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

07 April 2017

EIRGRID

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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 EirGrid does not intend to seek retrospection at this time.

The RfG defines the requirements applicable to new generators with a Maximum Capacity[2] 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 EirGrid'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. EirGrid considers the limits provided in Article 5 to be adequate. In summary, at this time EirGrid 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.

EirGrid is seeking and welcomes industry views on these proposals. Consultation responses shall be submitted to GridCode@eirgrid.com by 15/05/2017 with the subject title “RfG Banding Threshold Consultation”.

Following this consultation EirGrid 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 (CER) for approval.

Contents

Contents

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.

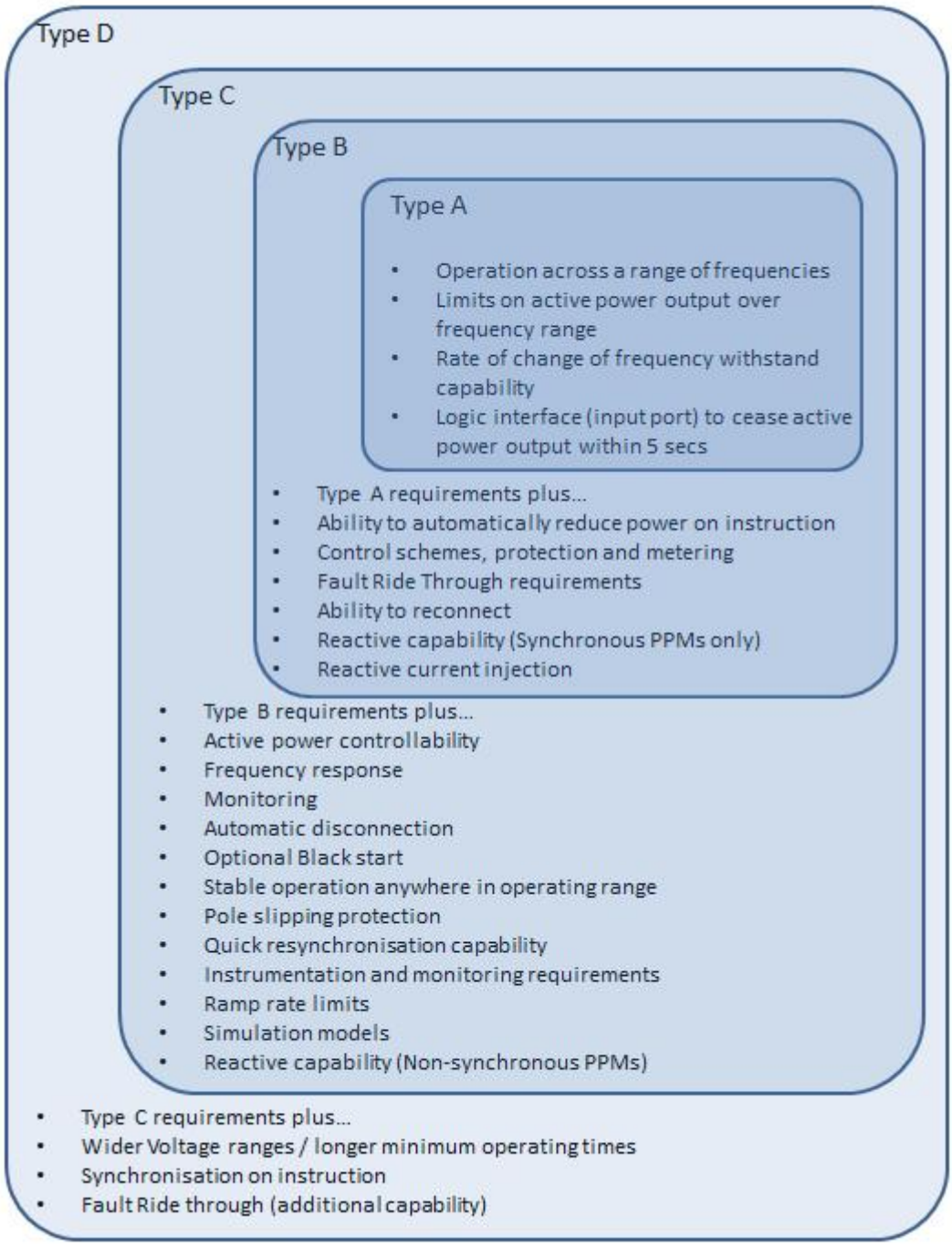


Figure 1Requirements by type

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) EirGrid and SONI 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

EirGrid 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. Over 85% of expected new generation will be automatically categorised as Type D as it is either transmission connected or distribution connected but greater than 10 MW. Further breakdown by size can be seen in figure 2 below.

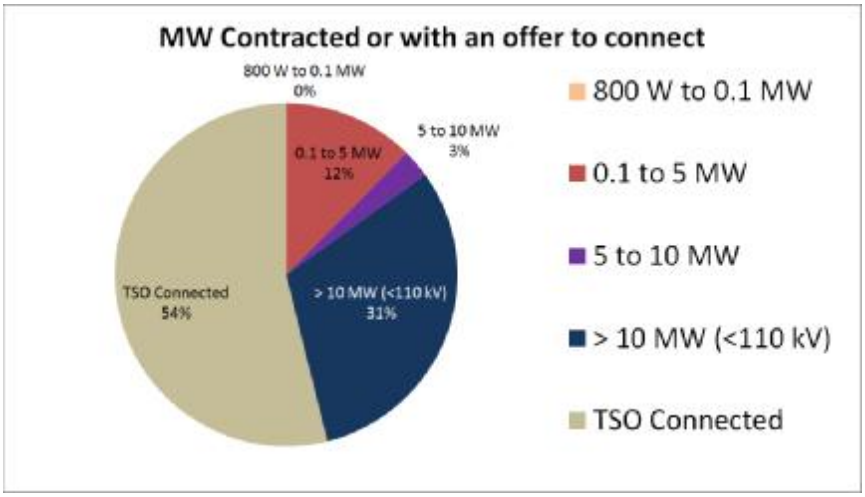


Figure 2 This chart shows the mix of generation by MEC expected to connect from 2019 onwards. Note these figures are based on MEC which will differ slightly from Maximum Capacity, however are deemed sufficient for this level of analysis. Whilst 800 W to 0.1 kW is shown at 0% it is in fact higher but due to rounding only shows at 0%

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 registered capacity MW thresholds and in the case of the Distribution Code the topology type.

The current Distribution Code refers to Topology Types, types A, B, C, D, and E. Reconciliation of the newly defined RfG "Types" A, B, C , and D, with the pre-existing Types A, B, C, D, and E is required. It is proposed to deal with these issues in a manner that will minimise the inevitable scope for confusion amongst users.

The origin of the current Distribution Code 'Types' is a principle that stemmed from the need to have differing requirements for differing network connection topologies. One

prominent example of their use was that of reactive power requirements, the capability of which is also an RFG requirement.

ESBN and EirGrid are minded that it is therefore appropriate to retain sub-divisions for various topologies and

- retain the application of a number of existing provisions, about which the RfG is silent, to various topologies;
- apply the new RfG provisions to only a subset of the topologies, where the latitude to do so is allowed for by the RfG.

For the avoidance of doubt, where an RfG requirement is mandatory across a given RfG Type, this will be respected and applied to all topologies, and not only to a subset.

ESBN and EirGrid are therefore minded to re-badge the existing Distribution Code Types A to E, to the newly named "Topologies 1-5". The definitions of these topologies will remain broadly as per the current ESBN Distribution Code but the opportunity will be taken to clean up the diagrams and text where more clarity can be brought.

The proposed approach is best illustrated by example. In the current Distribution Code, Table 6 summarises the application of the existing requirements for wind farms to the existing "Types", and is reproduced below in Appendix 4a. An illustrative sample of the proposed re-working of this table is shown in Appendix 4b.

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

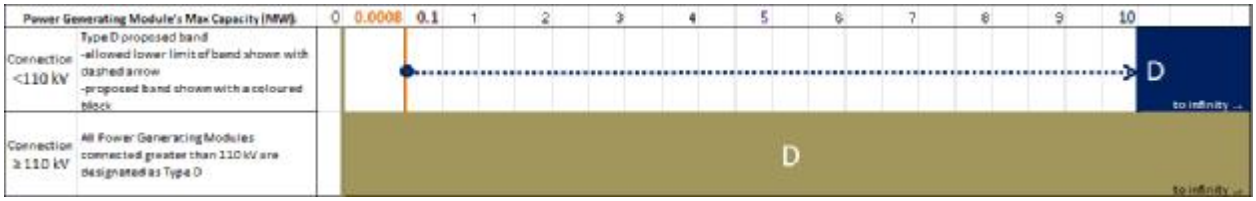
Synchronous areas	***Limit for maximum capacity threshold from which a power generating module is of type B***	***Limit for maximum capacity threshold from which a power generating module is of type C***	***Limit for maximum capacity threshold from which a power generating module is of type D***
Ireland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

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

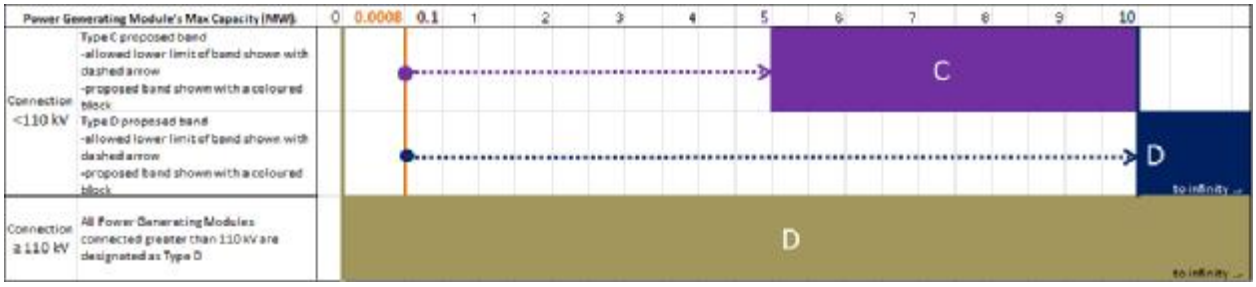
EirGrid proposes to set this lower limit of the band to 10 MW in order not to impose the more onerous Type D requirements on generators with a Maximum Capacity of less than 10 MW.



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.

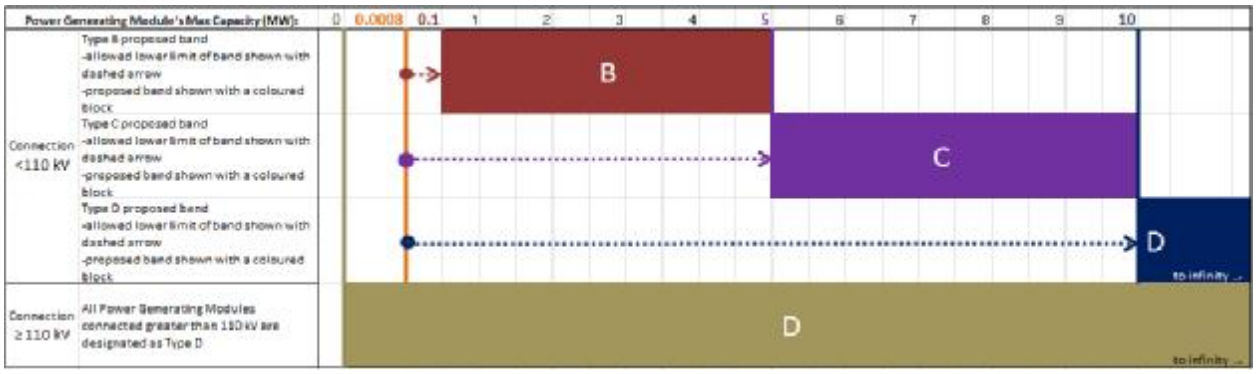
EirGrid proposes to set this lower limit of the band to 5 MW in order not to impose the Type C requirements on generators with a Maximum Capacity of less than 5 MW.



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.

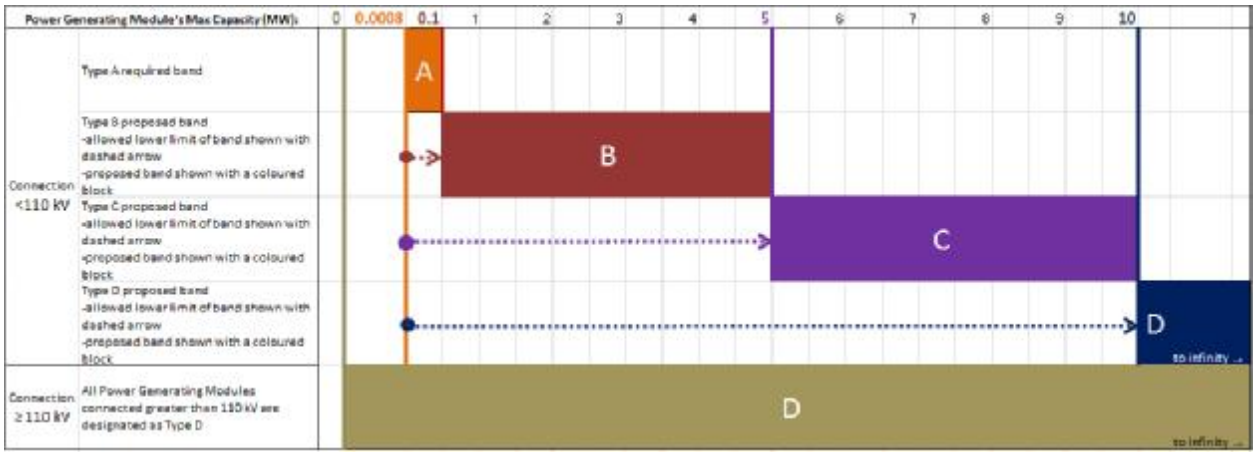
EirGrid proposes to set this lower limit of the band to 0.1 MW in order not to impose the Type B requirements on generators with a Maximum Capacity of less than 0.1 MW.



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 EirGrid observed the advice contained in the European Network of Transmission System Operators – Electricity (ENTSO-E) implementation guidelines for RfG[3]. 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, EirGrid 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 EirGrid has considered that advice when selecting these thresholds.

EirGrid 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 ≥ 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 EirGrid.

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. Banding Summary

Should the proposed thresholds be adopted the chart in Figure 3 below shows the spread of the expected types for the future plant subject to the RfG.

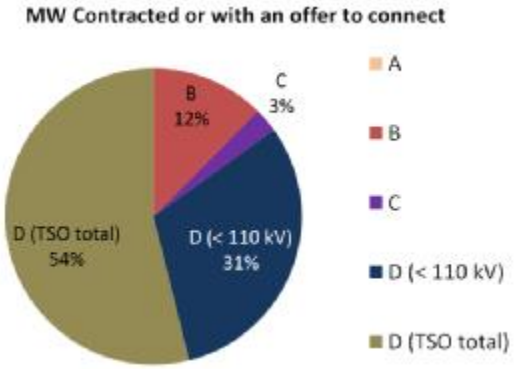


Figure 3 Breakdown by type in Ireland should the proposal be accepted

7. Review of threshold for Type Testing of generation

RfG creates a number of new requirements for small scale and micro generation. We received feedback at the European Stakeholder Forum that there are concerns about how these requirements will be monitored and tested. Currently, the process of connecting micro-generation is covered by the document “Conditions Governing the Connection and Operation of Micro-generation”. The technical thresholds here are:

- 25A at low voltage [230V], when the DSO network connection is single-phase;
- 16A at low voltage [230V], when the DSO network connection is three-phase.

In this regime, an “inform and fit” process is employed and provision of a Type –Test certificate of conformance to EN 50438, with Republic of Ireland settings, is deemed sufficient.

Any generator greater than these sizes has to formally apply for a connection and will in due course, be subject to an individual on-site witness test of the relevant generator interface protection.

ESB Networks does not propose to make any changes to the threshold up to which the inform-and-fit process applies, and beyond which a generator must apply for a connection.

ESB Networks is considering extending the threshold for the use of Type-test certification to beyond the range specified above. ESB Networks is considering a new threshold of 50kW and would welcome feedback on this consideration as part of this consultation process.

8. Continuing the conversation

Following this consultation, EirGrid 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 have any views on the general approach on the extension of the threshold of type-testing as described in Section 7?
- Do you have any views on the renaming of the topologies from Types A-E to Topologies 1-6?
- 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:

- EirGrid/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@eirgrid.com with the subject title “RfG Banding Threshold Consultation”.

If you require any further information please email EirGrid at gridcode@eirgrid.com or ESB Networks at DistCodePanel@esb.ie.

Appendix 1 - Article 5

Article 5, sections 2, 3 and 4 state[4]:

"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 states[5]

"**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_IGD_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

Appendix 4a Table 6 in Existing Distribution Code

Reproduction of Table 6 in existing Distribution Code

Table 6 indicates how the various requirements outlined in **DCC**11, will apply to the connection types described above. In addition, centrally dispatched wind farms must comply with **DCC**10.5.1a. For avoidance of doubt, the **MW** shown in Table 6 refer to:

1. The **MW** of generation of an individual wind farm; or
2. The sum of the **MW** of generation of **Contiguous Wind Farm Site** that are not deemed to be independent.

TABLE 6 – APPLICABILITY MATRIX

	Section	TYPE A	TYPE B	TYPE C	TYPE D	TYPE E
Fault Ride-Through	DCC11.2	All	≥ 5 MW	≥ 5 MW	≥ 5 MW	≥ 5 MW
FREQUENCY						
Tolerance over Frequency Range	DCC11.3.1	All	All	All	All	All
Participation in High Frequency Control	DCC11.3.2.3	All	≥5 MW	≥5 MW	≥5 MW	≥5 MW
Participation in Low Frequency Control	DCC11.3.2.3	All	≥5 MW	≥5 MW	≥5 MW	≥5 MW
Adherence to Maximum Ramp Rates	DCC11.3.4	All	≥5 MW	≥5 MW	≥5 MW	≥5 MW
Active Power Control Participation	DCC11.3.2.2	All	≥5 MW	≥5 MW	≥5 MW	≥5 MW
VOLTAGE						
Voltage Control	DCC11.4 DCC11.5.2.3	All	≥5 MW	N/A	N/A	N/A
Voltage Range	DCC11.4.2.1	All	N/A	N/A	N/A	N/A
Power Factor	DCC11.4.3	N/A	< 5MW	All	All	All
Reactive Power Range	DCC11.4.5	All	≥5 MW	N/A	N/A	N/A
SIGNALS/COMMUNICATIONS/CONTROL						
Signal List 1	DCC11.5.1.1	All	≥5 MW	≥5 MW	N/A	N/A
Signal List 2	DCC11.5.1.2	N/A	N/A	N/A	≥5 MW	≥5 MW
Signal List 3: Availability	DCC11.5.1.3	All	≥5 MW	≥5 MW	≥5 MW	≥5 MW
Signal List 4: Active Power Control	DCC11.5.1.4	All	≥5 MW	≥5 MW	≥5 MW	≥5 MW
Signal List 5: Frequency Control	DCC11.5.1.5	All	≥5 MW	≥5 MW	≥5 MW	≥5 MW
Signal List 6: Meteorological Data	DCC11.5.1.6	All	≥10 MW	≥10 MW	≥10 MW	≥10 MW
Signal List 7: DSO SCADA Signals	DCC11.5.1.7	N/A	≥2 MW <5 MW[6]	≥2 MW <5 MW[2]	≥2 MW <5 MW[2]	≥2 MW <5 MW[2]
Ability to Accept Control Signal- Active Power Control	DCC11.5.2.1	All	≥5 MW	≥5 MW	≥5 MW	≥5 MW
Ability to Accept Control Signal- Frequency Control Curve Mode Change	DCC11.5.2.2	All	≥5 MW	≥5 MW	≥5 MW	≥5 MW
Ability to Accept Control Signal- Voltage Control	DCC11.4.1 DCC11.4.2	All	≥5 MW	N/A	N/A	N/A
Installation of recloser at the WFPS site for network Protection	DCC11.5.2.8	N/A	All Medium Voltage Connections			

[6] In certain circumstances, depending on future changes to the network connection, topology, the amount of embedded generation on the particular network and system reasons, generators with an MEC <2MVA may be required to provide telecommunication infrastructure for SCADA.

	Section	TYPE A	TYPE B	TYPE C	TYPE D	TYPE E
Ability to receive Network Operator Initiated Shutdown command from DSO via DSO RTU[7] **or** **ability to be remotely disconnected by DSO via device located at or near WFPS[8]**	DCC11.5.2.4	N/A	Medium Voltage Connections ≥ 2MW and <5MW			
Ability to receive Network Operator initiated Shutdown command from DSO via DSO RTU	DCC11.5.2.4	N/A	38kV Connections ≥ 2MW and <5MW			
Ability to receive Network Operator Initiated Shutdown command from DSO or TSO via TSO RTU	DCC11.5.2.4	All	≥5 MW			
Responsible Operator	DCC11.5.2.6.1	N/A	All	All	All	All
Responsible Operator	DCC11.5.2.6.2	All	N/A	N/A	N/A	N/A
Declarations	DCC11.5.4	≥30 MW	≥30 MW	≥30 MW	≥30 MW	≥30 MW
Wind Power Forecasts	DCC11.5.3	≥30 MW	≥30 MW	≥30 MW	≥30 MW	≥30 MW

[7] As advised by DSO

[8] For medium voltage connections ≥ 2MW and <5MW, provided that adequate media coverage exists, remote operation of the recloser deployed to satisfy DCC10.5.2.8 may also be used to implement the requirements of DCC10.5.2.4 and DCC10.5.1.7.

Appendix 4b: Proposed Table for Distribution Code

Illustrative example of proposed re-working of Table 6 for PPMs

TABLE 6 – APPLICABILITY MATRIX

			Topology				
	Section		1	2	3	4	5
Fault Ride-Through	DCC11.2	Types	D	C, D			
FREQUENCY							
			Topology				
			1	2	3	4	5
Tolerance over Frequency Range	DCC11.3.1	Types	A,B,C,D				
Participation in High Frequency Control	DCC11.3.2.3		D	C, D			
Participation in Low Frequency Control	DCC11.3.2.3		D	C, D			
Adherence to Maximum Ramp Rates	DCC11.3.4		D	C, D			
Active Power Control Participation	DCC11.3.2.2		D	C, D			
VOLTAGE							
			Topology				
			1	2	3	4	5
Voltage Control	DCC11.4 DCC11.5.2.3	Types	D	C, D	N/A		
Voltage Range	DCC11.4.2.1		D	N/A			
Power Factor	DCC11.4.3		N/A	A, B, C			
Reactive Power Range	DCC11.4.5		D	C, D	N/A		
SIGNALS/COMMUNICATIONS/CONTROL							
			Topology				
			1	2	3	4	5
Signal List 1	DCC11.5.1.1	Types	D	C, D		N/A	
Signal List 2	DCC11.5.1.2		N/A	N/A		C, D	
Signal List 3: Availability	DCC11.5.1.3		D	C, D			
Signal List 4: Active Power Control	DCC11.5.1.4		D	C, D			
Signal List 5: Frequency Control	DCC11.5.1.5		D	C, D			
Signal List 6: Meteorological Data	DCC11.5.1.6		D				
Signal List 7: DSO SCADA Signals	DCC11.5.1.7		N/A	B1[9]			
Ability to Accept Control Signal- Active Power Control	DCC11.5.2.1		D	C, D			
Ability to Accept Control Signal- Frequency Control Curve Mode Change	DCC11.5.2.2		D	C, D			
Ability to Accept Control Signal- Voltage Control	DCC11.4.1 DCC11.4.2		D	C, D	N/A		
Installation of recloser at the WFPS site for network Protection	DCC11.5.2.8		N/A	All Medium Voltage Connections			

9 Type B: sub-type 1: ≥2 MW Max Capacity ≥5 MW

			Topology				
			1	2	3	4	5
Ability to receive Network Operator Initiated Shutdown command from DSO via DSO RTU[10] **or** **ability to be remotely disconnected by DSO via device located at or near WFPS[11]**	DCC11.5.2.4	Types	N/A	B1[1] Connected at Medium Voltage [10kV or 20kV]			
Ability to receive Network Operator initiated Shutdown command from DSO via DSO RTU	DCC11.5.2.4		N/A				
Ability to receive Network Operator Initiated Shutdown command from DSO or TSO via TSO RTU	DCC11.5.2.4						
Responsible Operator	DCC11.5.2.6.1		N /A	B, C, D			
Responsible Operator	DCC11.5.2.6.2		D	N /A			
Declarations	DCC11.5.4		D	D1[12]		N /A	
Wind Power Forecasts	DCC11.5.3		D				

[10] As advised by DSO
[11] For medium voltage connections ≥ 2MW and <5MW, provided that adequate media coverage exists, remote operation of the recloser deployed to satisfy DCC10.5.2.8 may also be used to implement the requirements of DCC10.5.2.4 and DCC10.5.1.7.
12 Type D: sub-type 1: Max Capacity ≥30 MW