



All-Island European Stakeholder Forum RfG – Requirements for Generators

11 October 2017

Belfast

European Stakeholder Forum

RfG Parameter Discussion

- Overview of presentations
- Recap on key principles
- Timelines for consultation

Overview of Presentations

- Background and general principles – Marie Hayden
- Update on the Banding Consultation - Emma Fagan
- Three Theme based presentations
 - Frequency – Raymond Skillen
 - Voltage and Fault Ride Through – Tony Hearne
 - System Restoration, instrumentation protection and models – Miriam Ryan
- General Discussion

Background

- RfG goes into detail on specific connection & performance requirements that will apply to generators whose main plant & equipment is purchased* post May 2018
 - Furthermore energy storage, other than pumped storage, is exempt from RfG
- For many requirements the local TSO(s) &/or DSO(s) has to make choices about exactly what requirements will be placed on generators in their jurisdiction
- The chosen parameters are approved by the National Regulator
- Relevant articles in RfG Network Code are 13-28

** Contracts put in place*

Background

- Consultation on these parameters is not mandated by the RfG however the TSOs and DSOs felt that consultation would be appropriate in Ireland and Northern Ireland
- EirGrid, SONI, ESN and NIEN are working together to draft these proposals and will issue jurisdiction-based consultation documents later in the year
- Today's presentation will provide detail on the nature of the requirements that we will be consulting on
- A recap of some of the “lingo” used in network codes and the principles adopted by the TSO/DSO/DNO when selecting requirements is provided in the new few slides

Concepts

- Four Types of requirements exist
 - **Mandatory** means the generator must do something
 - **Non-Mandatory** means the TSO/RSO/DSO can choose to apply this requirement
 - **Exhaustive** means that a requirement or specific number is given in RfG
 - **Non-Exhaustive** means that an allowable range is provided and the TSO/DSO must select within that range

Concepts

- Examples from Article 13 *General requirements for type A power generating modules*:
 - **Mandatory**
 - Article 13: A generator **shall** be capable of remaining connected to the network and operate within the frequency and time periods specified
 - **Mandatory Exhaustive**: Ireland and Northern Ireland between 47.5 Hz – 48.5 Hz **for 90 minutes**
 - **Mandatory Non-Exhaustive**: Ireland and Northern Ireland between 48.5 Hz – 49.0 Hz **To be specified by each TSO, but not less than 90 minutes**
 - **Non-Mandatory**
 - Article 13 Clause 2 (b) “the relevant **TSO may choose** to allow within its control area automatic disconnection and reconnection of power generating modules of Type A at randomised frequencies”

Selection of RfG Parameters

- General Principle
 - If the parameter exists today in the grid code, distribution code, connection agreements or setting schedule etc. and the value used today is within the range allowed for in RfG then we use the current value
 - If the parameter exists today but it is not within the range allowed for in RfG then we use the closest value to the current value
 - If the parameter or requirement does not exist today then we will identify and propose a suitable value

Concepts

- Where a standard is in the RfG but the RfG is silent on the wider ranges – the RSO can request to go beyond the standard
 - Example of this arises with frequency ranges later
- If a generator can operate to higher standards we can require performance at this level
- Generator Types can be subdivided for application e.g. Type B could be split into 0.1 MW – 1 MW and 1 MW – 5 MW with different requirements
- Some requirements are “site specific” e.g. signal lists and would be captured in connection agreements and functional specifications no will not be inserted into the grid codes

Consultation on RfG Parameters

- Consultation is on non-exhaustive parameters and on non-mandatory requirements ONLY
 - Mandatory Exhaustive requirements are already decided upon and cannot be changed
- ENTSO-E have provided non-binding written guidance (IGDs) concerning the elements of RfG requiring national decisions. 18 guidance documents are available at
 - <https://www.entsoe.eu/news-events/announcements/announcements-archive/Pages/18-RfG-related-implementation-guidance-documents.aspx>
- Specifically the “Parameters of Non-Exhaustive Requirements” is a very helpful document: RfG is laid out in tables pages 7-15
 - https://www.entsoe.eu/Documents/Network%20codes%20documents/NC%20RfG/161116_IGD_General%20guidance%20on%20parameters_for%20publication.pdf?Web=1

Grid Code and Distribution Code Updates

- Proposal is to include all requirements into the respective Codes
- As codes in Ireland are normally retrospective and RfG is not, this will require a change in approach and layout
- Grid Codes will be updated in 2019 after all generation, demand and HVDC decisions have been made

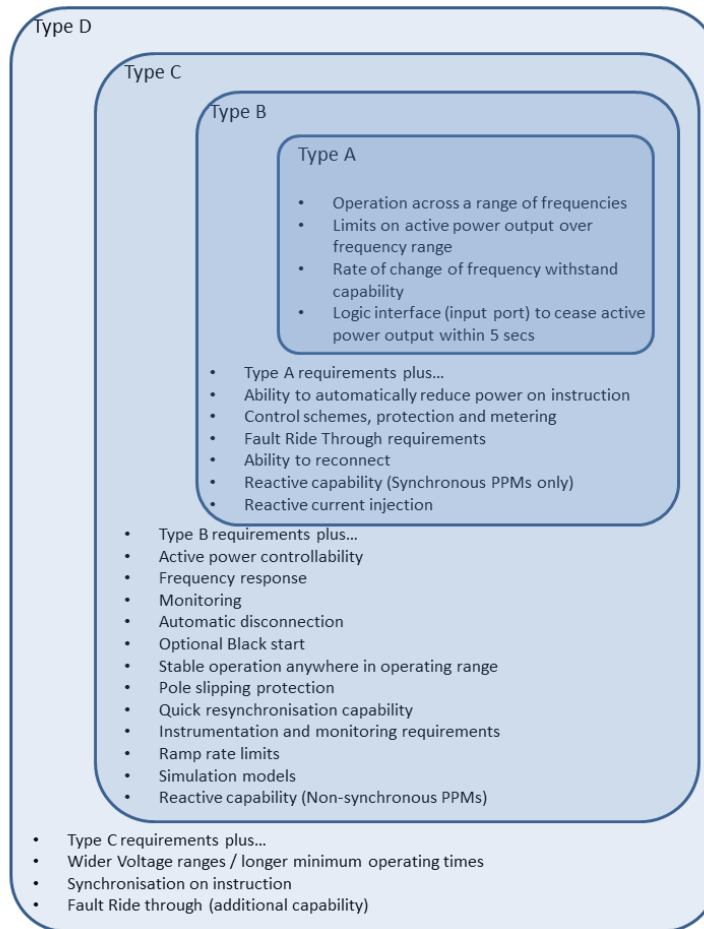
Consultation Timelines

- Plan is to publish the consultations in early December 2017
- 2 weeks after publication we propose to host a workshop or webinar to discuss parameters in detail if industry feel this would be useful – any thoughts?
- Consultation will be 6 weeks and will allow time for the Christmas break

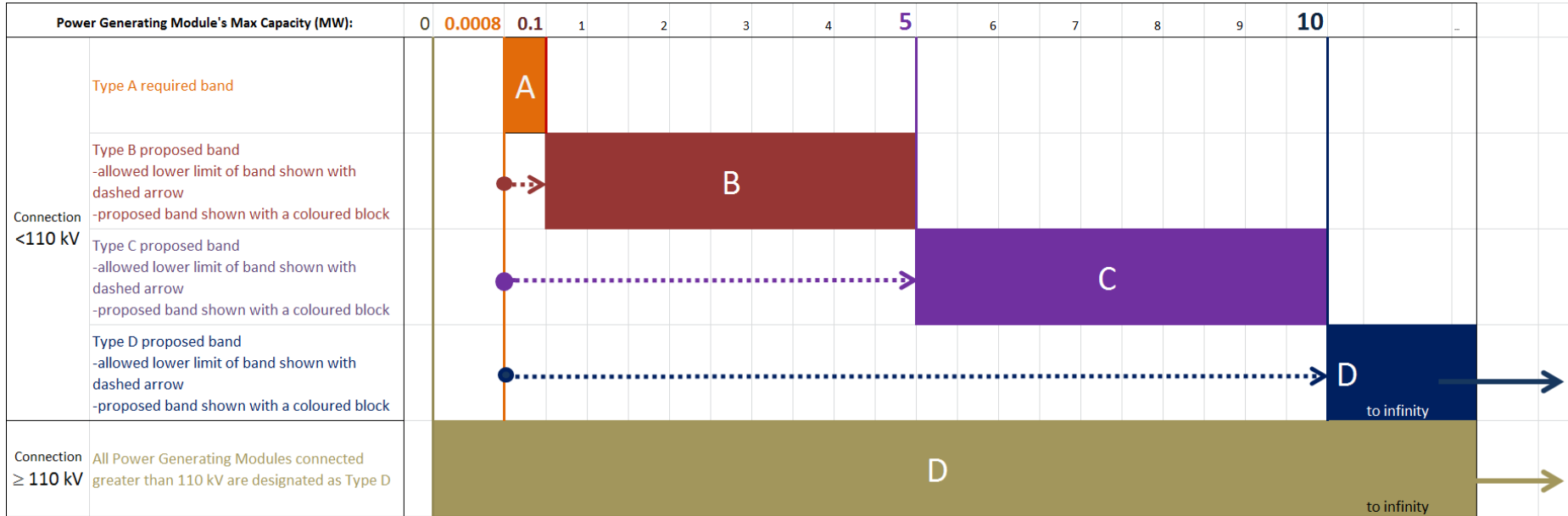
RfG Banding Consultation

- Consultation ran from 7 April to 15 May 2017
- Small number of responses received
- TSOs “minded to” position published 14 July 2017 – position unchanged
- Final position and submission to RAs will be finalised after Parameter Consultation

Requirements by Type



Generation Types by Band



Introduction to RFG Frequency Requirements

Raymond Skillen, SONI

Wednesday 11th October

RFG Frequency Requirements

- Commission Regulation (EU) 2016/631 Articles 13, 14, 15 and 16 requirements of type A,B,C and D respectively.
- Introduction into ongoing assessment of RFG and its impact on Grid code requirements.
- Main Parameters/technical areas covered
- Specific examples of Impact on Grid Code
 - Frequency Ranges
 - Admissible Active power reduction
 - Limited Frequency Sensitive Mode – Overfrequency (LFSM-O)
 - Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)
 - Frequency Sensitive Mode (FSM)

Comparison of RFG and existing Grid Code requirements

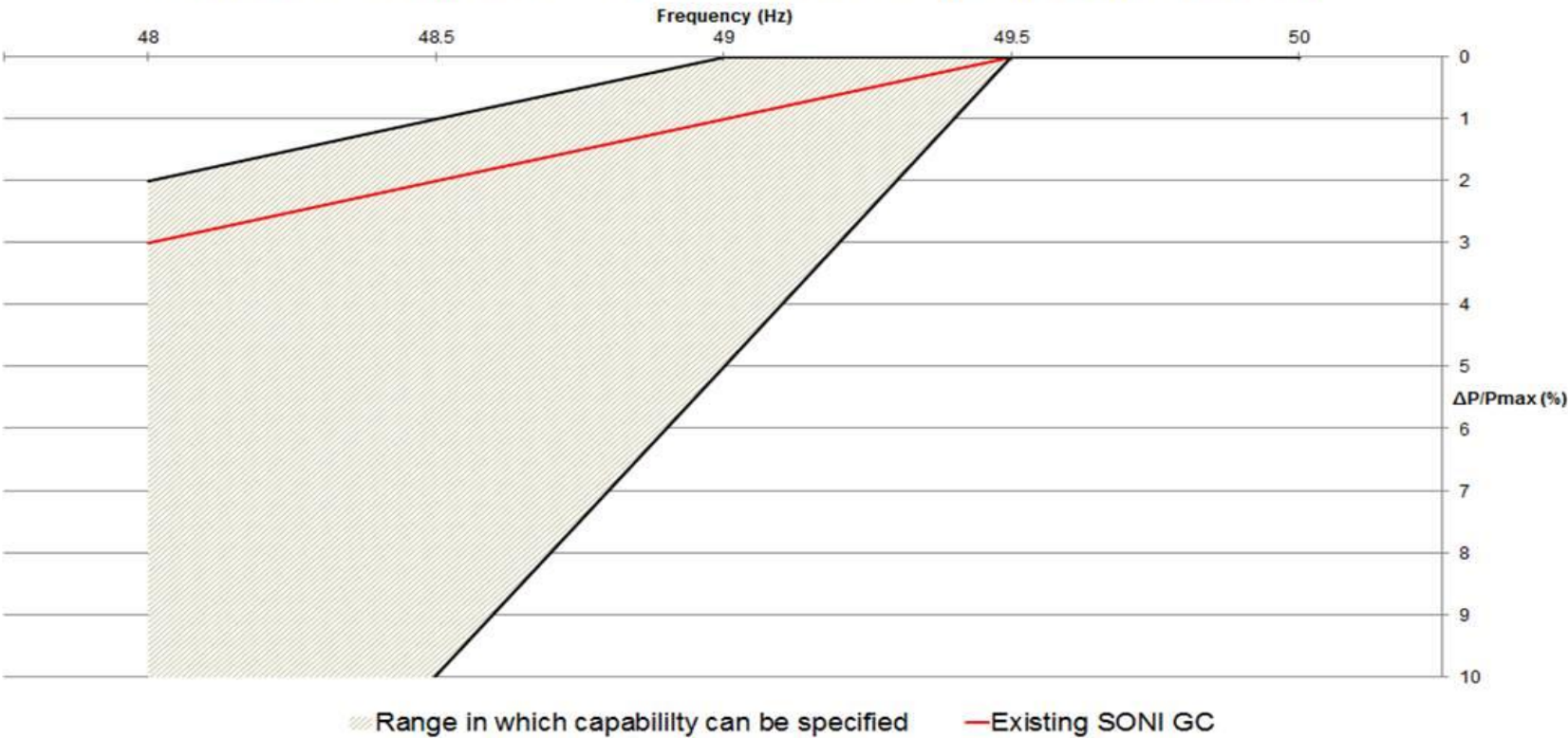
RFG Requirement	Article Ref	Article summary	Ireland & NI Codes
Frequency Range	13.1.A.(i) - (iii)	A power-generating module shall be capable of remaining connected to the network and operate within the frequency ranges and time periods specified.	Partially Specified
Rate of Change of Frequency	13.1.B	A power-generating module shall be capable of staying connected to the network and operate at rates of change of frequency up to a value specified by the relevant TSO, unless disconnection was triggered by rate-of-change-of-frequency-type loss of mains protection. The relevant system operator, in coordination with the relevant TSO, shall specify this rate-of-change-of-frequency loss of mains protection.	Partially Specified
Limited Frequency Sensitive Mode LFSM-O	13.2 (A) - (G)	The power-generating module shall be capable of activating the provision of active power frequency response at a frequency threshold and droop settings specified by the relevant TSO.	Partially Specified
Admissible Active Power Reduction (Falling Frequency)	13.4 & 13.5	The relevant TSO shall specify admissible active power reduction from maximum output with falling frequency in its control area as a rate of reduction falling within the boundaries, illustrated by the full lines in figure 2: (a) below 49 Hz falling by a reduction rate of 2 % of the maximum capacity at 50 Hz per 1 Hz frequency drop; (b) below 49.5 Hz, falling by a reduction rate of 10 % of the maximum capacity at 50 Hz frequency drop.	Not Specified in Ireland. Partially Specified in NI
Limited Frequency sensitive mode LFSM -U	15.2.(C)	As well as LFSM -O ,LFSM-U shall apply to type C generators The power-generating module shall be capable of activating the provision of active power frequency response at a frequency threshold and with a droop specified by the relevant TSO in coordination with the TSOs of the same synchronous area	Partially Specified
Frequency Sensitive Mode - FSM	15.2.(D)	In addition to LFSM-O , LFSM-U, the power-generating module when operating in Frequency Sensitive Mode (FSM) shall be capable of providing active power frequency response in accordance with the parameters specified by each TSO with the ranges specified.	Partially Specified
Rates of Change of Active Power Output	15.6.(E)	The relevant system operator shall specify, in coordination with the relevant TSO, minimum and maximum limits on rates of change of active power output (ramping limits)	Partially Specified

RFG Frequency Range Requirements

RFG - Frequency range analysis											Proposal
		SONI	SONI	SONI	SONI	SONI	EirGrid	EirGrid	RFG	IRE & NI	
Frequency Range		T non-PPM	D non-PPM	T PPM	D PPM	DSU's	non-PPM	PPM	RFG		
	47 - 47.5	*note 1	*note 1	0.33	0.33	0.33	0.33	0.33		0.33	
	47.5 - 48	*note 1	*note 1	60	60	60	60	60	90	90	
	48 - 48.5	*note 1	*note 1	60	60	60	60	60	90	90	
none exhaustive	48.5 - 49	*note 1	*note 1	60	60	60	60	60	90	non exhaustive > 90mins	
	49 - 49.5	*note 1	*note 1	60	60	60	60	60	unlimited	unlimited	
	49.5 - 50	unlimited	unlimited	unlimited	unlimited	unlimited	unlimited	unlimited	unlimited	unlimited	
	50 - 50.5	unlimited	unlimited	unlimited	unlimited	unlimited	unlimited	unlimited	unlimited	unlimited	
	50.5 - 51	*note 1	*note 1	60	60	60	60	60	unlimited	unlimited	
	51 - 51.5	*note 1	*note 1	60	60	60	60	60	90	90	
	51.5 - 52	*note 1	*note 1	60	60	60	60	60		60	
Grid code references / RFG article		cc 5.3.1	cc 5.3.1	cc 5.3.1	cc 5.3.1	cc 5.3.1	cc.7.3.1.1.a	WFPS1.5.1a	13.1.a.(i)		
		cc 5.3.2	cc 5.3.2	cc 5.3.2	cc 5.3.2	cc 5.3.2	cc.7.3.1.1.b	WFPS1.5.1b	13.1.a.(ii)		
		cc.s1.1.3.4	CC.S1.2.3.1	cc.s2.1.3.4	cc2.2.6.2 (a)	cc.13.1 (h,l,j,k)	cc.7.3.1.1.c	WFPS1.5.1c		*note 1 - Not time limited	
		cc.s1.1.3.6	CC.S1.2.4.2	cc.s.2.1.9.2(a)							
		cc.s1.1.5.2	CC.S1.2.3.3	cc.s.2.1.9.3							

Admissible Active Power Reduction (Falling Frequency)

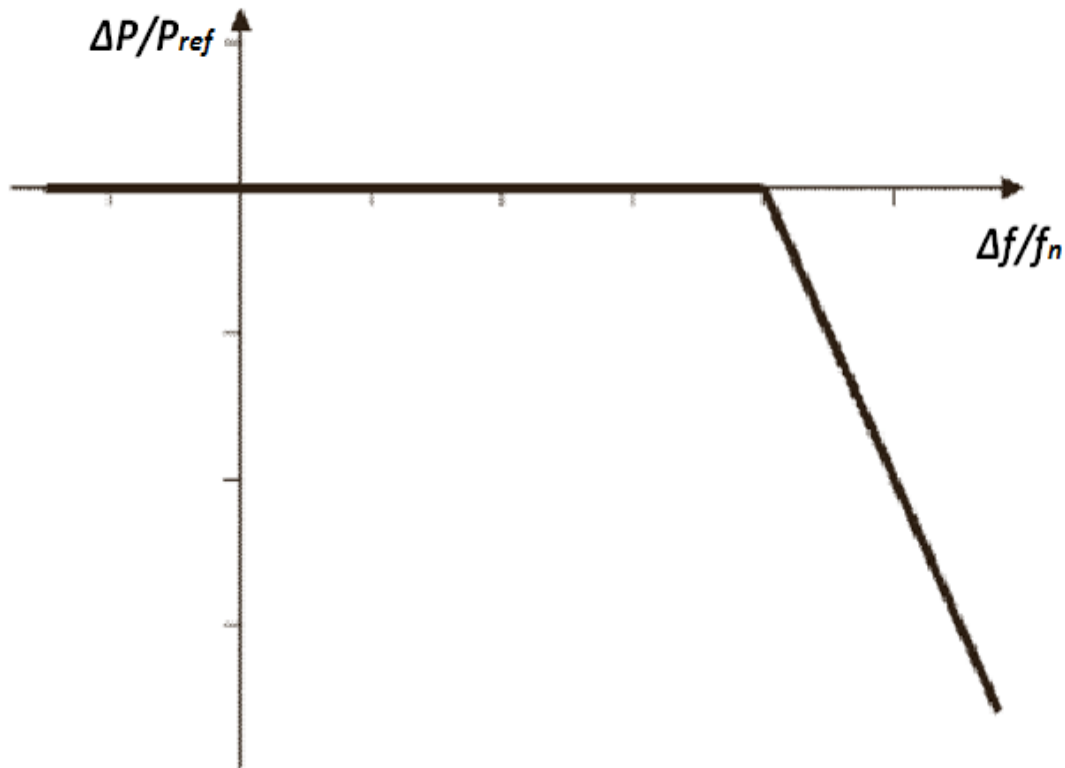
Article 13.4 - Maximum Power Capability Reduction with Falling Frequency



Article 15 for type C power-generating modules LFSM-O

The power-generating module shall be capable of activating the provision of active power frequency response according to figure 1 at a frequency threshold and droop settings specified by the relevant TSO;

- the frequency threshold shall be between 50,2 Hz and 50,5 Hz inclusive;
- the droop settings shall be between 2 % and 12 %.



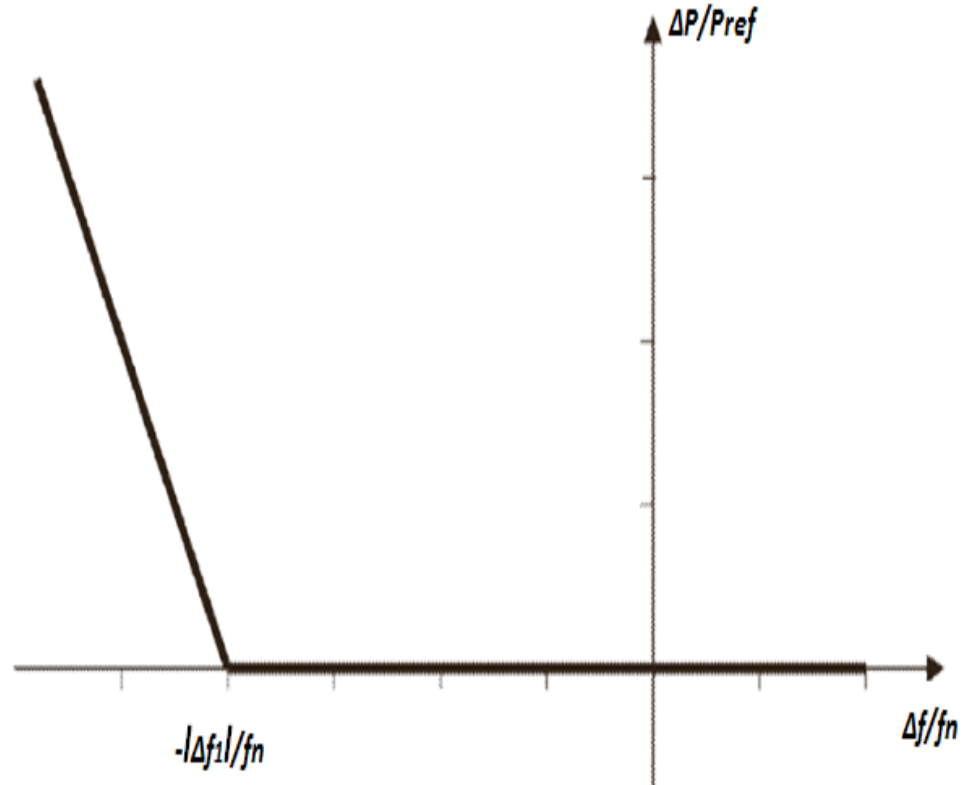
Article 15 for type C power-generating modules LFSM-U

The power-generating module shall be capable of activating the provision of active power frequency response at a frequency threshold and with a droop specified by the relevant TSO in coordination with the TSOs of the same synchronous area as follows:

- The frequency threshold specified by the TSO shall be between 49,8 Hz and 49,5 Hz inclusive,
- The droop settings specified by the TSO shall be in the range 2-12 %. This

is represented graphically;

Active Power Frequency Response Capability of Power Generating Modules in LFSM-U



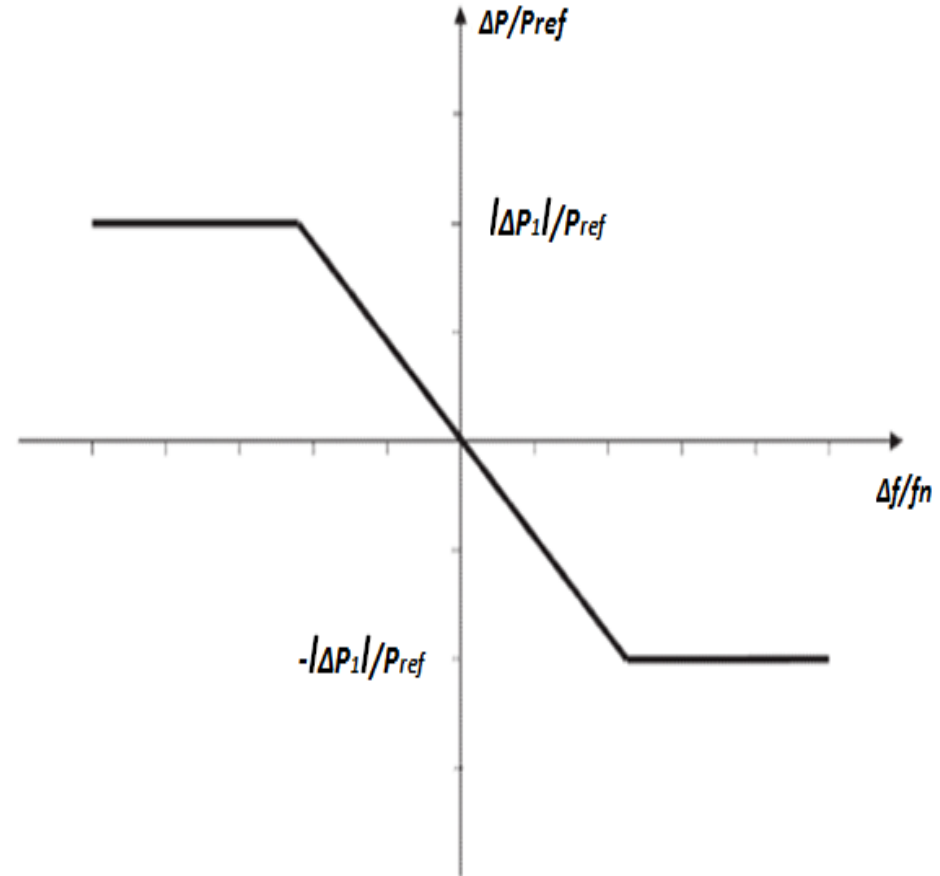
Article 15 for type C power-generating modules – FSM

The power-generating module shall be capable of providing active power frequency response in accordance with the parameters specified by each relevant TSO. In specifying those parameters, the relevant TSO shall take account of the following facts:

- in case of overfrequency, the active power frequency response is limited by the minimum regulating level,
- in case of underfrequency, the active power frequency response is limited by maximum capacity,
- the actual delivery of active power frequency response depends on the operating and ambient conditions of the power-generating module when this response is triggered, in particular limitations on operation near maximum capacity at low frequencies according to paragraphs 4 and 5 of Article 13 and available primary energy sources;

Active Power Frequency Response Capability of Power Generating Modules in FSM

illustrating the case of zero deadband and insensitivity



Reconciliation of Types [RoI D-Code]

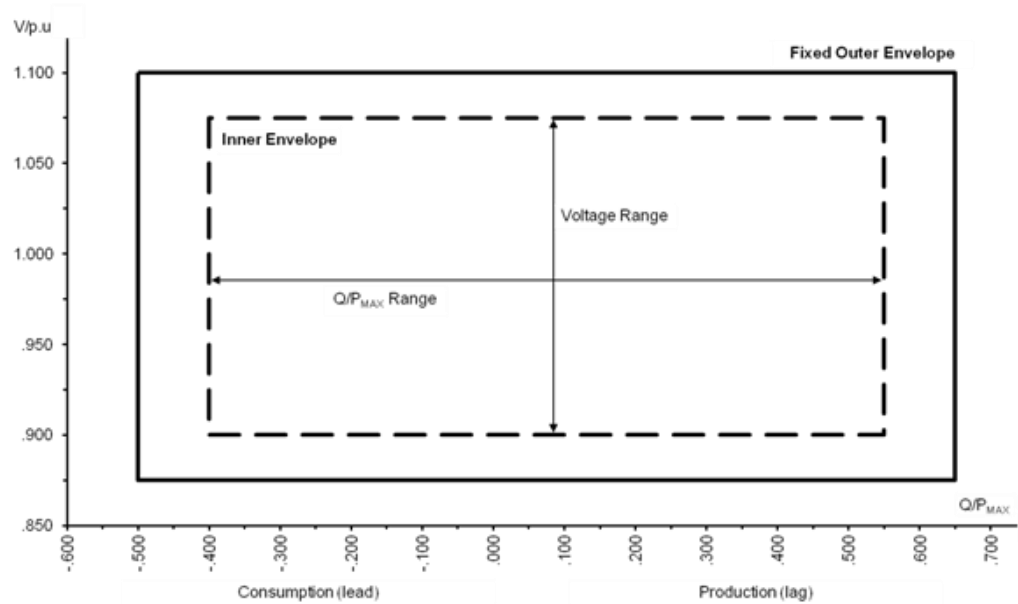
- ESB Networks is therefore minded to re-badge the existing Distribution Code Types A to E, to the newly named “Topologies 1-5”.
- The definitions of these topologies will remain broadly as per the current Distribution Code but the opportunity will be taken to clean up the diagrams and text, where more clarity can be brought.
- It is recognised and acknowledged that the scope for confusion amongst users still remains but we believe this to be a valid approach.
- For the rest of this presentation, any reference to “Types” will mean those defined in Network Codes unless otherwise stated

Old Name	New Name
Type A	Topology 1
Type B	Topology 2
Type C	Topology 3
Type D	Topology 4
Type E	Topology 5

Reactive Power Requirements

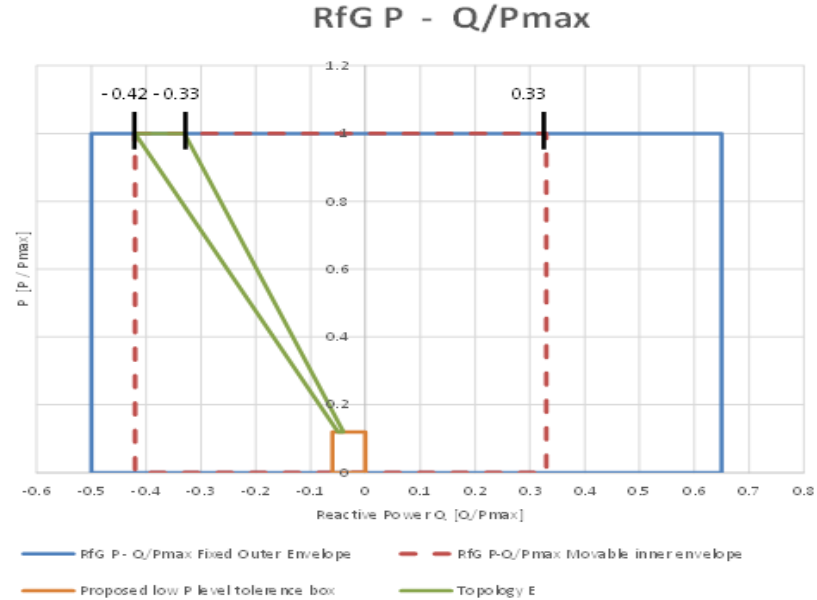
Reactive Power Requirements P-Q [PPMs]

- For Types B and C, RfG stipulates a fixed box on the P-Q plane, which reactive power capability requirements must not exceed.
- It further stipulates a second box, which, can be moved but whose dimensions are fixed.
- PPM boxes shown



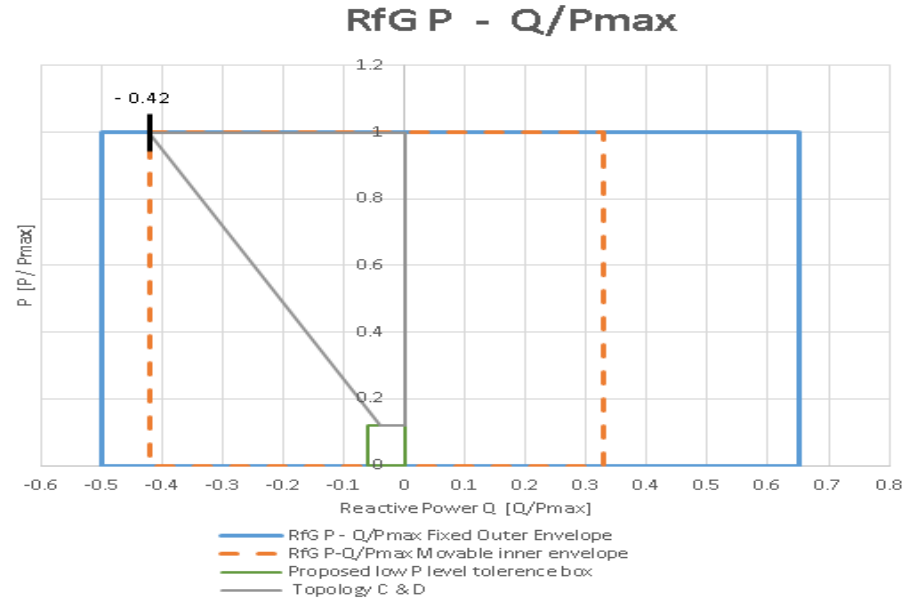
Do Existing RoI D-Code requirements conform? P-Q PPMs

- Topology 5
- [Previously known as “Type E”]



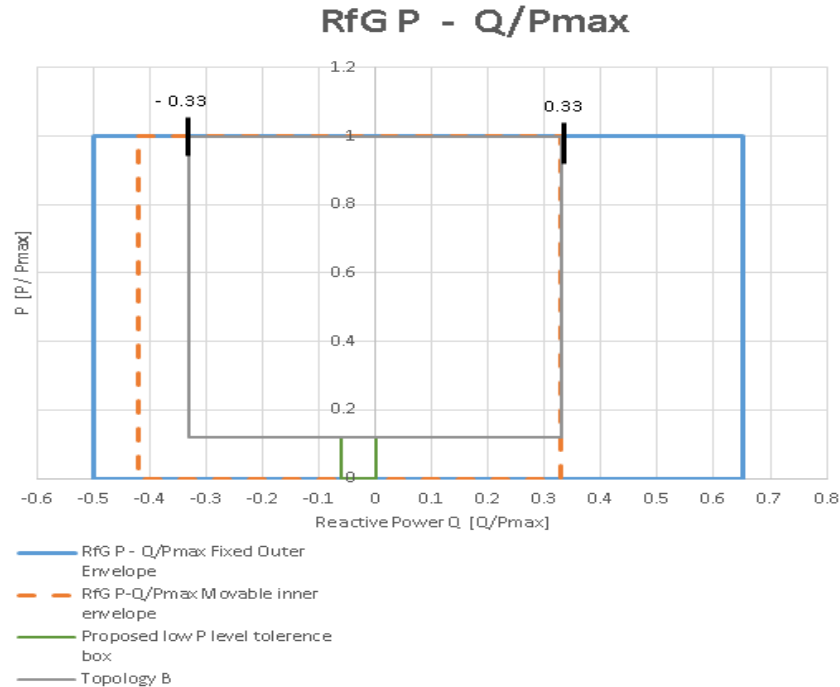
Do Existing RoI D-Code requirements conform? P-Q PPMs

- Topologies 3 and 4
- [Previously known as “Types C and D”



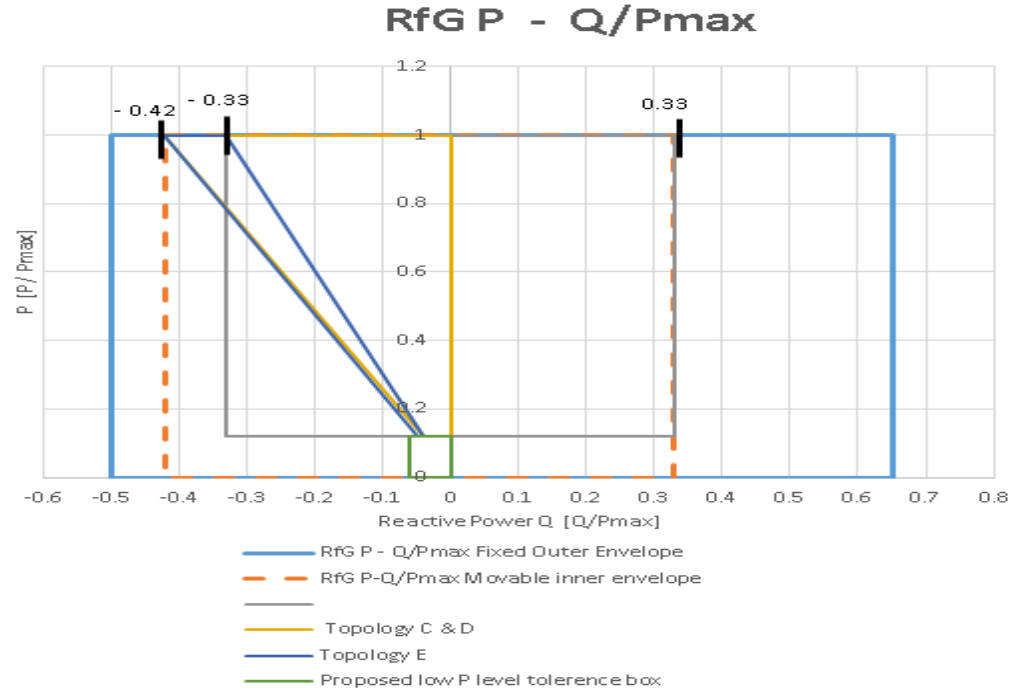
Do Existing RoI D-Code requirements conform? P-Q PPMs

- Topology 2
- [Previously known as “Type B”]



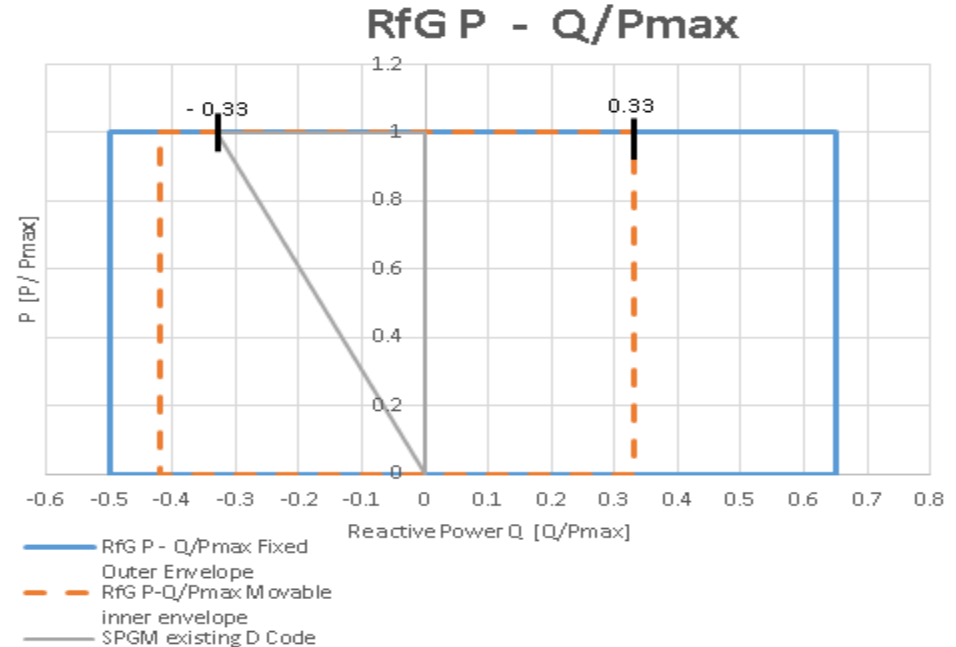
Do Existing RoI D-Code requirements conform? P-Q PPMs

- Topologies 2,3,4 and 5
- [Previously known as “Types B, C, D and E”



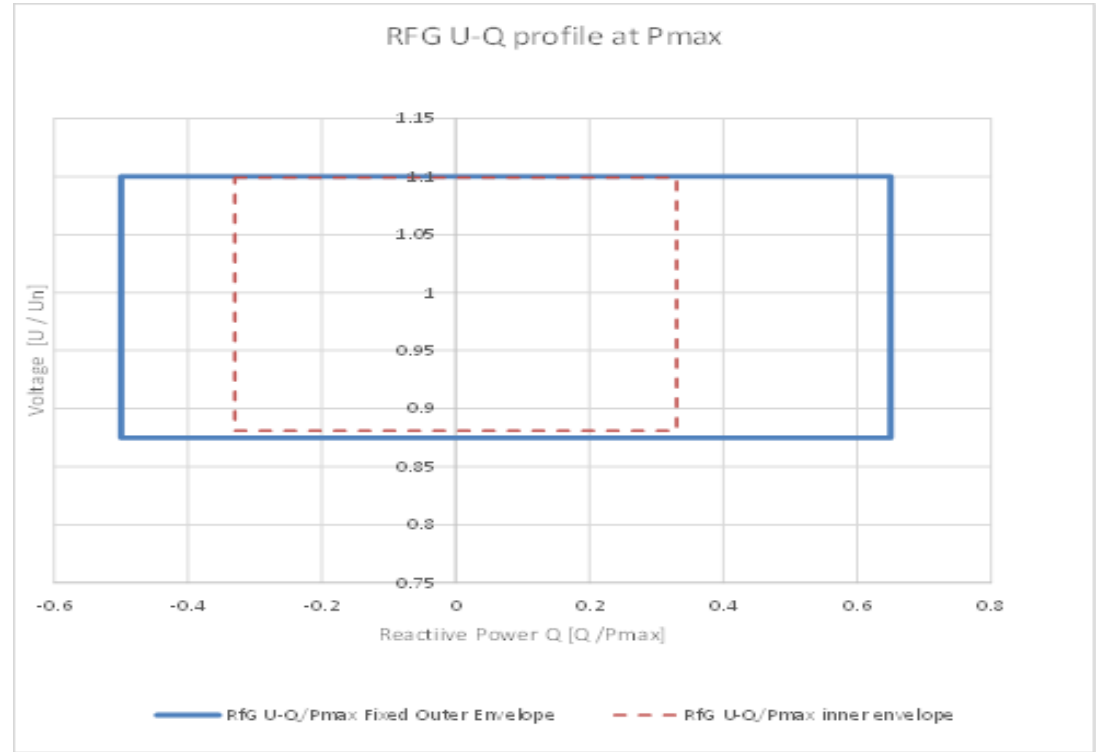
Do Existing RoI D-Code requirements conform? P-Q Sync PGMs

- Existing power factor requirements for generators not covered by specific requirements in Section 11 for wind generators, are stipulated in DCC 6.9.1 It states that....
- The **Customer** shall take all reasonable steps to operate the **Plant** and the facility to keep the power factor of the total load at the **Connection Point** for imported electricity between 0.90 lagging and unity and for exported electricity between 0.95 lagging and unity*



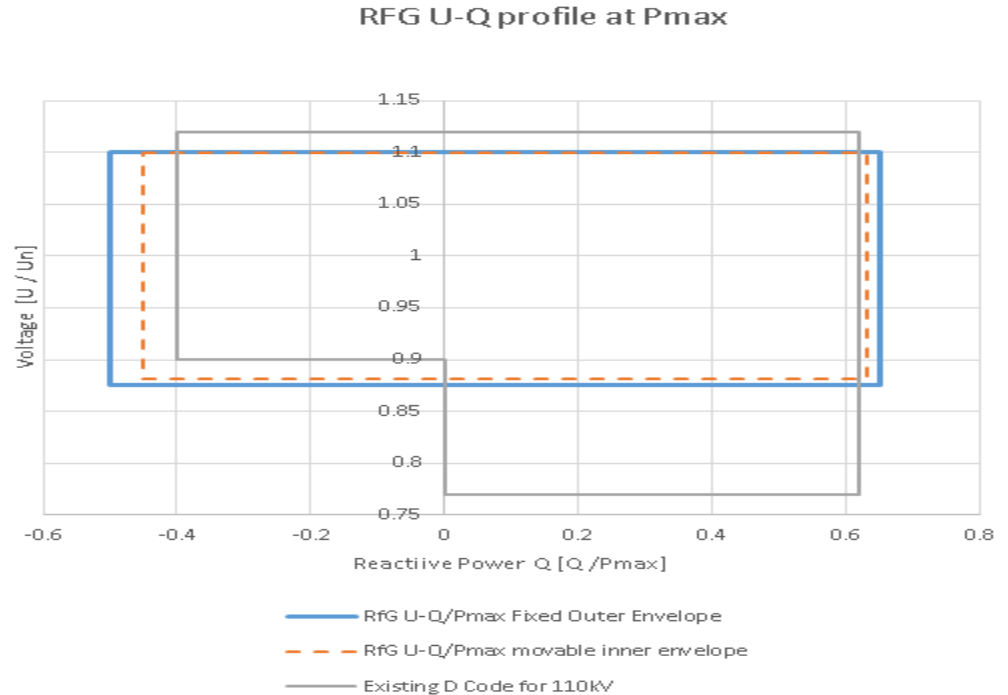
Reactive Power Requirements U-Q [PPMs]

- RfG also stipulates that the RSO shall define a U-Q/Pmax profile
- For Types B and C, RfG stipulates a fixed box on the P-Q plane, which reactive power capability requirements must not exceed.
- It further stipulates a second box, which, can be moved but whose dimensions are fixed.
- PPM boxes shown



Reactive Power Requirements U-Q 110kV [PPMs]

- 110kV
- Upper voltage limits outside of boxes
- Profile will be brought within the boxes



Reactive Power Requirements U-Q Distribution [PPMs]

- The current version of the R01 Distribution Code does not explicitly and graphically depict U-Q profiles.
- However, it does have Table 6A, which depicts a range of normal operating voltages.

TABLE 6A

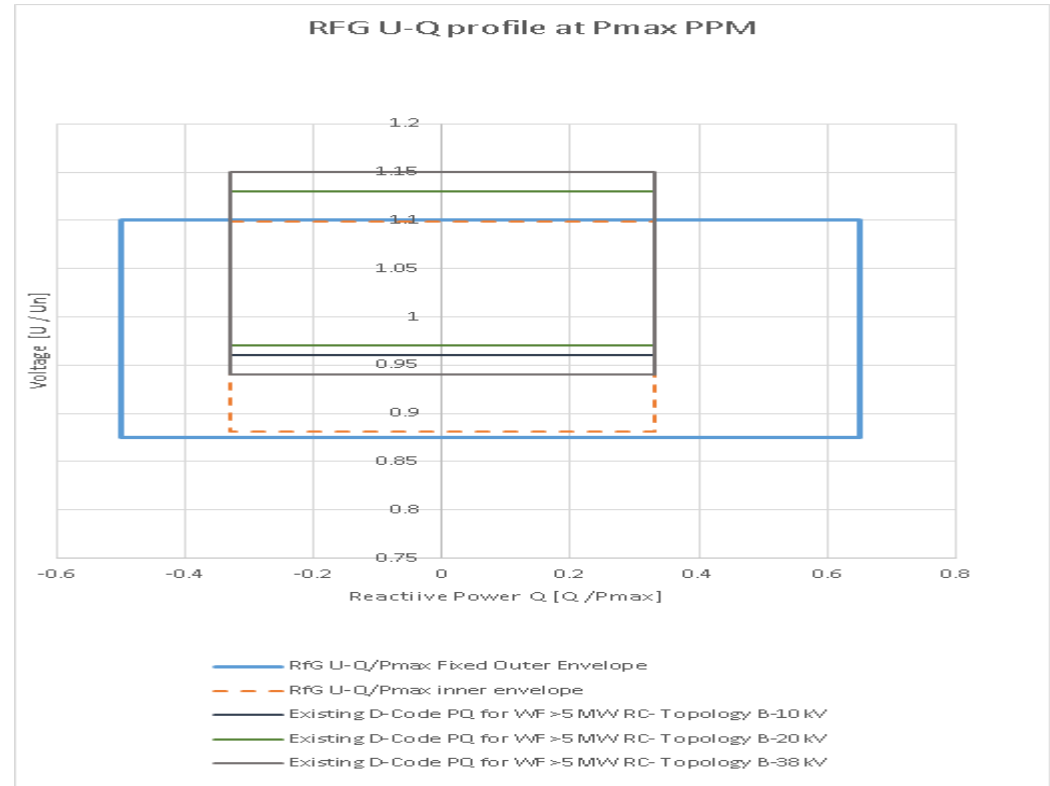
Description	Nominal Voltage	Normal Operating Range [kV] ^b	
		Lower bound	Upper bound
MV	10kV	9.6	11.3
MV	20kV	19.3	22.5
HV	38kV	35.6	43.8
110kV	110kV	99	123

Linkage between Reactive Power requirements and voltage ranges:

- DCC 11.4.3, which covers existing D Code Types [Topologies] B [<5MW], C, D and E, does not contain any explicit reference to having the P-Q capability across specific voltage ranges.
- DCC 11.4.5, which covers existing D Code Types A and B [>5MW], does explicitly state that the P-Q capability must be maintained across the voltage ranges is Table 6A.

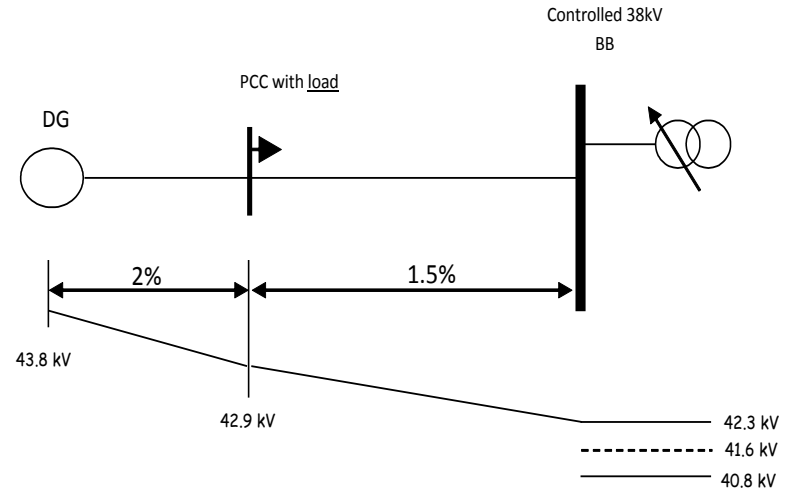
Reactive Power Requirements U-Q Distribution [PPMs]

- Rol case – how does Table 6 A line up with RfG “boxes”
- Upper voltage limits outside of boxes



How has this come about - Distribution?

- When planning Distribution Generation connections, the max allowable Connection Point voltage, for dedicated circuits, is higher than would be the case for demand connections or load driven network
- This effectively sterilizes part of these circuits for use on demand connections
- ESN have historically been minded to accept this risk, in the broader interests of connecting more generation and facilitating cheaper connections



What to do?

- Option 1: Retain existing Distribution Code requirements
- Option 2: Bring upper bounds for voltage range associated with P-Q requirements in line with RfG

Consequences of Option 2

- For Generator connections where the Connection Point voltage regularly exceeds 1.1 pu of nominal voltage, the effectiveness and ability to use reactive power capability of the generator will be severely compromised
- For [RoI] Topology 2 connections, ability to ultimately participate in SSRP or DRP provision is in doubt
- ESBN may have to give consideration to reduction of max allowable Connection Point voltage to 1.1 pu for generators applying after Entry into Force of RfG
- This may have implications for costs of future connections

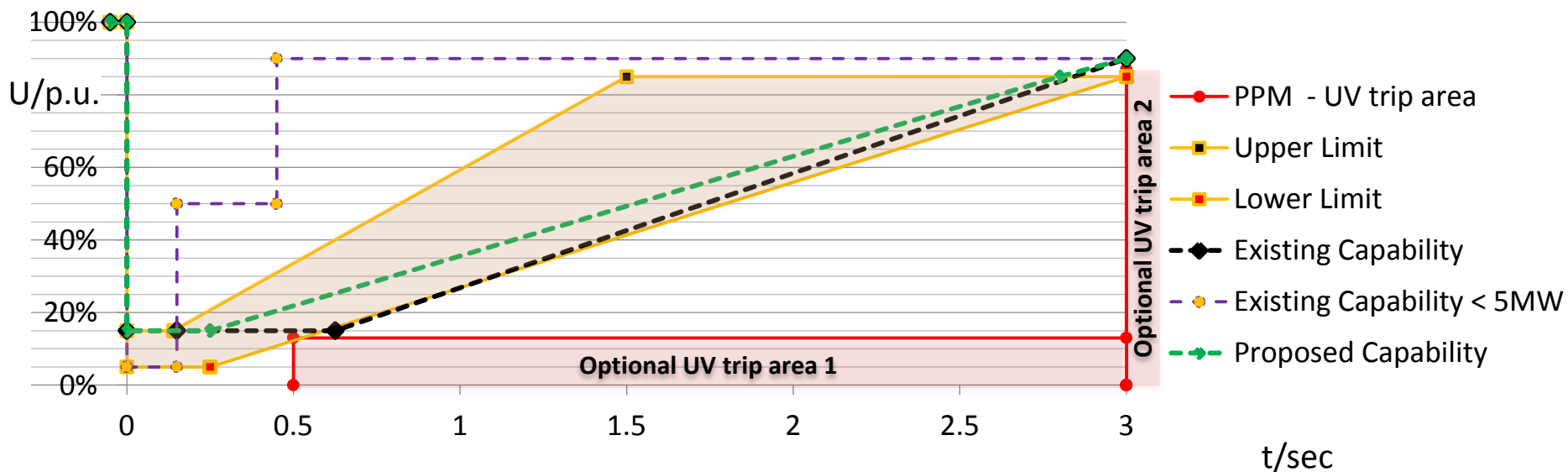
Intended course of action

- In the immediate term, ESNB may have no choice but to align U-Q profiles with RfG
- For the reasons stated above, ESNB is also minded to use any available mechanisms, which may or may not include a class derogation, to seek ways to resolve this issue
- This may include seeking changes to RfG in the next review period to lift the upper bound of the U-Q envelope to reflect Irish conditions – ideally, align with 1.118pu for voltage range elsewhere in RfG

Fault Ride Through

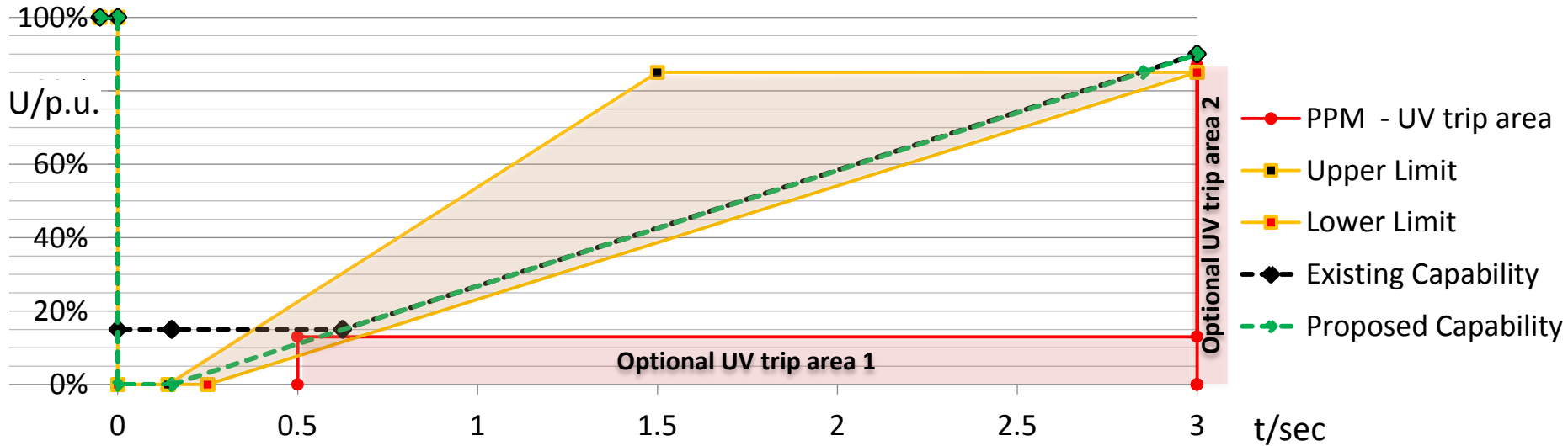
PPM - Type B,C, D ($U_n < 110\text{kV}$)

- Slight change needed to Rol D-Code



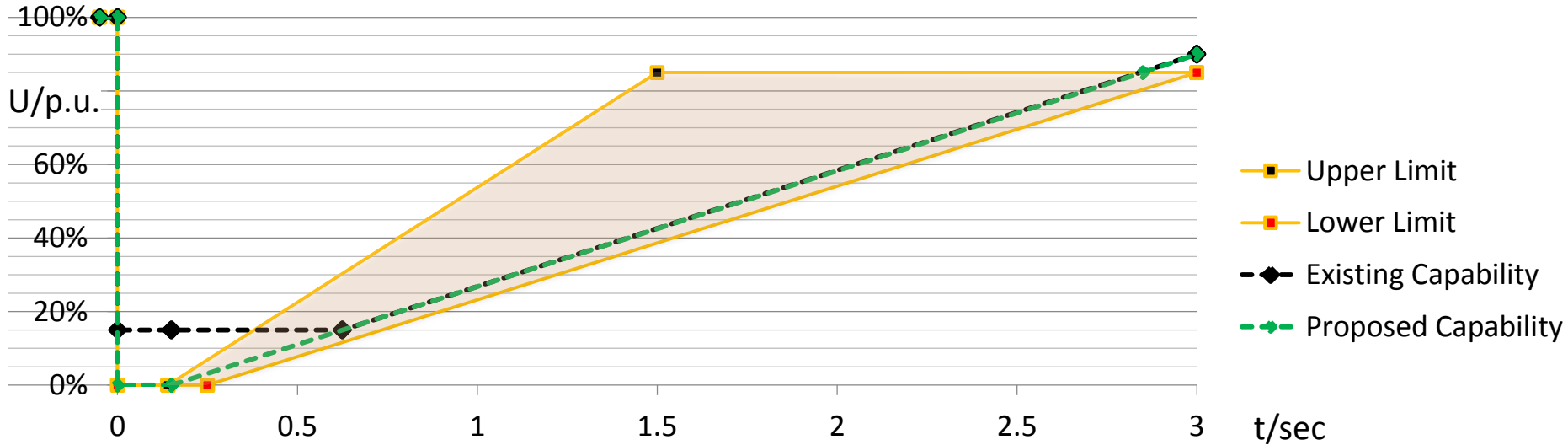
PPM - Type D (Distribution Connected) ($110\text{kV} \leq U_n$)

- Change needed to RoI D- Code



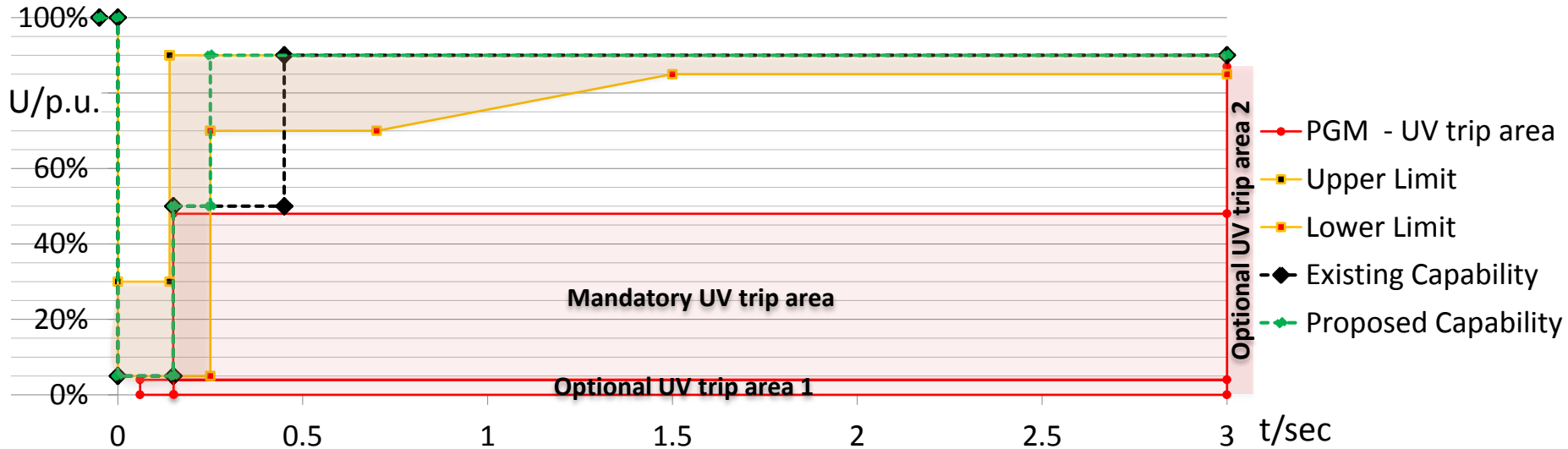
PPM - Type D (Transmission Connected) ($110\text{kV} \leq U_n$)

- Change needed to RoI Grid Code



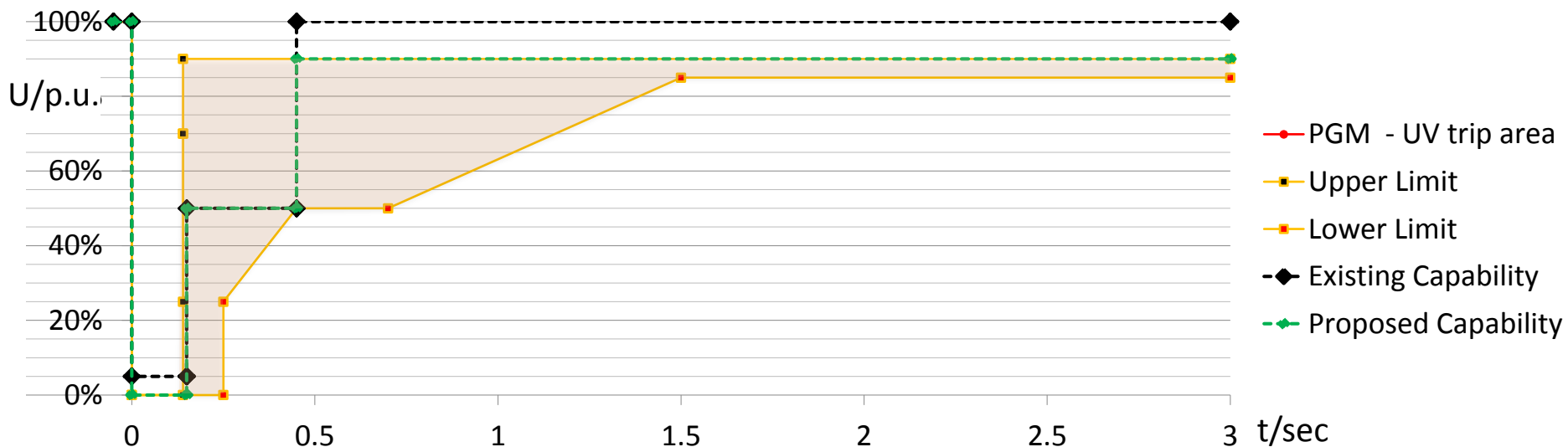
Synchronous PGM - Type B, C, D ($U_n < 110\text{kV}$)

- Change needed to RoI D-Code



Synchronous PGM - Type D ($110\text{kV} \leq U_n$)

- Change needed to Rol D- and G-Code



Controllability

Controllability

- Article 14 relates to controllability of Type B (0.1-5MW) generators
 - Clause 2-a is a **Mandatory** requirement that all generators shall be equipped with an interface (input port) in order to be able to reduce active power output following an instruction at the input port
 - Clause 2-b is **non-Mandatory** and says that the relevant system operator shall have the right to specify the requirements for further equipment to allow active power output to be remotely operated
- Whilst there is no intent to deliberately use the RfG adoption as a means to introduce more onerous requirements than prevail at present, the issue of controllability of < 5MW generators has been actively discussed in Ireland and Northern Ireland recently and it is important that this is accurately reflected in the General Application of RfG requirements submitted to the RAs for approval next year
- Therefore, the consultation will propose that Clause 2-B be made Mandatory
 - in Ireland for a subset of the Type B generators
 - in Northern Ireland for all Type B generators
- The detail of the type of equipment, sub-divisions etc., will be progressed through the existing channels which are the DCRPs in Ireland and Northern Ireland

System Restoration

- Comparison of RFG and existing Grid Code requirements
- Example of a new requirement

Comparison of RFG and existing Grid Code requirements

RFG Article Ref	Article	EirGrid Grid Code	SONI Grid Code
14(04)(a)	The relevant TSO shall specify the conditions under which a power-generating module is capable of reconnecting to the network after an incidental disconnection caused by a network disturbance.	Current requirements only apply to a subset of units.	Currently, specified in the form of an operational procedure.
15(05)(a)(ii)	Power-generating facility owners shall, at the request of the relevant TSO, provide a quotation for providing black start capability. The relevant TSO may make such a request if it considers system security to be at risk due to a lack of black start capability in its control area.		Currently, included in the connection agreements for units in excess of 100 MW.
15(05)(a)(iii)	A power-generating module with black start capability shall be capable of starting from shutdown without any external electrical energy supply within a time frame specified by the relevant system operator in coordination with the relevant TSO.	Time frame not specified.	Current requirements only applies a subset of units.
15(05)(a)(iv)	A power-generating module with black start capability shall be able to synchronise within the frequency limits laid down in point (a) of Article 13(1) and, where applicable, voltage limits specified by the relevant system operator or in Article 16(2).	Only applies to a subset of units and specified frequency limits differs.	Frequency limits differs.
15(05)(b)(iii)	The method for detecting a change from interconnected system operation to island operation shall be agreed between the power-generating facility owner and the relevant system operator in coordination with the relevant TSO. The agreed method of detection must not rely solely on the system operator's switchgear position signals.		
15(05)(c)(iii)	power-generating modules shall be capable of continuing operation following tripping to houseload, irrespective of any auxiliary connection to the external network. The minimum operation time shall be specified by the relevant system operator in coordination with the relevant TSO, taking into consideration the specific characteristics of prime mover technology.	Minimum operation time not specified	
20(03)(a)	The relevant TSO shall specify the post-fault active power recovery that the power park module is capable of providing and shall specify: (i) when the post-fault active power recovery begins, based on a voltage criterion; (ii) a maximum allowed time for active power recovery; and (iii) a magnitude and accuracy for active power recovery.		

Example of tripping to Auxiliaries (RFG vs EirGrid Grid Code) (1)

Differences between RFG and EirGrid Grid Code:

- Applicable generation units
 - RFG applies to power generation units type C and D with minimum times of 15 minutes (Article 15(c)(ii)).
 - EirGrid Grid Code applies to all generation units with minimum start up times of 30 minutes (CC.7.3.2).
- Minimum operation time
 - RFG states that the TSO must specify the minimum operation time, taking into consideration the specific characteristic of the prime mover technology
 - EirGrid Grid Code states not the minimum operation time.

Example of tripping to Auxiliaries (RFG vs EirGrid Grid Code) (2)

What is the proposal?

1. Modify CC.7.3.2. to include generation units with minimum re-synchronisation times of 15 minutes.
2. To specify the minimum operation times following a tripping to auxiliaries. Proposal is four hours.

Instrumentation, Simulation and Protection

RFG Article Ref	Article	EirGrid Grid Code	SONI Grid Code
14(05)(a)	With regard to control schemes and settings: (i) the schemes and settings of different control devices of the power-generating module that are necessary for transmission system stability and for taking emergency action shall be coordinated and agreed between the relevant TSO, the relevant system operator and the power-generating facility owner. (ii) any changes to the schemes and settings, mentioned in point (i), of the different control devices of the power-generating module shall be coordinated and agreed between the relevant TSO, the relevant system operator and the power-generating facility owner, in particular if they apply in the circumstances referred to in point (i) of paragraph 5(a).	Changes to agreement and coordination of control schemes.	Current SGC is scheme specific, general clarification needed.
14(05)(b)(ii)	electrical protection of the power-generating module shall take precedence over operational controls, taking into account the security of the system and the health and safety of staff and of the public, as well as mitigating any damage to the power-generating module;	Does not include priority in relation to plant, personnel, etc.	Does not include priority in relation to plant, personnel, etc.
14(05)(b)(iii)	protection schemes may cover the following aspects: - external and internal short circuit, - asymmetric load (negative phase sequence), - stator and rotor overload, - over-/underexcitation - over-/undervoltage at the connection point, - over-/undervoltage at the alternator terminals - inter-area oscillations - inrush current - asynchronous operation (pole slip) - protection against inadmissible shaft torsions (for example, subsynchronous resonance) - power-generating module line protection - unit transformer protection - back-up against protection and switchgear malfunction - overfluxing (U/f) - inverse power - rate of change of frequency, and - neutral voltage displacement		Does not reference any particular protection schemes. Instead the Grid Code assigns responsibilities to the relevant parties.
14(05)(b)(iv)	Changes to the protection schemes needed for the power-generating module and the network and to the settings relevant to the power-generating module shall be agreed between the system operator and the power-generating facility owner, and agreement shall be reached before any changes are made.	Currently agreement on settings is only required in relation to 3 particular protection schemes and only where changes will have an operational impact.	Requirements met via the connection agreement, not the SGC.
14(05)(d)	with regard to information exchange: (i) power-generating facilities shall be capable of exchanging information with the relevant system operator or the relevant TSO in real time or periodically with time stamping, as specified by the relevant system operator or the relevant TSO; (ii) the relevant system operator, in coordination with the relevant TSO, shall specify the content of information exchanges including a precise list of data to be provided by the power-generating facility.		
15(06)(a)	With regard to loss of angular stability or loss of control, a power-generating module shall be capable of disconnecting automatically from the network in order to help preserve system security or to prevent damage to the power-generating module. The power-generating facility owner and the relevant system operator in coordination with the relevant TSO shall agree on the criteria for detecting loss of angular stability or loss of control.		

Instrumentation, Simulation and Protection

(2)

RFG Article Ref	Article	EirGrid Grid Code	SONI Grid Code
15(06)(b)(i) Para 1	with regard to instrumentation: (i) power-generating facilities shall be equipped with a facility to provide fault recording and monitoring of dynamic system behaviour. This facility shall record the following parameters: - voltage, - active power, - reactive power, and - frequency The relevant system operator shall have the right to specify quality of supply parameters to be complied with on condition that reasonable prior notice is given		
15(06)(b)(i) Para 2	(ii) the settings of the fault recording equipment, including triggering criteria and the sampling rates shall be agreed between the power-generating facility owner and the relevant system operator in coordination with the relevant TSO;		
15(06)(c)(iii)	The request by the relevant system operator referred to in point (i) shall be coordinated with: - the format in which models are to be provided - the provision of documentation on a model's structure and block diagrams, - an estimate of the minimum and maximum short circuit capacity at the connection point, expressed in MVA, as an equivalent of the Network;	Requirements for the min and max Short Circuit Capacity is not included.	
15(06)(d)	With regard to the installation of devices for system operation and devices for system security, if the relevant system operator or the relevant TSO considers that it is necessary to install additional devices in a power-generating facility in order to preserve or restore system operation or security, the relevant system operator or relevant TSO and the power-generating facility owner shall investigate that matter and agree on an appropriate solution;		
15(06)(f)	earthing arrangement of the neutral-point at the network side of step-up transformers shall comply with the specifications of the relevant system operator.		
16(02)(c)	Without prejudice to point (a), the relevant system operator in coordination with the relevant TSO shall have the right to specify voltages at the connection point at which a power-generating module is capable of automatic disconnection. The terms and settings for automatic disconnection shall be agreed between the relevant system operator and the power-generating facility owner.		
16(04)(d)	the relevant system operator and the power-generating facility owner shall agree on the settings of synchronisation devices to be concluded prior to operation of the power-generating module. This agreement shall cover: (i) voltage; (ii) frequency; (iii) phase angle range; (iv) phase sequence; (v) deviation of voltage and frequency.		

Specification of Protection Schemes (1)

- RFG lists a number of protection schemes for power generating modules in Article 14(b)(iii).
- EirGrid Grid Code contains a number of non-exhaustive list of protection schemes, depending on user type.
- SONI Grid Code states who is responsible for the provision of the protection but doesn't not list the required protection schemes.

Specification of Protection Schemes (2)

- What is the proposal?
 - No changes to the EirGrid Grid Code.
 - Inclusion of non-exhaustive lists of protection schemes in SONI Grid Code but the allocation of the responsibility to provide these schemes would remain unchanged.

Fault Recording (1)

- RFG states that Power-Generating facilities shall be equipped with a facility fault recording and monitoring of dynamic system behaviour.
- EirGrid Grid Code does not any detail on the use of such recorders.
- SONI Grid Code includes the requirements for disturbance / event recorders under the operational metering requirements.

Fault Recording (2)

- What is the proposal?
 - Inclusion of the necessary event/disturbance recorders requirements in the EirGrid Grid Code
 - No changes required to the SONI Grid Code.