density of load and generation)
- ensuring that requirements needed for guaranteeing security of supply will be fulfilled considering the peculiarities of each national systems (e.g. dependency on power imports from abroad)

In particular, in reference to the first bullet point, SONI have proposed the thresholds to equal the existing thresholds that are applied in the Grid and Distribution codes today or, where that is not possible, to apply the closest threshold allowable under the RfG.

For information, there are additional considerations listed in the implementation guidelines for choosing the thresholds between C & D, B & C and A & B and SONI has considered that advice when selecting these thresholds.

SONI has also taken account of the work done under the DS3 project in recent years which examined future generation portfolios and the capabilities needed from this future portfolio .

All future transmission connected generation and distribution connected generation greater than 110 kV will be automatically considered as Type D, and hence have the technical capabilities and be capable of providing the full suite of services as determined by the RfG. This must be acknowledged in determining whether the lower limits of Type D (for voltage levels of less than 110 kV only), Type C and Type B should be dropped below the maximum allowed values, and hence demanding these requirements for generators with a lower maximum capacity. The additional costs to generators would need to be offset against network savings.

³ <https://www.entsoe.eu/major-projects/network-code-implementation/cnc/Pages/default.aspx> in particular the guidance document named “Making non-mandatory requirements at European level mandatory at national level”

C/D Threshold

The C/D threshold proposal is 10 MW. It is not considered necessary to lower this to less than 10 MW.

In any event the majority of Type D-only requirements actually only apply to Type D \geq 110 kV. For example the Fault Ride Through requirements for Type D are stated in Article 16(3)(a)(i), however for Type Ds $<$ 110 kV, the user is redirected back to Tables 3.1 and 3.2 in Article 14(3). These requirements are for types B, C, and D <110 kV.

B/C Threshold

The B/C threshold proposal is 5 MW. Currently active power control and frequency control is not requested of distribution connected wind generation connected less than 5 MW:

In order to be as consistent as possible with the existing Distribution Code, it is not proposed to lower the B/C threshold to less than 5 MW. Lowering this to less than 5 MW is not necessary and is considered inappropriate by SONI.

A/B Threshold

The A/B threshold proposal is 0.1 MW. It is not considered necessary to lower this to less than 0.1 MW. Generation between 0.0008 MW and 0.1 MW will be set as Type A. Requirements for Type B such as Fault Ride Through are not required at this time from generation of this size as there will be sufficient generation with maximum capacity of greater than 0.1 MW that will provide this. Should the future expected generation capacity mix change substantially in the coming years, this threshold may need to be reviewed. In addition it would be particularly onerous for generation of this size to provide this capability. Furthermore active power reduction and observability is not necessary for generation of this size.

6. Continuing the conversation

Following this consultation, SONI shall take into account the stakeholder inputs and update the banding threshold proposals if necessary. The updated proposals shall then support national discussion on the non-exhaustive requirements. Following this discussion, a final submission shall be made to the respective regulatory authority (CER/UREGNI) for approval.

We will be accepting input on our proposed banding thresholds until **15/05/2017**. In particular we would like your views on the following:

- Do you agree with the banding proposals as set out in this paper?
- Do you believe that lower thresholds should have been considered?
- If yes, please explain what levels you would have proposed?
- If yes, please explain why including any costs/benefits/savings you believe will materialise from your proposal?
- If yes, do you believe your levels facilitate Grid and Distribution Code objectives?
- Do you agree with the removing of the existing Types A, B and C in the NIE Networks Distribution Code?
- Are there any other considerations you believe the TSO should consider in finalising the proposals?
- Any other comments.

Keep the following in mind whilst preparing your response:

- SONI does not intend on applying the requirements retrospectively at this time;
- Changes cannot be made for three years;
- Requirements are only applicable to generation that have concluded a final and binding contract for the purchase of the main generating plant after 17th May 2018; and
- RfG requirements are based on Maximum Capacity and not Maximum Export Capacity (MEC).

We look forward to receiving your feedback and using it to improve our proposal. Please email your submission to gridcode@soni.ltd.uk with the subject title “RfG Banding Threshold Consultation”.

If you require any further information please email SONI at gridcode@soni.ltd.uk or NIE Networks at lsg.nto@nienetworks.co.uk.

Appendix 1 - Article 5

Article 5, sections 2, 3 and 4 state⁴:

“2. Power generating modules within the following categories shall be considered as significant:

- (a) connection point below 110 kV and maximum capacity of 0.8 kW or more (type A);
- (b) connection point below 110 kV and maximum capacity at or above a threshold proposed by each relevant TSO in accordance with the procedure laid out in paragraph 3 (type B). This threshold shall not be above the limits for type B power generating modules contained in Table 1;
- (c) connection point below 110 kV and maximum capacity at or above a threshold specified by each relevant TSO in accordance with paragraph 3 (type C). This threshold shall not be above the limits for type C power generating modules contained in Table 1; or
- (d) connection point at 110 kV or above (type D). A power generating module is also of type D if its connection point is below 110 kV and its maximum capacity is at or above a threshold specified in accordance with paragraph 3. This threshold shall not be above the limit for type D power generating modules contained in Table 1.

Synchronous areas	Limit for maximum capacity threshold from which a power generating module is of type B	Limit for maximum capacity threshold from which a power generating module is of type C	Limit for maximum capacity threshold from which a power generating module is of type D
Continental Europe	1 MW	50 MW	75 MW
Great Britain	1 MW	50 MW	75 MW
Nordic	1.5 MW	10 MW	30 MW
Ireland and Northern Ireland	0.1 MW	5 MW	10 MW
Baltic	0.5 MW	10 MW	15 MW

Table 1: Limits for thresholds for type B, C and D power generating modules

3. Proposals for maximum capacity thresholds for types B, C and D power generating modules shall be subject to approval by the relevant regulatory authority or, where applicable, the Member State. In forming proposals the relevant TSO shall coordinate with adjacent TSOs and DSOs and shall conduct a public consultation in accordance with Article 10. A proposal by the relevant TSO to change the thresholds shall not be made sooner than three years after the previous proposal.

4. Power generating facility owners shall assist this process and provide data as requested by the relevant TSO.”

⁴ <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0631&from=EN>

Appendix 2 - Article 10

Article 10 states⁵

“Public consultation

1. Relevant system operators and relevant TSOs shall carry out consultation with stakeholders, including the competent authorities of each Member State, on proposals to extend the applicability of this Regulation to existing power-generating modules in accordance with Article 4(3), for the proposal for thresholds in accordance with Article 5(3), and on the report prepared in accordance with Article 38(3) and the cost-benefit analysis undertaken in accordance with Article 63(2). The consultation shall last at least for a period of one month.

2. The relevant system operators or relevant TSOs shall duly take into account the views of the stakeholders resulting from the consultations prior to the submission of the draft proposal for thresholds, the report or cost benefit analysis for approval by the regulatory authority or, if applicable, the Member State. In all cases, a sound justification for including or not the views of the stakeholders shall be provided and published in a timely manner before, or simultaneously with, the publication of the proposal.”

⁵ <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0631&from=EN>

Appendix 3: Requirements by Type

NC RfG requirements regarding generators type A, B, C, D

Source Entsoe Implementation Guideline Document (IGD)

https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_I GD_Selecting%20national%20MW%20boundary_for%20publication.pdf?Web=1

General Requirements:

Title	Requirement type	Type A	Type B	Type C	Type D
FREQUENCY RANGES	Frequency stability	X	X	X	X
LIMITED FREQUENCY SENSITIVE MODE (OVERFREQUENCY)	Frequency stability	X	X	X	X
RATE OF CHANGE OF FREQUENCY WITHSTAND CAPABILITY	Frequency stability	X	X	X	X
CONSTANT OUTPUT AT TARGET ACTIVE POWER	Frequency stability	X	X	X	X
MAXIMUM POWER REDUCTION AT UNDERFREQUENCY	Frequency stability	X	X	X	X
AUTOMATIC CONNECTION	Frequency stability	X	X	X	X
REMOTE SWITCH ON/OFF	Frequency stability	X	X		
ACTIVE POWER REDUCTION	Frequency stability		X		
ACTIVE POWER CONTROLLABILITY AND CONTROL RANGE	Frequency stability			X	X
DISCONNECTION OF LOAD DUE TO UNDERFREQUENCY	Frequency stability			X	X
FREQUENCY RESTORATION CONTROL	Frequency stability			X	X
FREQUENCY SENSITIVE MODE	Frequency stability			X	X
LIMITED FREQUENCY SENSITIVE MODE (UNDERFREQUENCY)	Frequency stability			X	X
MONITORING OF FREQUENCY RESPONSE	Frequency stability			X	X
CONTROL SCHEMES AND SETTINGS	General system management		X	X	X
INFORMATION EXCHANGE	General system management		X	X	X
PRIORITY RANKING OF PROTECTION AND CONTROL	General system management		X	X	X
TRANSFORMER NEUTRL-POINT TREATMENT	General system management			X	X
ELECTRICAL PROTECTION SCHEMES AND SETTINGS	General system management		X	X	X
INSTALLATION OF DEVICES FOR SYSTEM OPERATION AND/ OR SECURITY	General system management			X	X
INSTRUMENTATION FOR FAULT AND DYNAMIC BEHAVIOUR RECORDING	General system management			X	X
LOSS OF STABILITY	General system management			X	X
RATE OF CHANGE OF ACTIVE POWER	General system management			X	X
SIMULATION MODELS	General system management			X	X
SYNCHRONISATION	General system management				X
AUTO RECLOSURES	Robustness of Generating Units			X	X
STEADY-STATE STABILITY	Robustness of Generating Units			X	X
RECONNECTION AFTER AN INCIDENTAL DISCONNECTION DUE TO A NETWORK DISTURBANCE	System restoration		X	X	X
BLACK START	System restoration			X	X
CAPABILITY TO TAKE PART IN ISOLATED NETWORK OPERATION	System restoration			X	X
QUICK RE-SYNCHRONISATION	System restoration			X	X
HIGH/LOW VOLTAGE DISCONNECTION	Voltage stability			X	
VOLTAGE RANGES	Voltage stability				X

Synchronous generating modules requirements:

Title	Requirement type	Type A	Type B	Type C	Type D
POST FAULT ACTIVE POWER RECOVERY	Robustness of Generating Units		X	X	X
FAULT RIDE THROUGH CAPABILITY OF SYNCHRONOUS GENERATORS CONNECTED BELOW 110 kV	Robustness of Generating Units		X	X	
FAULT RIDE THROUGH CAPABILITY OF SYNCHRONOUS GENERATORS CONNECTED AT 110 kV OR ABOVE	Robustness of Generating Units				X
CAPABILITIES TO AID ANGULAR STABILITY	Robustness of Generating Units				X
VOLTAGE CONTROL SYSTEM (SIMPLE)	Voltage stability		X	X	
REACTIVE POWER CAPABILITY (SIMPLE)	Voltage stability		X		
REACTIVE POWER CAPABILITY AT MAXIMUM ACTIVE POWER	Voltage stability			X	X
REACTIVE POWER CAPABILITY BELOW MAXIMUM ACTIVE POWER	Voltage stability			X	X
VOLTAGE CONTROL SYSTEM	Voltage stability				X

PPMs requirements:

Title	Requirement type	Type A	Type B	Type C	Type D
SYNTHETIC INERTIA CAPABILITY	Frequency stability			X	X
POST FAULT ACTIVE POWER RECOVERY	Robustness of Generating Units		X	X	X
FAULT RIDE THROUGH CAPABILITY OF POWER PARK MODULES CONNECTED BELOW 110 kV	Robustness of Generating Units		X	X	X
FAULT RIDE THROUGH CAPABILITY OF POWER PARK MODULES CONNECTED AT 110 kV OR ABOVE	Robustness of Generating Units				X
REACTIVE CURRENT INJECTION	Voltage stability		X	X	X
REACTIVE POWER CAPABILITY (SIMPLE)	Voltage stability		X		
PRIORITY TO ACTIVE OR REACTIVE POWER CONTRIBUTION	Voltage stability			X	X
REACTIVE POWER CAPABILITY AT MAXIMUM ACTIVE POWER	Voltage stability			X	X
REACTIVE POWER CAPABILITY BELOW MAXIMUM ACTIVE POWER	Voltage stability			X	X
REACTIVE POWER CONTROL MODES	Voltage stability			X	X
POWER OSCILLATIONS DAMPING CONTROL	Voltage stability			X	X