

Ireland Grid Code Review Panel #1 2019

Welcome to all members

12 April 2019



Agenda

Time	Topic
09:00 – 09:30	Tea/Coffee and Pastries
09:30 – 12:00	<ol style="list-style-type: none">1. Introduction:<ol style="list-style-type: none">1. Welcome;2. Minutes and Actions from Previous Meeting (18 October 2018).2. Proposed Modification:<ol style="list-style-type: none">1. MPID 275 RfG Incorporation into the Ireland Grid Code.3. Discussion:<ol style="list-style-type: none">1. Substantial Modification to existing Users under the Connection Code.4. Updates:<ol style="list-style-type: none">1. CRU Update.5. AOB

Proposed Modification - MPID 275

- Background
 - RfG came into effect on the 17th of May 2016.
 - Following an extension to the “Existing Classification” date by the CRU, the RfG is applicable to all new Power Generation Modules (PGMs)
 - Existing PGMs will remain subject to the existing Grid code Requirements.
 - To deemed to be existing:
 - A PGM must already be connected to the transmission system by 30th November 2018; or
 - The power-generating facility owner has concluded a final and binding contract for the purchase of the main generating plant by 30th November 2018

Proposed Modification - MPID 275

- Article 10 of the RfG required the SOs to consult on a subset of non-exhaustive parameters.
- From December 2018 until February 2019, EirGrid and ESNB held a joint consultation on all of the non-exhaustive parameters of the RfG (Articles 13 to 28 inclusive).
- During the consultation, EirGrid and ESNB hosted an industry workshop on the proposals and extended the initial consultation period to allow additional time for responses.

Proposed Modification - MPID 275

- A total of 13 responses were received.
- These drove some changes to the proposed parameters.
- Final joint proposal submitted to the CRU on the 16th May 2018, which include 13 consultation responses as well as the SOs replies.
- CRU approved the proposal on the 26th of November 2018.

Proposed Modification - MPID 275

- Incorporative Method

Demarcation of Requirements

Requirements in the **Grid Code** which are not marked by a symbol and border are applicable to all **Users** (which expression means all persons (other than the **TSO**) to whom any individual section of the **Grid Code** applies).

Requirements in the **Grid Code** which are marked by a symbol and border as per *Table 1: Non-RfG Generation Requirements* are applicable to **Non-RfG Generation Units**.

Table 1: Non-RfG Generation Requirements

Symbol	Applicable to
⊖	Non-RfG Generation Units

Requirements in the **Grid Code** which are marked by a symbol and border as per *Table 2: RfG Generation Requirements* are applicable to **RfG Generation Units**.

Table 2: RfG Generation Requirements

Symbol	Applicable to
○	RfG Generation Units

Proposed Modification - MPID 275

- Incorporative Method

Definitions Section

Term	Definition
Non-RfG Generation Units	<p>A Generation Unit with a signed Connection Agreement:</p> <ul style="list-style-type: none">a) Connected to the Network on or before the 30th November 2018; orb) Whose owner has concluded a final and binding contract for the purchase of the main Plant on or before the 30th November 2018 and provides evidence of same, as acknowledged by the TSO, on or before the 31st May 2019. Such evidence shall at least contain the contract title, its date of signature and date of entry into force, and the specifications of the main Plant to be constructed, assembled, or purchased; orc) Is one of the exceptions to the applicability of the RfG Generation Unit requirements and is a Generation Unit as follows:<ul style="list-style-type: none">(i) Installed to provide back-up power and operate in parallel with the Network for less than five minutes per calendar month while the system is in normal system state; or(ii) No permanent Connection Point and is used by the TSO to temporarily provide power when normal system capacity is partly or completely unavailable; or(iii) Energy Storage Units except for Pumped Storage Plant. <p>A Non-RfG Generation Unit that undergoes a substantial modification to its Connection Agreement and concludes a final and binding contract for the purchase of the Plant being modified after the 30th November 2018 will be deemed an RfG Generation Unit, unless the Plant being modified is one of the exceptions listed in c) above.</p>
RfG Generation Units	A Generation Unit that is not a Non-RfG Generation Unit .

Proposed Modification - MPID 275

- Incorporative Method

- (v) The TSO may request **Generation Units of Registered Capacity** greater than or equal to 60MW to have the capacity to operate under **AGC** at all loads between **AGC Minimum Load** and **AGC Maximum Load**

- (w) Remain synchronised to the **Transmission System** and operate within the frequency ranges and time periods specified in *Table CC.7.3.1.1*.

Table CC.7.3.1.1: Minimum Time Periods for Generation Units to Remain Operational without Disconnecting

Frequency Range	Time Period
47 – 47.5 Hz	20 seconds
47.5 – 48.5 Hz	90 minutes
48.5 – 49 Hz	90 minutes
49 – 51 Hz	Unlimited
51 – 51.5 Hz	90 minutes
51.5 – 52 Hz	60 minutes

- (x) Remain synchronised to the **Transmission System** and operate within the ranges of the **Transmission System Voltage** at the connection point, for an unlimited time period, as specified below:
- (i) 400 kV system: 360 kV to 420 kV (0.9 p.u. – 1.05 p.u.)
 - (ii) 220 kV system: 198 kV to 245 kV (0.9 p.u. – 1.114 p.u.)
 - (iii) 110 kV system: 99 kV to 123 kV (0.9 p.u. – 1.118 p.u.)

Proposed Modification - MPID 275

- Incorporative Method

CC.7.3.1.5 Where the TSO approaches a **Generator**, the **Generator** will co-operate with the TSO in the development of procedures and facilities to improve the response of each **Generation Unit** during conditions of system stress, including, for example, automatic start-up of fast-start **Generation Units** following a loss of **Generation Unit(s)** or in advance of an anticipated loss of **Generation Unit(s)**. This shall be subject to the agreement of the **Generator** that the procedures are consistent with secure operation of the **Generator's Plant**, such agreement not to be unreasonably withheld.



CC.7.3.2

Where start-up time of **Generation Units** exceeds thirty minutes, they shall be designed to have the capability, where supply from the **Transmission System** is lost, to reduce output to match house load and sustain operation (i.e. tripping to **Auxiliaries**).



CC.7.3.2.1

In case of disconnection of the **Generation Unit** from the **Transmission System**, the **Generation Unit** shall be capable of quick re-synchronisation as agreed between the TSO and the **Generator**.

CC.7.3.2.2

Where start-up time of **Generation Units** exceeds fifteen minutes, they shall be designed to have the capability, where supply from the **Transmission System** is lost, to reduce output to match house load and sustain operation (i.e. tripping to **Auxiliaries**). **Generation Units** must be designed to trip to house load from any operating point in its **Reactive Power** capability. In this case, the identification of house load operation must not be based solely on the system operator's switchgear position signals.

Proposed Modification - MPID 275

- Incorporative Method

PPM1.5.3 FREQUENCY RESPONSE

PPM1.5.3.1 In **Resource Following Mode**, the **Frequency Response System** shall have the capabilities as displayed in the *Power-Frequency Response Curve* in *Figures PPM 1.2*, where the power and frequency ranges required for points A, B, C, D, E are defined below in *Table PPM 1.1* and *Table PPM 1.2*. **Controllable PPM Frequency Response** and **Governor Droop** shall be calculated with respect to **Registered Capacity**.



The **Frequency Response System** shall adjust the **Active Power** output of the **Controllable PPM** according to a **Governor Droop**, settable by the TSO in a range from 2% to 10% and defaulting to 4%, when operating in the ranges outside the deadband range F_B - F_C in the *Power-Frequency Response Curve*.



The **Frequency Response System** shall adjust the **Active Power** output of the **Controllable PPM** according to a **Governor Droop**, settable by the TSO in a range from 2% to 12% and defaulting to 4%, when operating in the ranges outside the deadband range F_B - F_C in the *Power-Frequency Response Curve*.

Proposed Modification - MPID 275

- Incorporative Method

Demarcation of Requirements

Requirements in the **Grid Code** which are not marked by a symbol and border are applicable to all **Users** (which expression means all persons (other than the **TSO**) to whom any individual section of the **Grid Code** applies).

Requirements in the **Grid Code** which are marked by a symbol and border as per *Table 1: Non-Network Code User Requirements* are applicable to Non-Network Code Users.

Table 1: Non-Network Code User Requirements

Symbol	Applicable to
\ominus	Non-RfG Generation Units
\triangleleft	Non-DCC Demand Units
\parallel	Non-HVDC Units

Requirements in the **Grid Code** which are marked by a symbol and border as per *Table 2: Network Code User Requirements* are applicable to Network Code Users.

Table 2: Network Code User Requirements

Symbol	Applicable to
\circ	RfG Generation Units
\triangleleft	DCC Demand Units
\parallel	HVDC Units



Proposed Modification - MPID 275




- Incorporative Method

Demarcation of Requirements

Requirements in the **Grid Code** which are not marked by a symbol and border are applicable to all **Users** (which expression means all persons (other than the **TSO**) to whom any individual section of the **Grid Code** applies).







Requirements in the **Grid Code** which are marked by a symbol and border as per *Table 1: Non- Network Code User Requirements* are applicable to Non-Network Code Users.

Table 1: Non-Network Code User Requirements

Symbol	Applicable to
	Non-RfG Generation Units
	Non-DCC Demand Units
	Non-HVDC Units

Requirements in the **Grid Code** which are marked by a symbol and border as per *Table 2: Network Code User Requirements* are applicable to Network Code Users.

Table 2: Network Code User Requirements

Symbol	Applicable to
	RfG Generation Units - V1
	RfG Generation Units - V2
	DCC Demand Units - V1
	DCC Demand Units - V2
	HVDC Units - V1
	HVDC Units - V2




Comments Received (1)

- CC.7.3.1.1
 - These new requirements will be assessed on a case-by-case basis
 - TSO and Generator will agree on necessary arrangements

○	<p>(aa) Enter into an agreement with the TSO regarding technical capabilities of the Generation Units to aid angular stability under fault conditions.</p> <p>(bb) Equipped with a facility to provide fault recording and monitoring of dynamic system behaviour. This facility shall record the following parameters:</p> <ul style="list-style-type: none">— voltage;— active power;— reactive power; and— frequency. <p>The TSO will specify the quality of supply parameters for fault recording and monitoring of dynamic system behaviour. The settings of the fault recording equipment and the communications protocols for the recorded data shall be agreed between the Generator and the TSO. The dynamic system behaviour monitoring shall include an oscillation trigger specified by the TSO, with the purpose of detecting poorly damped power oscillations. The facilities for quality of supply and dynamic system behaviour monitoring shall include arrangements for the Generator and the TSO to access the information.</p> <p>(cc) With regard to the installation of devices for system operation and devices for system security, if the TSO considers that it is necessary for a Generator to install additional devices in order to preserve or restore system operation or security, the TSO and the Generator shall investigate that matter and agree on an appropriate solution.</p>
---	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Comments Received (2)

- CC.7.3.2.1 - 3
 - These new requirements also apply to PPMs
 - However, unlikely due to quick start-up time i.e. less than 15 minutes

	
CC.7.3.2.1	In case of disconnection of the Generation Unit from the Transmission System , the Generation Unit shall be capable of quick re-synchronisation as agreed between the TSO and the Generator .
CC.7.3.2.2	Where start-up time of Generation Units exceeds fifteen minutes, they shall be designed to have the capability, where supply from the Transmission System is lost, to reduce output to match house load and sustain operation (i.e. tripping to Auxiliaries). Generation Units must be designed to trip to house load from any operating point in its Reactive Power capability. In this case, the identification of house load operation must not be based solely on the system operator's switchgear position signals.
CC.7.3.2.3	Generation Units shall be capable of continuing operation for 4 hours following tripping to house-load, irrespective of any auxiliary connection to the external Transmission System .

Comments Received (3)

- PPM1.3.2
 - CC.7.3.1.1 (x) will be removed from the exclusion list for clarity

PPM1.3.2

In addition to PPM1, **Controllable PPMs** and **Energy Storage Power Station**

Demand are required to comply with the following sections of the **Grid Code**:

- GC - General Conditions
- PC - Planning Code
- PCA – Planning Code Appendix
- CC- Connection Conditions excluding:
 - CC.7.2.5.1
 - CC.7.2.5.2
 - **CC.7.3.1.1** (a) to (h) and (j) to (u) and **(x)** to (y) and (dd)
 - CC.7.3.1.2
 - CC.7.3.5
 - CC.7.3.6
 - CC.7.3.7
 - CC.7.3.8
 - CC.12.2
 - CC.12.3
- OC.1
- OC.2
- OC.4 excluding:

Comments Received (4)

- PPM1.4.2

Performance after 3 seconds?

- If fault has not been cleared after 3 seconds, then best endeavors should be made to remain connected, without risking damage to the PPM.

Meaning of underlined text?

- Where requested, the TSO can provide the local pre and post faults conditions for the fault ride through capability. This will allow the user to carry out any necessary studies.

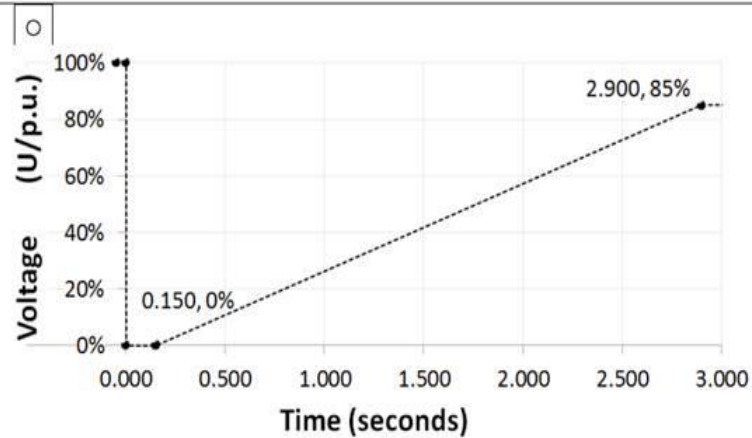
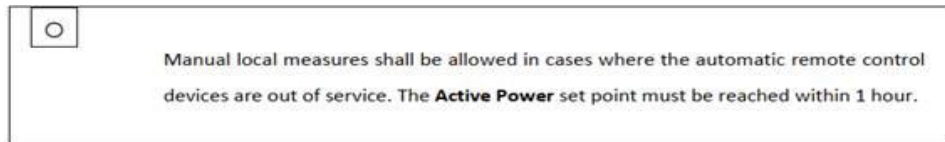


Figure PPM1.4.2: Voltage-against-time profile at the connection point for fault conditions

The **TSO** specifies the pre-fault and post-fault conditions for the fault-ride-through capability on a case-by-case base, and where requested by the **Controllable PPM**. The specified pre-fault and post-fault conditions for the fault-ride-through capability will be made publicly available. This includes;

Comments Received (5)

- PPM1.5.2.1
 - As stated in the RfG submission paper, TSO acknowledges that for more remote sites, 1 hour will be challenging but that best endeavors should prevail.
 - This is not for normal operation and is deemed to be an emergency measure.



Comments Received (6)

- PPM1.5.3.1
 - Governor Droop range for non-RfG PPMs: 2 – 10%
 - Governor Droop range for RfG PPMs: 2 – 12%



The **Frequency Response System** shall adjust the **Active Power** output of the **Controllable PPM** according to a **Governor Droop**, settable by the **TSO** in a range from 2% to 10% and defaulting to 4%, when operating in the ranges outside the deadband range F_B - F_C in the Power-Frequency Response Curve.



The **Frequency Response System** shall adjust the **Active Power** output of the **Controllable PPM** according to a **Governor Droop**, settable by the **TSO** in a range from 2% to 12% and defaulting to 4%, when operating in the ranges outside the deadband range F_B - F_C in the Power-Frequency Response Curve.

Comments Received (7)

- FSM, LFSM-O and LFSM-U

- These 3 new modes are in addition to Curve 1 and 2.
- They are applicable to RfG Generation Units only.
- Each of the 3 modes can be enabled independently of one another.
- A unit operating in FSM will not be operating in LFSM and vv.
- Control Logic and Testing Procedures are currently being developed by TSO.
- PPM must “always operate” in Frequency Sensitive Mode under current GC. FSM under RfG is an additional mode which will be enabled by TSO as required.
- PPMs referred to as capable of acting as a load does not mean Battery storage, as it is not subject to RfG.

Comments Received (8)

- PPM1.6.2.2

- The tolerance will be based on the % of full reactive power.
- Step change in “power factor setpoint” will change to “active power”.
- The necessary monitoring process will be developed by TSO.
- Speed of response requirement is only stipulated for PF setpoint in RfG.
- Existing requirement to implement set-points within 20s, and then achieve 90% of Reactive Power response within 1s.

- (a) The **Controllable PPM** shall be capable of receiving a **Power Factor** control (PF) set-point to maintain the **Power Factor** set-point at the **Connection Point**;

☐

The **Power Factor** shall be maintained within the tolerance of ± 0.5 % of the **Power Factor** set-point at the **Connection Point**.

The speed of response of the **Voltage Regulation System** shall be such that, following a step change in **Power Factor** set-point at the **Connection Point** the **Controllable PPM** shall achieve 90 % of its steady-state **Reactive Power** response within 1 second.

Comments Received (9)

- PPM1.7.1.5
 - The new signal lists are being developed as part of the Control Logic and Testing Procedures. These will sit alongside the signal lists for existing units.

PPM1.7.1.5

Signals List #5

The **Controllable PPM** shall make the following signals available at the designated **TSO Telecommunication Interface Cabinet** for that **Controllable PPM**:

- a) Frequency Response Curve (i.e. *Power-Frequency Response Curve 1 or 2*);
- b) **Frequency Response System** status feedback (ON/OFF);
- c) **Frequency Response System Governor Droop** feedback (%).

○

With regard to real-time monitoring of **Frequency Sensitive Mode**, as described in PPM1.5.3.13, the **Controllable PPM** shall be equipped to transfer in real time and in a secured manner, at least the following signals:

- a) status signal of **Frequency Sensitive Mode** (on/off);
- b) actual parameter settings for **Active Power** frequency response; and
- c) **Governor Droop** and **Frequency Response Deadband**.

The **TSO** shall specify additional signals to be provided by the **Generator** by monitoring and recording devices in order to verify the performance of the active power frequency response provision of participating **Controllable PPMs**.

Comments Received (10)

- The CCGT Reps submitted comments in relation to Article 13.4 and 13.5 - Admissible Power Reduction with falling frequency
 - Concerns related to
 - The selection of the most arduous allowable limit under the RfG; and
 - The ability of CCGTs to stay within the required power reduction of 2 %.
 - Preference would have to either:
 - Have a wider allowable Power Reduction Range, ideally closer to the maximum allowable limit of 10 %; or
 - For the admissible Power Reduction to be determined on an individual generation unit basis.

Comments Received (11)

- To address these concerns, TSO is proposing the following amendment to the proposed Modification:

“The maximum admissible **Active Power** reduction from **Registered Capacity** with falling frequency shall be no greater than;

(i) Steady State Domain: 2% of the **Registered Capacity** at 50 Hz, per 1 Hz frequency drop, below 49.5 Hz; and

(ii) Transient Domain: 2 % of the **Registered Capacity** at 50 Hz, per 1 Hz frequency drop below 49 Hz

and subject to the ambient condition correction curves as provided by each individual **Generation Unit** as well as other relevant technical factors as agreed between the **TSO** and the **Generator**.

For **Generation Units** using gas a fuel source at the time of the **Low Frequency Event**, the standard ambient conditions for the measurement of admissible **Active Power** Reduction will be 10° C, 70 % relative humidity and 1013 hPa.”

- Following the proposed change in red above, the CCGT reps stated that they cannot support clause CC.7.3.1.1(dd) of the proposed modification.

RfG Derogations (1)

- Article 15.2.d (i) and (ii) - Frequency Sensitive Mode - Active Power Range ($\Delta P/P_{\max}$)
 - The parameter, Active Power Range ($\Delta P/P_{\max}$), was included in the RfG as an error and will be removed in the next iteration of the RfG.
 - In the interim, a derogation from the need to specify this parameter is required.
- Article 15.2.d (iii) - Frequency Sensitive Mode – PPM Frequency Response Capability
 - The allowable range for the change to power output specified in RfG of 1.5% to 10% would result in the loss of frequency response from PPM units which are currently specified in the Grid Code.
 - ENTSO-E confirmed that it was not the intention of the RfG to reduce the capability of a fleet of generation. The understanding is that once a National Code was submitted to the NRA by 2012 that those requirements can be considered when implementing the RfG requirements.
 - In order to retain the existing Grid Code requirements, EirGrid must seek a derogation from Article 15.2.d(iii)

RfG Derogations (2)

- Article 18.2.b(i) and Article 21.3.b(i) & (ii) -Voltage Withstand Capability and associated Reactive Power Maximum Voltage
 - Following engagement with ENTSO-E, it became clear that there is an error in Article 18 figure 7 and Article 21 figure 8 of RfG. This error incorrectly stated that the reactive power capability range at the connection point would be less than the withstand voltage that is defined at the connection point.
 - This error will be addressed in the next iteration of the Network Codes, however, in the interim EirGrid will be seeking a class derogation for all PGMs connected at a voltage level equal to 110 kV and below 300 kV.

RfG Derogations (3)

- Articles 16 and 25 – Voltage Withstand Capability
 - Under these articles, the maximum voltage withstand capability of 1.118 p.u. for connections equal to or greater than 110 kV but less than 300 kV would require 220 kV equipment to be able to continuously withstand 246 kV.
 - In order to comply with this requirement, user would need to install 300 kV equipment at 220 kV level. This would place a substantial cost on new or replacement 220 kV installations going forward.
 - In addition, under the Grid Code, the maximum transmission system voltages are nominally 240 kV and 245 kV during normal conditions and following transmission faults respectively. As such, the transmission system would not be continuously operated at 246 kV.
 - EirGrid is now planning to submit a class derogation to address this, which would align the voltage withstand capability requirements for new plant with the existing Grid Code requirements.

Substantial Modification (1)

- Article 4 of the RfG states:
 - Existing power-generating modules are not subject to the requirements of this Regulation except where:
 - a) A type C or D power-generating module has been modified to such an extent that its connection agreement must be substantially revised in accordance with the following procedure:
 - i. Power-generating facility owners who intend to undertake the modernisation of a plant or replacement of equipment impacting the technical capabilities of the power-generating module shall notify their plans to the relevant system operator in advance;
 - ii. If the relevant system operator considers that the extent of the modernisation or replacement of equipment is such that a new connection agreement is required, the system operator shall notify the relevant regulatory authority or; where applicable, the Member State; and
 - iii. The relevant regulatory or, where applicable, the Member State shall decide if the existing connection agreement needs to be revised or a new connection agreement is required and which requirements of this Regulation shall apply; or
 - b) A regulatory authority or, where applicable, a Member State decides to make an existing power-generating module subject to all or some of the requirements of this Regulation, following a proposal from the relevant TSO in accordance with paragraphs 3, 4 and 5.

Substantial Modification (2)

- The Connection Network Codes do not define what constitutes a substantial modification.
- As part of the RfG workshop, TSO had previously stated that a practical approach to the application of the RfG would be sought.
- TSO is seeking views on what constitutes a substantial modification to an existing PGM.

AOB

Draft Minutes will be issued within 10 working days

